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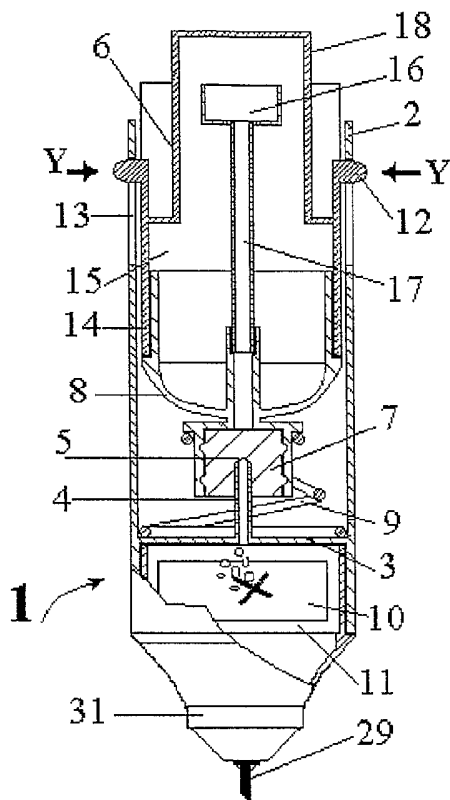
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(54) Title: A FLUID INSTRUMENT



(57) Abstract: A marking instrument for applying a fluid, said instrument comprising a main body having a replaceable cartridge receiving location and a cannula for puncturing a cartridge received at said location; a cartridge having a re-sealable diaphragm, said diaphragm allowing repeated puncture and sealing by said cannula, said cartridge further having a deformable wall portion; wherein said cartridge is biased away from a puncturing position, movement into the puncturing position causing deformation of the deformable wall portion to thereby reduce the internal volume of the cartridge. In this regard, the reduction in the internal volume of the cartridge results in the pressure therein being increased, which will urge fluid contained in the cartridge to flow through the punctured re-sealable diaphragm.

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A FLUID INSTRUMENT

The present invention relates to instruments for applying fluid, and
5 more particularly, to marking instruments for writing, drawing or
painting, such as pens, markers or brushes.

In this respect, in the field of writing, drawing and painting
instruments, many different types of pens, drawing brushes, and
10 markers for school or office use are known. Such instruments may
include an absorbent felt in a casing that is loaded with a fluid, for
example ink, and this generally finds its way to the tip of the
instrument due to capillary action and gravity.

15 Consequently, when the instrument is stored with its tip uppermost,
the fluid drains away therefrom, and often such instruments are
thrown away in the mistaken belief that all of the ink therein has been
used up, whereas a vigorous shaking of the instrument would result
in the fluid again finding its way to the tip. Other instruments have a
20 replaceable cartridge, which again relies on gravity for its contents to
find its way to the tip of the instrument. Drawing brushes for use by
children, in particular, can be difficult and messy to use.

It is an object of the present invention to provide an instrument for
25 applying a fluid, that overcomes, or at least alleviates, problems
associated with known fluid applicator instruments.

In accordance with one aspect of the present invention, there is
30 provided a marking instrument for applying a fluid, said instrument
comprising:- a main body having a replaceable cartridge receiving
location and a cannula for puncturing a cartridge received at said

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location; a cartridge having a re-sealable diaphragm, said diaphragm allowing repeated puncture and sealing by said cannula, said cartridge further having a deformable wall portion; wherein said cartridge is biased away from a puncturing position, movement into
5 the puncturing position causing deformation of the deformable wall portion to thereby reduce the internal volume of the cartridge.

In this regard, the reduction in the internal volume of the cartridge results in the pressure therein being increased, which will urge fluid
10 contained in the cartridge to flow through the punctured resealable diaphragm. The movement to the puncturing position can be effected manually by a user urging the cartridge downwardly relative to the main body and cannula. Once the user removes their downward force on the cartridge, the cartridge will be biased away from the
15 puncturing position such that the resealable diaphragm once again is sealed, thereby preventing further fluid from passing therethrough. The deformable wall portion may be formed of resilient material, having memory, so that it will return to its original shape, once the cartridge moves away from the puncturing position.

20

The cannula can communicate with an outlet fluid chamber provided in the main body, whereby fluid contained in the cartridge can be transferred to the outlet fluid chamber on puncturing of the re-sealable diaphragm. Hence the arrangement provides a resealable
25 valve between the cartridge and the outlet fluid chamber.

The cartridge may be arranged to be slidably received within a cartridge holder provided on the main body and an outer surface of the cartridge can be provided with one or more inwardly movable protrusions which are locatable in one or more apertures provided in
30 the cartridge holder. Such an arrangement provides a convenient mechanism for simple and reliable loading and removal of the cartridge. The protrusions and apertures are preferably positioned

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such that with the cartridge loaded in the holder, the cannula will at all times be at least partially inserted in the resealable diaphragm, the cannula only fully puncturing the resealable diaphragm as a result of movement thereof towards the puncturing position.

5

The cartridge holder may have an abutment surface, against which the cartridge abuts when the cannula punctures the diaphragm and a spring member can be disposed at or adjacent said abutment surface of the main body for biasing the cartridge out of abutment with said
10 abutment surface. Such a spring member provides a convenient biasing means.

The diaphragm can be mounted on the deformable wall portion of said cartridge and conveniently comprises a substantially tubular
15 outer casing, said deformable wall portion being provided in the form of an outwardly directed domed ring, the diaphragm being provided in a central area of the ring. When the deformable wall portion is deformed, it deforms to become inwardly directed.

20 The cartridge may be provided with a main fluid chamber for holding fluid, and a secondary fluid chamber connected through a fluid supply tube to said diaphragm, wherein, when the cartridge is in a first orientation, a measured dose of fluid can enter the secondary fluid chamber and wherein, when in a second orientation, no more than the
25 measured dose within the secondary fluid chamber can be delivered through the supply tube to the diaphragm. With such an arrangement, the outlet fluid chamber is less likely to be overcharged with fluid, thereby reducing the risk of leakages.

30 The cartridge may be provided with a recess into which the second fluid chamber moves, as the cartridge moves to said puncturing position.

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Conveniently, the resealable diaphragm extends in the direction of the cannula to an extent which allows a tip of the cannula to reside sealably there within. Hence the tip of the cannula is either sealably
5 located in the resealable diaphragm or in communication with the cartridge. The resealable diaphragm may comprise in this regard a rubber stopper.

Conveniently, the spring member can be positioned around the
10 cannula and is provided with a resealable cannula seal member which resealably seals the cannula and prevents exposure of a tip of the cannula until the cartridge is moved towards the puncturing position. The resealable cannula seal member allows repeated sealing and penetration by the cannula.

15

According to a further aspect of the present invention there is provided an instrument for applying fluid, said instrument comprising:- a main fluid chamber; and a cannula for penetrating a re-sealable diaphragm provided in association with access to a
20 secondary fluid chamber, said diaphragm allowing repeated puncture and sealing by said cannula; wherein the secondary fluid chamber is in fluid communication with said main fluid chamber, and which, in a first orientation of the instrument, can be filled to a measured dosage from said main fluid chamber; wherein the main fluid chamber has a
25 deformable wall portion to which the secondary fluid chamber is coupled, such that in a deformation of the deformable wall portion to a deformed position, the secondary fluid chamber and cannula move relative to one another, whereby the cannula punctures said re-sealable diaphragm, the said deformation further acting to reduce the
30 combined volume of the main and secondary fluid chambers.

The instrument may have biasing means for biasing the deformable

- 5 -

wall portion, against deformation to the deformed position. The cannula may be in fluid communication with an outlet fluid chamber.

Conveniently, the outlet fluid chamber is provided with an absorbent material such as felt or sponge. A nib or tip can be provided in fluid communication with the outlet fluid chamber.

In this connection, the instrument can be one of a writing instrument, a drawing instrument, a painting instrument, or a marker.

10

According to a further aspect of the present invention there is provided a marking instrument for applying a fluid, said instrument comprising:-

a fluid chamber; and

15

a cannula for puncturing said fluid chamber;

20

wherein said fluid chamber has a re-sealable diaphragm which is movable between sealed and punctured positions with respect to said cannula, and further wherein in a sealed position, said cannula partially penetrates said diaphragm, and wherein in a punctured position said cannula fully punctures said diaphragm to thereby communicate with an interior of said chamber, the cannula being biased away from a punctured position to the sealed position.

25

The present invention conveniently is involved in dispensing relatively small quantities of fluid, such as 0.001-5 mill or more, for use e.g. in a marking instrument.

30

The fluid is preferably of relatively low viscosity and does not include any large particulates so the ejection of the fluid does not require undue manual pressure and the relevant passages within the instrument are not easily blocked.

Several embodiments of the present invention, will now be described, by way of example, with reference to the accompanying drawings, in which:

5

Figure 1 is a part sectioned view of an instrument of a first embodiment of the present invention;

10 Figure 2 is a part sectioned view through a first embodiment of the instrument of Figure 1 after applying a force X;

Figure 3 is an enlarged section from the first embodiment of Figure 1 showing a deformable wall portion in a first configuration;

15 Figure 4 is an enlarged section from the first embodiment of Figure 1 showing the deformable wall portion in a second configuration;

Figure 5 is a section of a fluid cartridge of the instrument of Figure 1;

20 Figure 6 is side view of the fluid cartridge of the instrument of Figure 1;

Figure 7 is a part sectioned side view of an instrument of the present invention;

25

Figure 8 is a part sectioned side view of the instrument of Figure 7 after a force X has been applied;

30 Figure 9 shows a part sectioned view of an instrument of the present invention;

Figure 10 is a part sectioned view through the instrument of Figure 9

after a force X has been applied;

Figure 11 shows a part sectional view of an instrument according to a further embodiment of the present invention; and

5

Figure 12 shows a part sectional view of the instrument of Figure 11 after a force X has been applied.

10 Figures 1 to 6 show an instrument for applying fluid. In the embodiments shown the instrument takes the form of a pen. However, the instrument may alternatively any one of a writing instrument, a drawing instrument, a painting instrument, or a marking instrument.

15 As shown, the pen 1 comprises an elongate, substantially cylindrical holder 2, which forms the outer casing of the pen.

Together with an abutment surface 3, the holder 2 forms cartridge receiving location in which is further provided a cannula 4 having a sharpened tip 5. The cannula is used for puncturing a replaceable cartridge 6 received in the holder 2.

20

The cartridge 6 has a re-sealable diaphragm 7 in the form of a resilient stopper (shown enlarged in Figure 4). The diaphragm 7 allows repeated puncture and sealing by said cannula. The cartridge is provided with a deformable wall portion 8, which is configured as
25 an outwardly directed domed ring.

30 A spring 9 biases the cartridge 6 away from a puncturing position, movement into the puncturing position causing a deformation of the deformable wall portion to thereby reduce the internal volume of the cartridge 6. The reduction in the internal volume of the cartridge results in the pressure therein being increased, which will urge fluid contained in the cartridge 6 to flow through the punctured resealable

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diaphragm 7. The movement to the puncturing position can be effected manually by a user urging the cartridge downwardly relative to the main body and cannula, as shown in Figure 2.

5 Once the user removes their downward force on the cartridge, the cartridge will be biased away from the puncturing position such that the resealable diaphragm 7 once again is sealed, thereby preventing further fluid from passing therethrough. The deformable wall portion 8 is formed of resilient material, having memory, so that it will return
10 to its original shape, once the cartridge moves away from the puncturing position.

The cannula 4 communicates with an outlet fluid chamber 11 provided in a main body 2 of the instrument, whereby fluid contained
15 in the cartridge 6 can be transferred to the outlet fluid chamber 11 on puncturing of the re-sealable diaphragm 7. Hence the arrangement provides a resealable valve between the cartridge and the outlet fluid chamber.

20 The cartridge 6 is arranged to be slidably received within a cartridge holder provided on the main body and an outer surface of the cartridge can be provided with one or more inwardly movable protrusions 12 which are locatable in one or more slots 13 provided
25 in the cartridge holder 2. The protrusions 12 and slots 13 are positioned such that with the cartridge 6 loaded in the holder 2, the tip 5 of the cannula 4 will at all times be at least partially inserted in the stopper 7, the cannula 4 only fully puncturing the resealable diaphragm as a result of movement thereof towards the puncturing position.

30

The resealable diaphragm 7 is mounted centrally on the deformable wall portion 8 of said cartridge 6 and comprises a substantially

- 9 -

tubular outer casing 14. When the deformable wall portion is deformed, it deforms to become inwardly directed, i.e it projects into the interior of the cartridge, as shown in Figure 4.

5 The cartridge is provided with a main fluid chamber 15 for holding fluid, and a secondary fluid chamber 16 connected through a fluid supply tube 17 to said diaphragm 7, wherein, when the cartridge is in a first orientation, a measured dose of fluid can enter the secondary fluid chamber and wherein, when in a second orientation, no more
10 than the measured dose within the secondary fluid chamber can be delivered through the supply tube to the diaphragm. In other words, once the secondary fluid chamber 16 has been charged with fluid and then orientated as shown in Figure 2, only the amount of fluid in the secondary fluid chamber can be dispensed to the outlet fluid chamber
15 11. Continued repeated force X will not result in any more fluid being dispensed, unless the instrument is again inverted and the secondary fluid chamber 16 recharged. In this way overloading of the outlet fluid chamber is prevented.

20 The cartridge is provided with a recess 18 into which the second fluid chamber moves, as the cartridge moves to said puncturing position.

The cap 30 may be attached to the top of the recess during use of the instrument.

25

As shown in Figures 1 and 4, the stopper that forms the resealable diaphragm 7 extends in the direction of the cannula to an extent which allows a tip of the cannula to reside sealably there within. Hence the tip of the cannula is either sealably located in the
30 resealable diaphragm or in communication with the cartridge.

A pen nib or tip 29 is mounted in a housing 31, the housing

- 10 -

containing a cylindrical block of felt 10,28 to act as a reservoir for marking ink for the nib or tip.

5 An initial usage of the pen 1 may require several operations of the pressing on the cartridge so as completely to load the felt 10,28 so that the nib or tip 29 is supplied with sufficient ink for writing.

10 Replacement air is allowed back into cartridge through the cannula 4 when the deformable wall portion 8 returns to its original shape as shown in Figure 1 and Figure 3, once the fluid from the secondary fluid chamber 16 has been transferred to the outlet fluid chamber 11.

15 As shown in the modification of Figures 7 and 8, the spring 9 can be positioned around the cannula 4 and is provided with a resealable cannula seal member 19 which resealably seals the cannula and prevents exposure of a tip of the cannula until the cartridge is moved towards the puncturing position. The resealable cannula seal member allows repeated sealing and penetration by the cannula. Operation of the modified instrument including the resealable cannula seal member 19 together with a cartridge 6 is shown in Figures 9 and 10.

20 Figures 11 and 12 show a further embodiment, where a main fluid chamber 20 is provided integrally in the instrument, rather than being provided separately as a cartridge.

25 In this embodiment, a secondary fluid chamber 21 is provided in an upper portion of the instrument within the main fluid chamber 20, the secondary fluid chamber being movable, by virtue of its mounting on deformable wall portion 22, relative to a cannula 23 having a tip.24.

30 Ordinarily, the secondary fluid chamber 21 is biased through spring 25 outwardly of the main fluid chamber, and abuts an inner surface of

- 11 -

the casing of the main fluid chamber. In this position as shown in Figure 11 the cannula tip 24 is partially inserted in a resealable diaphragm 26 of the secondary fluid chamber. When force X is applied against the bias of spring 25, the deformable wall portion 22
5 collapses inwardly to thereby reduce the volume within the fluid chambers 20 and 21. At the same time, the tip 24 of the cannula punctures the diaphragm 26 to permit fluid to flow from secondary fluid chamber 21 to an outlet fluid chamber 27.

10 This flow loads the felt 28 or similar material held within the outlet fluid chamber, this chamber being in communication with a nib 29 or similar pen tip. A cap 30 is used to protect the nib and to prevent its drying out when not in use.

15 The present invention conveniently involves dispensing relatively small quantities of fluid, such as 0.001-5 mill or more, for use e.g. in a marking instrument.

20 The fluid is preferably of relatively low viscosity and does not include any large particulates so the ejection of the fluid does not require undue manual pressure and the relevant passages within the instrument are not easily blocked.

Claims:

1. A marking instrument for applying a fluid, said instrument comprising:-

5 a main body having a cartridge receiving location and a cannula for puncturing a cartridge received at said location;

a replaceable cartridge for containing marking fluid having a re-sealable diaphragm, said diaphragm allowing repeated puncture and sealing by said cannula, said cartridge further having a deformable
10 wall portion;

wherein said cartridge is biased away from a puncturing position, movement into the puncturing position causing deformation of the deformable wall portion to thereby reduce the internal volume of the cartridge.

15

2. An instrument according to claim 1, wherein the cannula communicates with an outlet fluid chamber provided in the main body, whereby fluid contained in the cartridge can be transferred to the outlet fluid chamber on puncturing of the re-sealable diaphragm.

20

3. An instrument according to claim 1 or 2, wherein the cartridge is arranged to be slidably received within a cartridge holder provided on the main body.

25

4. An instrument according to claim 3, wherein an outer surface of the cartridge is provided with one or more inwardly movable protrusions which are locatable in one or more apertures provided in the cartridge holder.

30

5. An instrument according to any preceding claim, wherein the cartridge holder has an abutment surface, against which the cartridge abuts when the cannula punctures the diaphragm.

6. An instrument according to claim 5, wherein a spring member is disposed at or adjacent said abutment surface of the main body for
5 biasing the cartridge out of abutment with said abutment surface.

7. An instrument according to any preceding claim, wherein the diaphragm is mounted on the deformable wall portion of said
10 cartridge.

10

8. An instrument according to claim 7, wherein the cartridge comprises a substantially tubular outer casing, said deformable wall portion being provided in the form of an outwardly directed domed ring, the diaphragm being provided in a central area of the ring.

15

9. An instrument according to claim 7 or claim 8, wherein the cartridge is provided with a main fluid chamber for holding fluid, and a secondary fluid chamber connected through a fluid supply tube to said diaphragm,

20

wherein, when the cartridge is in a first orientation, a measured dose of fluid can enter the secondary fluid chamber and wherein, when in a second orientation, no more than the measured dose within the secondary fluid chamber can be delivered through the supply tube to the diaphragm.

25

10. An instrument according to any preceding claim, wherein the resealable diaphragm extends in the direction of the cannula to an extent which allows a tip of the cannula to reside sealably there within.

30

11. An instrument according to claim 10, wherein the resealable diaphragm comprises a rubber stopper.

12. An instrument according to claim 6, wherein the spring member is positioned around the cannula and is provided with a resealable cannula seal member which resealably seals the cannula and prevents exposure of a tip of the cannula until the cartridge is moved towards the puncturing position.
- 5
13. An instrument for applying a fluid, said instrument comprising:-
a main fluid chamber;
10 a cannula for penetrating a re-sealable diaphragm provided in association with access to a secondary fluid chamber, said diaphragm allowing repeated puncture and sealing by said cannula;
wherein the secondary fluid chamber is in fluid communication with said main fluid chamber, and which, in a first orientation of the instrument, can be filled to a measured dosage from said main fluid chamber;
15 wherein the main fluid chamber has a deformable wall portion to which the secondary fluid chamber is coupled, such that in a deformation of the deformable wall portion to a deformed position, the secondary fluid chamber and cannula move relative to one another, whereby the cannula punctures said re-sealable diaphragm, the said deformation further acting to reduce the combined volume of the main and secondary fluid chambers.
- 20
14. An instrument according to claim 13, wherein the instrument has biasing means for biasing the deformable wall portion against deformation to the deformed position.
- 25
15. An instrument according to claim 12 or 13, wherein the cannula is in fluid communication with an outlet fluid chamber.
- 30
16. An instrument according to any preceding claim, wherein the

instrument is one of a writing instrument, a drawing instrument, a painting instrument, or a marking instrument.

5 17. A marking instrument for applying a fluid, said instrument comprising:-

a fluid chamber; and

a cannula for puncturing said fluid chamber;

10 wherein said fluid chamber has a re-sealable diaphragm which is movable between sealed and punctured positions with respect to said cannula, and further wherein in a sealed position, said cannula partially penetrates said diaphragm, and wherein in a punctured position said cannula fully punctures said diaphragm to thereby communicate with an interior of said chamber, the cannula being biased away from a punctured position to the sealed position.

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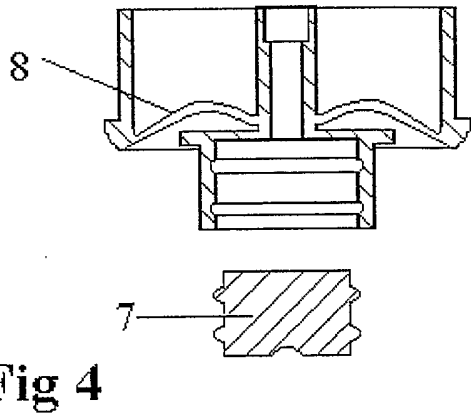
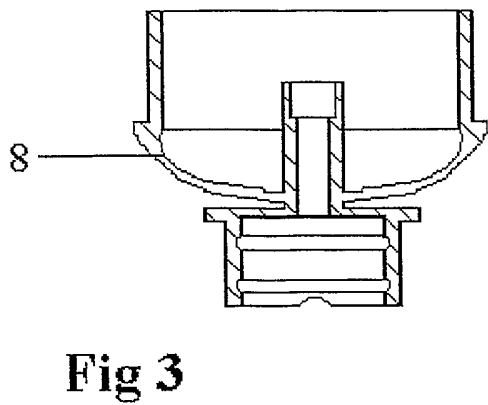
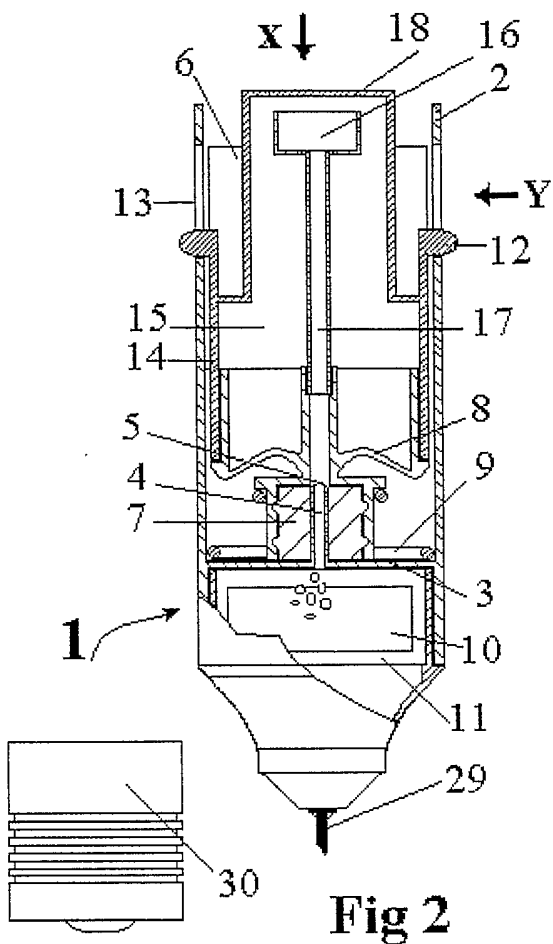
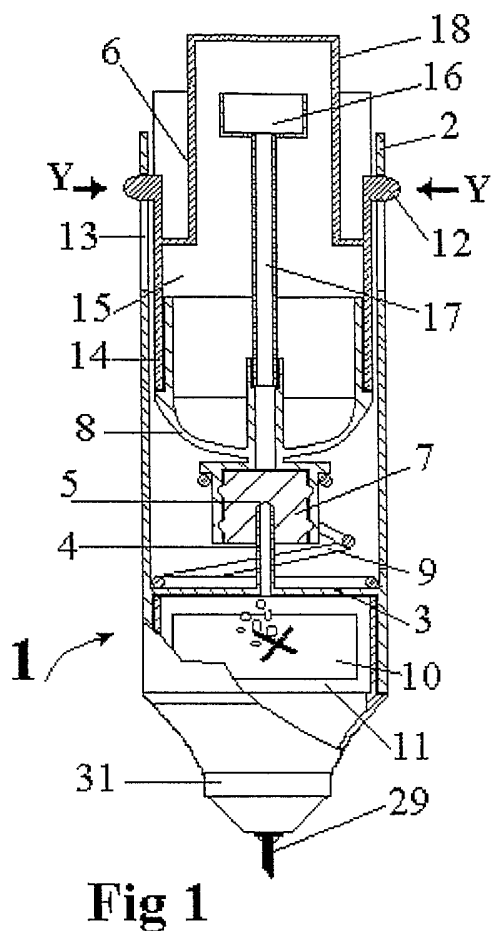
18. A cartridge for a marking instrument, the cartridge comprising:
a main chamber for containing fluid, said main chamber having a resiliently deformable wall portion; and

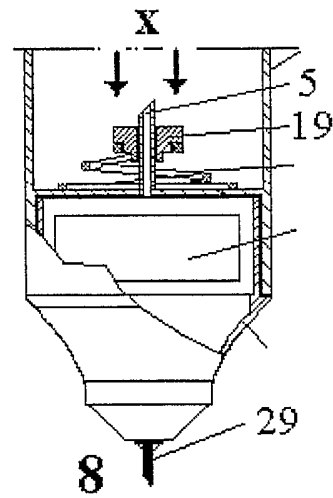
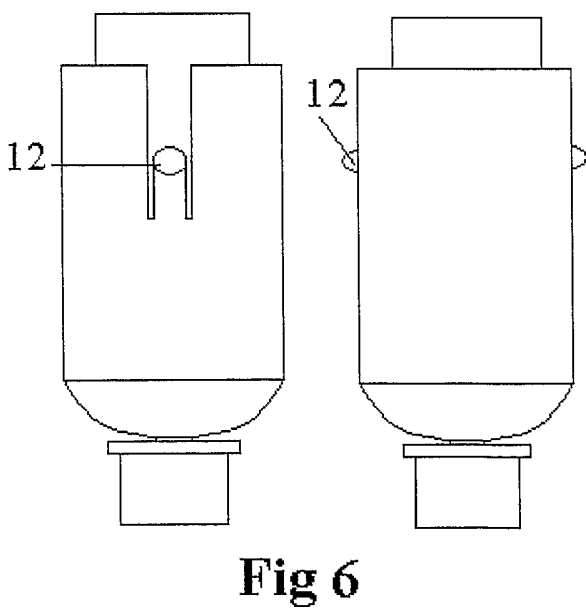
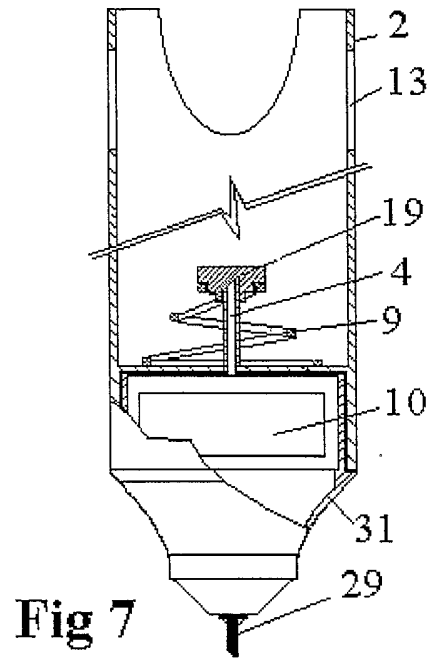
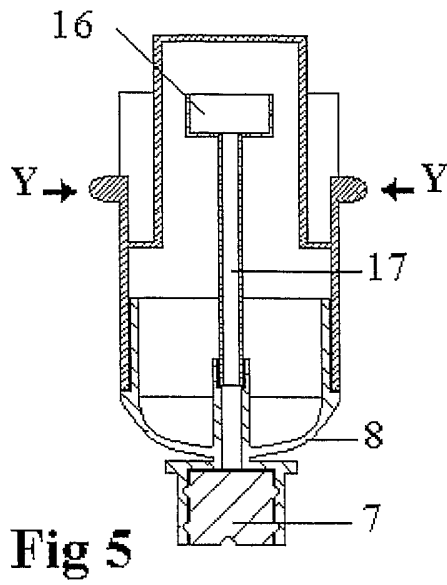
20 a re-sealable diaphragm for allowing access to the main chamber;

wherein said resiliently deformable wall portion is arranged to deform on puncturing of said diaphragm to thereby reduce the internal volume of the chamber.

25

30





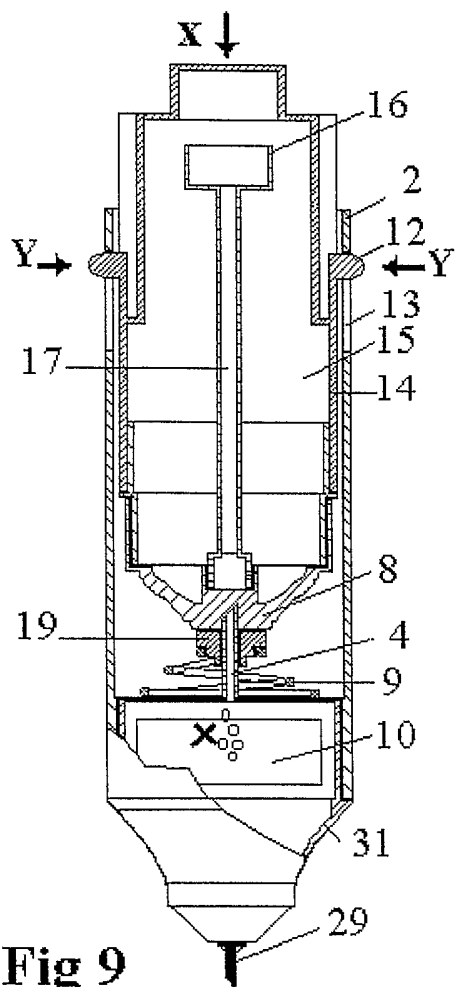


Fig 9

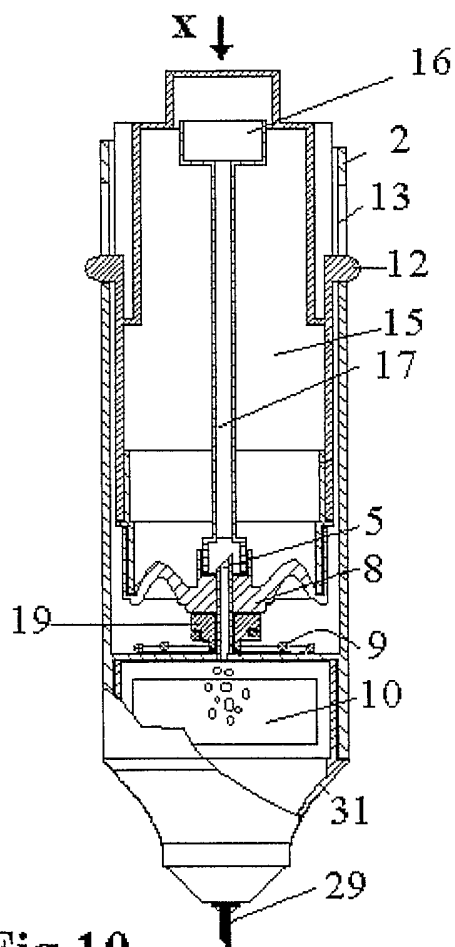


Fig 10

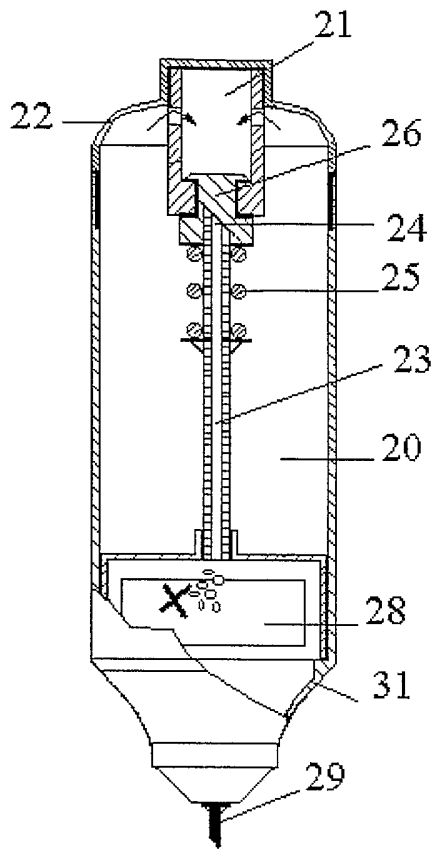


Fig 11

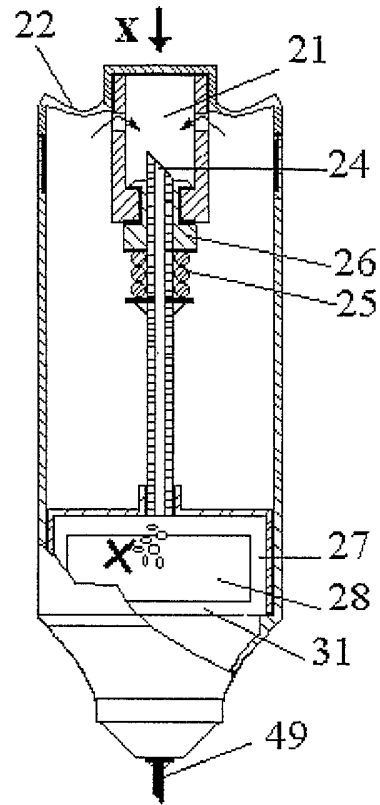


Fig 12