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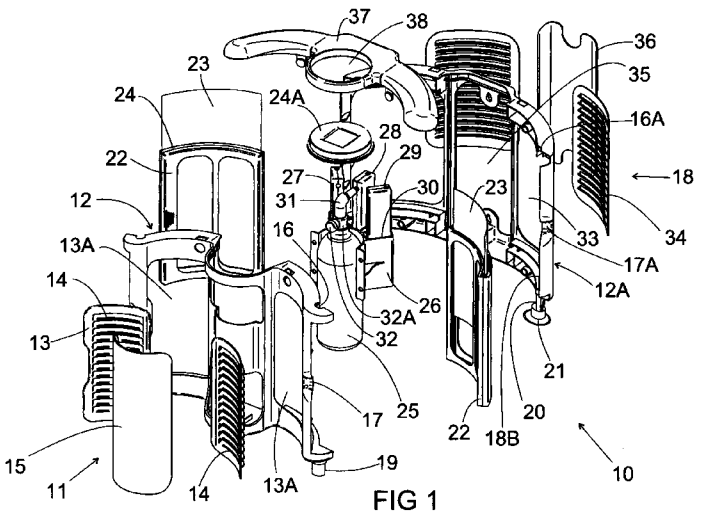

FIG 1

(57) Abstract: The invention provides an insect trap including a housing having located therein a gas bottle or container, one or more modulators having a viscous medium to produce a pulsed flow of gas and a capillary tube interconnecting the gas bottle or container and a respective modulator; a conduit assembly interconnecting a modulator at one end and connectable to a gas bottle or container at another end; an attachment body for attachment to a gas bottle or container; and a method of producing a pulsed flow of gas from a container or source of said gas.

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INSECT TRAP

FIELD OF THE INVENTION

This invention relates to an improved insect trap suitable for trapping of flying insects including mosquitoes, sand flies, wasps, fleas, midges and the like.

BACKGROUND TO THE INVENTION

Conventional insect traps of one type are relatively compact and include a housing, a source of light located in the housing and a capture or immobilization medium such as a sheet having adhesive impregnated thereon or entrapment container for retention of flying insects after they have entered the housing through an opening thereof after being attracted by the light source. Such insect traps are described in US Patents 4400903, 4332100, 4930251, 5231792, 5301456, 5365690, 5513465, 5915948, 5974727, 6502347, 6886292 and 7284350. While these insect traps are relatively inexpensive, they are inefficient because a light source does not have the same attraction to flying insects as for example carbon dioxide which is a very strong attractant for mosquitoes for example who can detect carbon dioxide from a long distance away from the trap location i.e. about 70-100 metres away.

It was also well known to incorporate a fan or air blower in insect traps of the type described above which could produce a draught of air within the housing to force insects into an entrapment chamber or immobilization medium such as an adhesive impregnated sheet. However while the inclusion of the fan or air blower provided an increase in overall effectiveness in trapping ability they were not as efficient as insect traps which used carbon dioxide as an attractant lure. These types of insect traps are described in US Patents 4127961, 6574914, 6840003 and 7191560.

There was another type of conventional insect trap which used carbon dioxide as an attractant lure and in this case it was normally necessary to generate the carbon dioxide in situ. Thus in one form it was necessary to generate carbon dioxide by

catalytic conversion from a hydrocarbon fuel such as propane. This is described for example in US Patents 6145243, 6718685, 6779296, 6840005, 6892492, 6925752 and 7293388. Other means of generating carbon dioxide include reacting acetic acid with baking soda as described in US Patents 4506473 and 6920716. Another method of generating or passing the carbon dioxide to the insect trap was to pass the carbon dioxide through a vertically extending exhaust tube to minimize cooling and minimize condensation of moisture as described in US Patent 6662489. In US Patent 5382422 reference is made to preparing and delivering a gas mixture of liquid chemical compounds such as octenol acetone soluble in liquid carbon dioxide to be used as an enhanced attractant for biting insects.

However it will be appreciated that such means of generating or supplying carbon dioxide to the insect traps were expensive but also complicated the overall structure of the insect trap. However a more relevant problem was that the carbon dioxide gas was supplied as a constant flow which was relatively ineffective in attracting insects to the trap.

It is therefore an object of the invention to provide an insect trap that is simple to operate and effective in use.

The insect trap of the invention includes a housing having located therein:

(i) a gas bottle or container

(ii) one or more modulators having a viscous medium to produce a pulsed flow of gas; and

(iii) a capillary tube interconnecting the gas bottle or container and a respective modulator wherein said capillary tube has a restricted zone to decrease the flow of gas therethrough whereby the pulsed flow of gas is caused to flow out of the housing at a greatly reduced rate compared to a flow rate that would be produced if the restricted zone was absent.

The housing is suitably compact and may have a central cavity or space for location of the gas bottle. A single modulator may be used or a plurality of modulators may

also be used wherein each modulator contains an attractant lure specific to a particular winged insect. Thus for example, if three modulators are used the trap may be used for attraction of wasps, mosquitoes and sandflies as described hereinafter.

The housing may also be provided with a suitable insect immobilization device such as capture medium suitably in the form of paper or sticky paper located in a mounting frame which is releasably connected to an interior of the housing. Alternatively use may be made of an entrapment container. The housing may also include a plurality of grilles having air slots for entry of insects into a hollow interior of the housing. Suitably there may be provided a pair of grilles in a front wall of the housing and a pair of grilles located in a rear wall of the housing wherein each pair of grilles are located in side parts or wings of the housing symmetrically assigned with regard to the central cavity or space.

Preferably the housing has a top wall, bottom wall and side walls which are all formed from translucent or transparent material so that light from a light assembly located within the housing may be refracted as it passes through the walls of the housing. Alternatively the housing may be predominantly formed from the translucent or transparent material.

The light assembly is preferably powered by a solar panel which is connected to or located adjacent an LED unit.

In another aspect of the invention there is provided a method of producing a pulsed flow of gas such as carbon dioxide from a container or source of said gas which includes the steps of:-

(i) reducing the flow rate of the gas by passing the gas through a capillary tube having at least on restricted zone; and

(ii) passing said gas through one or more modulators containing a viscous medium to produce the pulsed flow of gas.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference may now be made to a preferred embodiment of the insect trap of the invention as shown in the attached drawings wherein:

FIG 1 is an exploded perspective view of a front side of the insect trap;

FIG 2 is an exploded perspective view of a rear side of the insect trap shown in FIG 1;

FIG 3 is a front perspective and assembled view of the insect trap shown in FIG 1 showing the capture frame and associated capture sheet removed therefrom for reasons of clarity;

FIG 4 is a similar view shown in FIG 3 but showing a rear assembled view of the fly trap shown in FIG 3;

FIG 5 is an exploded underside view of the light assembly incorporated in the fly trap shown in FIG 1;

FIG 6 is a similar view to that shown in FIG 5 from the top of the light assembly;

FIGS 7, 8 and 9 are different perspective views of the gas bottle and associated modulators which are used in the insect trap shown in FIG 1;

FIG 10 is a perspective view of an assembled insect trap shown in FIG 1 with a transparent cover removed showing incorporation of the gas bottle and modulators shown in FIGS 7, 8 and 9;

FIG 11 is a plan view of the insect trap shown in FIG 10 with a top plate removed again showing incorporation of the gas bottle and associated modulators shown in FIGS 7,8 and 9;

FIGS 12, 13, 14 and 15 show various views of the assembled insect trap of the invention;

FIGS 16 -19 show details of the capillary tubes connecting each modulator to the gas bottle; and

FIGS 19A - 27 refer to another embodiment of the invention in relation to formation of the restricted zone.

In FIG 1 there is shown insect trap 10 having a front wall assembly 11 having peripheral frame 12, grilles 13 each having air slots 14, a front transparent cover 15 bounded by grilles 13 on each side, and locating projections or sockets 16 and 17 which engage with corresponding projections or sockets 16A and 17A shown on peripheral frame 12A of rear wall assembly 18. Each grille 13 may engage in snap fit or interference fit with associated apertures 13A located in frames 12 and 12A.

Peripheral frame 12 also has bottom locating projections 19 which engage with corresponding projections 20 on peripheral frame 12A of rear wall assembly 18 so that each wall assembly 11 and 18 may be snap fitted together so as to be totally supported by legs 21 of rear wall assembly 18. There are also provided additional locating projections 18A on peripheral frame 12 shown in FIG 2 which engage with corresponding locating sockets 18B on peripheral frame 12A.

There is also shown capture plates or frames 22, capture sheets 23 which are slidably retained within an internal space 24 of each capture plate 22, light assembly 24A, gas bottle 25, a support frame 26 for modulators 27, 28 and 29 which are each retained in associated sockets 30 of support frame 26. There is also provided manifold 31 interconnecting gas bottle 25 and each modulator 27, 28 and 29 so that

gas bottle 25 is in fluid communication with a hollow interior of each modulator 27, 28 and 29. There is also provided an actuator button or a rotary on-off control 32 for actuating flow of gas from gas bottle 25 to modulators 27, 28 and 29. On-off control 32 may be connected to a needle valve, ball valve or any other valve 32A for controlling the flow of gas from bottle 25.

Rear wall assembly 18 also includes grilles 34 each engageable with associated apertures 33 of peripheral frame 12A in a similar manner to grilles 13 engaging with apertures 13A. There is also shown a rear plate or cover 36 made up of transparent material which covers an access window or space 35 to gas bottle 25 and associated modulators 27, 28 and 29. There is also provided top plate 37 having aperture 38 for retention of light assembly 24A.

In FIG 2 there is shown recess 39 in peripheral frame 12 for accommodation of gas bottle 25 and associated modulators 27, 28 and 29 and retaining lugs 40 in aperture 13A for retention of grilles 34 whereby lugs 40 engage with slots 40A. There are also provided slots 41 in rear plate 36 which engage with retaining apertures 42 in lugs 43. Peripheral frame 12A is also provided with mating recess 44 which mates with corresponding recess 39 to provide a central compartment 61 shown in FIG 10 to enclose gas bottle 25 and modulators 27, 28 and 29.

In FIGS 3-4 there is shown an assembled view of insect trap 10 from a front view and rear view respectively. It will be noted that each capture frame 22 and associated capture sheet 23 are retained in an associated slot 45 of insect trap 10.

It will also be appreciated from a view of FIGS 3-4 that insect trap 10 instead of being formed from interconnecting front and rear wall assemblies 11 and 18 as shown in FIGS 1-2 can be made as a one piece moulding from suitable transparent or translucent plastics material.

In FIGS 5-6 there is shown light assembly 24A having housing 46, solar panel 49, LED unit 47 and plastics refraction plate 50 wherein light from LED unit 47 will be refracted as it passes through plate 50.

In FIGS 7-9 there is shown gas bottle 25 and associated modulators 27, 28 and 29. Each modulator has a pair of opposed housing components 51 and 52 shown in FIG 8 with manifold 31 having an intermediate part 53 and inlet component or nozzle 54 being of smaller diameter than intermediate part 53. Inlet component or nozzle 54 has a bore of about 0.50 to 1.00mm and carbon dioxide gas from gas bottle 25 may flow continuously into inner passage 55 of modulator 27 where it may encounter an attachment medium 57A which may contain a viscous component such as honey. Suitable attractant lures for the insect may include a variety of attractant lures as described in International Publication WO/2010/012031 which is reproduced herein in its entirety. Thus for example, suitable attractant lures may be selected from suitable food grade constituents that with the aid of natural moisture contained in the medium produce a certain amount of carbon dioxide that will supplement the flow of gas from gas bottle 25. Volatile attractant lures may include lactic acid, octenol including l-octen-3-ol, L-lysine, acetone valeric acid and kairomones. Instead of honey molasses or syrups may form examples of viscous substances that may be combined with the volatile attractant lure. Suitable viscous substances may have a viscosity in the range of 500-30,000 cp. There also may be used other attractant lures which are a food grade component such as mushroom extract, sugar, ammonium bicarbonate and sodium chloride. Such components can be dissolved in a suitable solvent which be cider vinegar, red wine or white wine.

While only one modulator 27 may be used within the scope of the invention it is preferred that specific attractant lures may be differently formulated to attract different biting insects and that such different attractant lures may be used in modulators 28 and 29. Thus for example lures specific for paper wasps or yellow jacket species may be used. Such lures contain as one component acetic acid and as another component a compound selected from isobutanol, racemic 2-methyl-1-butanol, S-(-)-2-methyl-l-butanol, 2-methyl-2-propanol, heptyl butyrate and butyl butyrate. This

attractant lure is described in US Patent 6083498. Another attractant lure which may be used in modulator 29 may be an attractant lure for sand flies as described in US Patent 4886662 which contains alpha-terpineol as an active component.

However it will be appreciated that each of modulators 27, 28 and 29 will have a viscous component which will have the important ability of causing carbon dioxide to be expelled from outlet 57 of outer passage 56 in a pulsed or intermittent flow so that separate plumes of attractant lure and CO_2 may be expelled through grilles 13 and 34 as described in International Publication WO/2010/012031. The flow of gas in modulator 27 is shown by the arrows in full outline in FIG 7. Modulator support frame 26 also includes attachment apertures 26A for attachment to frame 12 or 12A by suitable fasteners (not shown).

FIG 7 also shows a manifold or manifold assembly 31 which may be directly attached to an outlet 33A of gas bottle 25 by welding or by screw threaded engagement at 33B.

In FIG 10 there is shown the insect trap 10 after removal of transparent cover 15 and also illustrating compartment 61 for gas bottle 25 and associated modulators 27, 28 and 29. Each of modulators 27, 28 and 29 are contained in associated holders 30. Also shown are webs 26C interconnecting holders 30.

In FIG 11 it is shown that gas bottle 25 and associated modulators 27, 28 and 29 in compartment 61 are centrally located and wings or side parts 62 and 63 are symmetrically orientated in regard to compartment 61.

FIGS 12-13 show the presence of transparent front cover 15 and transparent rear cover 36 for gas bottle 25 and associated modulators 27, 28 and 29. Each of side parts 62 and 63 may be formed from translucent material so that light from light assembly 24A may be totally visible through covers 15 and 36 and side parts 62 and 63. In fact side parts 62 and 63 may be formed from refractive material so that light from light assembly 24A is bent as it passes through top wall 37 and peripheral frames 12 and 12A and this will provide a greater attraction to insects. In fact light

from light assembly 24A may extend from trap 10 in all directions as shown by arrows A, B, C, D and E in FIG 13 and arrow F in FIG 12.

FIGS 14 and 15 also show that top plates or cover 37 and base wall 64 may be also formed from translucent material so that light from light assembly 24A may also shine through top cover 37 and base wall 64 as shown by arrows I, J, K, L, G, H, M and N.

It will also be appreciated that legs 21 may be replaced or fitted into spikes (not shown) for retention of insect trap 10 within the ground if desired.

In FIG 16 there is shown a sectional view through trap 10 through line A-A shown in FIG 3 in top plan. There is shown an internal mechanism 64 of conduits whereby carbon dioxide is transported to modulators 27, 28 and 29 through capillary tubes 65, 66 and 67 which communicate with each of modulators 27, 28 and 29 through inlets 68, 69 and 70. Each capillary tube 65, 66 and 67 is crimped or twisted as shown by crimped or restricted zone 71 in FIGS 16-17 and the crimped or restricted zone 71 has a diameter of from 0.005 to 0.2mm compared to an unrestricted part 72 of capillary tube 65, 66 and 67 which can have a diameter of 0.025 to 1.25 mm. The restricted zone 71 may have a gas flow of 5-39g of gas per day and more suitably 18g per day.

It will also be appreciated that crimped or restricted zone 71 will greatly increase frictional contact of the gas with an internal surface of restricted zone 71 and this will greatly reduce the flow of gas through restricted zone 71. The length of restricted zone 71 may also vary from 10-125mm. Obviously the greater the length of restricted zone 71 the greater reduction in gas flow may be achieved.

It is also preferred that multiple restricted zones 71 may be used but it is preferred that there is only a single restricted zone 71.

Instead of using a twisted or crimped zone 71 as shown in FIGS 16-17 a restricted zone 73 may be used which is of much smaller diameter than unrestricted part 72 as shown in FIGS 18-19.

Reference may be made to another embodiment of the invention as shown in FIGS 19A - 27 wherein reference is made to an adjustment body which may produce the restricted zone discussed above but such restricted zone will be produced within a capillary tube by use of one or more pressurizing devices which upon contact with the capillary tube will produce the restricted zone but upon withdrawal of the pressurizing device(s) from the capillary tube the restricted zone may no longer be present. This embodiment takes advantage of the natural resilience or elasticity of the material which forms the capillary tube which for example may be copper or plastics material. Thus the pressurizing device(s) may only make bearing contact with the capillary tube to produce the restricted zone and thus the flow rate of gas can be calculated as may be required. The flow rate may be measured by passing the capillary tube or adjustment body under water to gauge the size of the bubbles being generated. Thus it will be appreciated that such restricted zone may not be permanent but may be temporarily caused by contact with the pressurizing devices which may be a plurality or pair of adjustment nuts for example. By opening up the transverse dimension or diameter of the capillary tube this may also remove impurities from the gas after passage through the restricted zone.

In FIGS 19A -25 reference is made to an adjustment body 80 having an end flange 81, transverse passage 82 having a pair of adjustment nuts 83 each having a respective outer end 84 having a hexagonal shaped recess 85 for engagement by a suitable tool such as an Allan key (not shown) or other type of hexagonal key. The adjustment body 80 also includes a longitudinal passage 86 which contains the capillary tube 87. There is also provided a spigot 88 which may be used for engagement with a hose 89 shown in FIG 26 for transmission of carbon dioxide gas to a modulator housing 28. The capillary tube 87 may be made of copper or similar material which extends from one end 91 of adjustment body 80 and which is welded

thereto shown at 92. The other end of capillary tube 87 extends through spigot 88 and is welded to end 93 of spigot 88 as shown at 94.

Spigot 88 is also provided with a bearing ridge 89A, tapered end 89B and flat 89C for retention of hose 89 shown in FIG 26. FIG 25A shows formation of restricted zone 95 which is formed in capillary tube 87 by pressure or the force generated by flat bearing faces 96 of each adjustment nut 83 on capillary tube 87.

FIG 26 shows connection of hose 89 to spigot 88 of adjustment body 80. Hose 89 is also connected to a connection body or nozzle 97 having a hollow bore 98 which extends through a side wall 28A of modular 28 as shown in FIG 26. Connection body 97 may be similar to body 53 shown in FIG 7 having inlet 54. Hose 89 may be connected to spigot 99 in a similar manner as connection of hose 89 to spigot 88 described above. Gas flows through hollow bore 98 to inner tube 55 of modulator 28.

FIG 26 also shows how adjustment body 80 may have connected thereto a large hexagonal nut 100 which has a threaded internal part 101 for connection to a suitable inlet of a gas bottle (not shown).

FIG 27 shows another arrangement involving use of adjustment body 80 in being connected to the modulator 108 described in International Publication WO2010/012031 which has a housing component 102 and inner tube or insertion tube 103 which also has a finger aperture 104, ribs 105 separated by spaces or gaps 106, and socket 107 for connection with connection body or nozzle 97 having a hollow bore 98 wherein spigot 99 having O-ring 99A is engageable in hollow bore 109 of socket 107. Modulator 108 also has reinforcing ribs 110. Bore 98 is in flow communication with internal passage 103 as shown. Hose 89 is connected to connector body 97 and at its other end is adjustment body 80 connected to hexagonal nut 100 as shown in FIG 26.

Thus another aspect of the invention provides a conduit assembly interconnecting a modulator as shown in WO2010/012031 or modulator 28 wherein the conduit assembly at one end has a connector body fitted to the modulator for discharge of

gas such as CO2 into a hollow interior of the modulator to produce a pulsed flow of gas and the conduit assembly at another end is attached to an adjustment body having a restricted zone in a capillary tube for reducing the flow rate of the gas wherein the adjustment body is connected to a gas source such as a gas bottle. The invention may also include within its scope the adjustment body *per se*.

It will be appreciated with the advent of the present invention that a small gas bottle of carbon dioxide of around 500g may last for a month 24/7 because of the fact that a very small pulsed flow of gas is produced in bubbles or plumes interposed between plumes of attractant lure as shown in International Publication WO/2010/012031. The insect trap of the invention does not need to be connected to an electrical source of power such as the mains or a battery. Also a gas regulator is not required. Also by the use of a very simple mechanism as shown in FIGS 18-19 complicated connection mechanisms to a source of carbon dioxide as described in the prior art discussed above are not required or needed.

The invention in another aspect may include a method of controlling flow of carbon dioxide from a container of carbon dioxide which includes the steps of:-

(i) attaching a manifold assembly containing a capillary tube which has a restricted zone to an outlet of the container; and

(ii) causing carbon dioxide to flow through the manifold assembly at a reduced flow rate compared to the situation when the restricted zone is not present.

The invention also included within its scope the manifold assembly *per se*.

CLAIMS:

1. An insect trap including a housing having located therein:
   (i) a gas bottle or container
   (ii) one or more modulators having a viscous medium to produce a pulsed flow of gas
   (iii) a capillary tube interconnecting the gas bottle or container and a respective modulator wherein said capillary tube has a restricted zone to decrease the flow of gas therethrough whereby the pulsed flow of gas is caused to flow out of the housing at a greatly reduced rate compared to a flow rate that would be produced if the restricted zone was absent.
2. An insect trap as claimed in claim 1 wherein the viscous medium has one or more attractable lures for insects.
3. An insect trap as clamed in claim 1 or 2 wherein the housing has a central cavity or space for location of the gas bottle or container.
4. An insect trap as claimed in any one of claims 1, 2 or 3 wherein a single modulator is contained within the housing.
5. An insect trap as claimed in any one of claims 2 or 3 wherein a plurality of modulators are used wherein each modulator contains an attractant specific to a particular winged insect.
6. An insect trap as claimed in any one of claims 1 – 5 wherein the housing contains an insect immobilization device or entrapment container releasably mounted therein.
7. An insect trap as claimed in claim 6 wherein the immobilization device has capture medium located in a mounting frame which is releasably mounted to an interior of the housing.
8. An insect trap as claimed in any one of claims 1 – 7 wherein the housing has one or more grilles having air slots for entry of insects into the housing.
9. An insect trap as claimed in claim 8 wherein said housing has a pair of said grilles located in a front wall and a rear wall of the housing.

10. An insect trap as claimed in any one of claims 1 – 9 wherein the housing is formed from predominantly transparent or translucent material whereby light from inside the housing may be refracted as it passes through the housing.

11. An insect trap as claimed in claim 10 wherein the housing has a top wall, bottom wall and a continuous side wall all formed from said transparent or translucent material.

12. An insect trap as claimed in claim 10 or 11 wherein the housing has a light assembly located within the housing.

13. An insect trap as claimed in claim 12 wherein the light assembly includes a solar panel and a LED unit wherein the LED unit is powered by the solar panel.

14. An insect trap as claimed in any one of claims 1 – 13 wherein the restricted zone is formed by crimping or twisting the capillary tube.

15. An insect trap as claimed in any one of claims 1 – 14 wherein the restricted zone has a diameter of from 0.005 to 0.2mm compared an unrestricted part of the capillary tube having a diameter of 0.025 to 1.25mm.

16. An insect trap as claimed in any one of claims 1 - 15 wherein the restricted zone is adjustable in regard to diameter or lateral dimension.

17. An insect trap as claimed in claim 16 wherein said restricted zone is formed temporarily within said capillary tube by use of one or more pressurising devices which upon contact with the capillary tube will produce the restricted zone which is adjustable but upon withdrawal of the pressurising devices the restricted zone will no longer be present.

18. A conduit assembly interconnecting a modulator at one end and connectable to a gas bottle or container at another end, said conduit assembly having (i) a connector body fittable to the modulator for discharge of gas such as carbon dioxide into a hollow interior of the modulator, and (ii) an attachment body having a capillary tube which incorporates a restricted zone for reducing the flow rate of the gas.

19. A conduit assembly as claimed in claim 18 wherein the attachment body is adjustable in relation to controlling the amount of pulses of gas passed into the modulator.

20. A conduit assembly as claimed in claim 18 which includes one or more pressurising devices for temporarily forming said restricted zone upon contact with the capillary tube but upon withdrawal of the pressurising device(s) the restricted zone is absent.

21. An attachment body for attachment to a gas bottle or container having a longitudinal bore and a capillary tube located in said longitudinal bore and a passage located transverse to the longitudinal bore combining one or more pressurising devices for pressurising the capillary tube for forming a restricted zone wherein an amount of said gas pulses may be regulated as said gas pulses pass through the capillary tube in use.

22. A method of producing a pulsed flow of gas from a container or source of said gas which includes the steps of:

(i) reducing the flow rate of the gas by passing the gas through a capillary tube having at least one restricted zone; and

(ii) passing said gas through one or more modulators containing a viscous medium to produce a pulsed flow of gas.

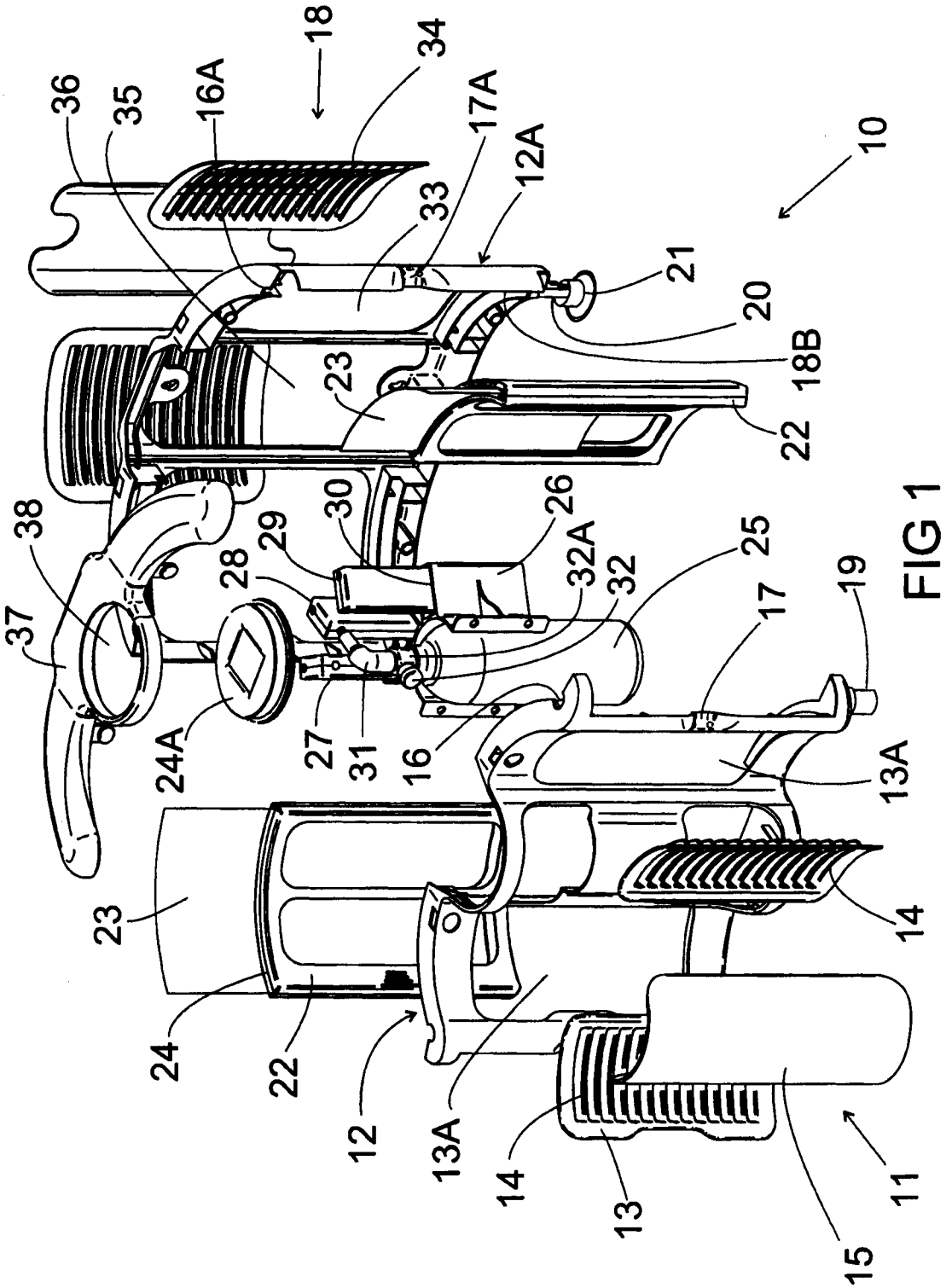
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FIG 1

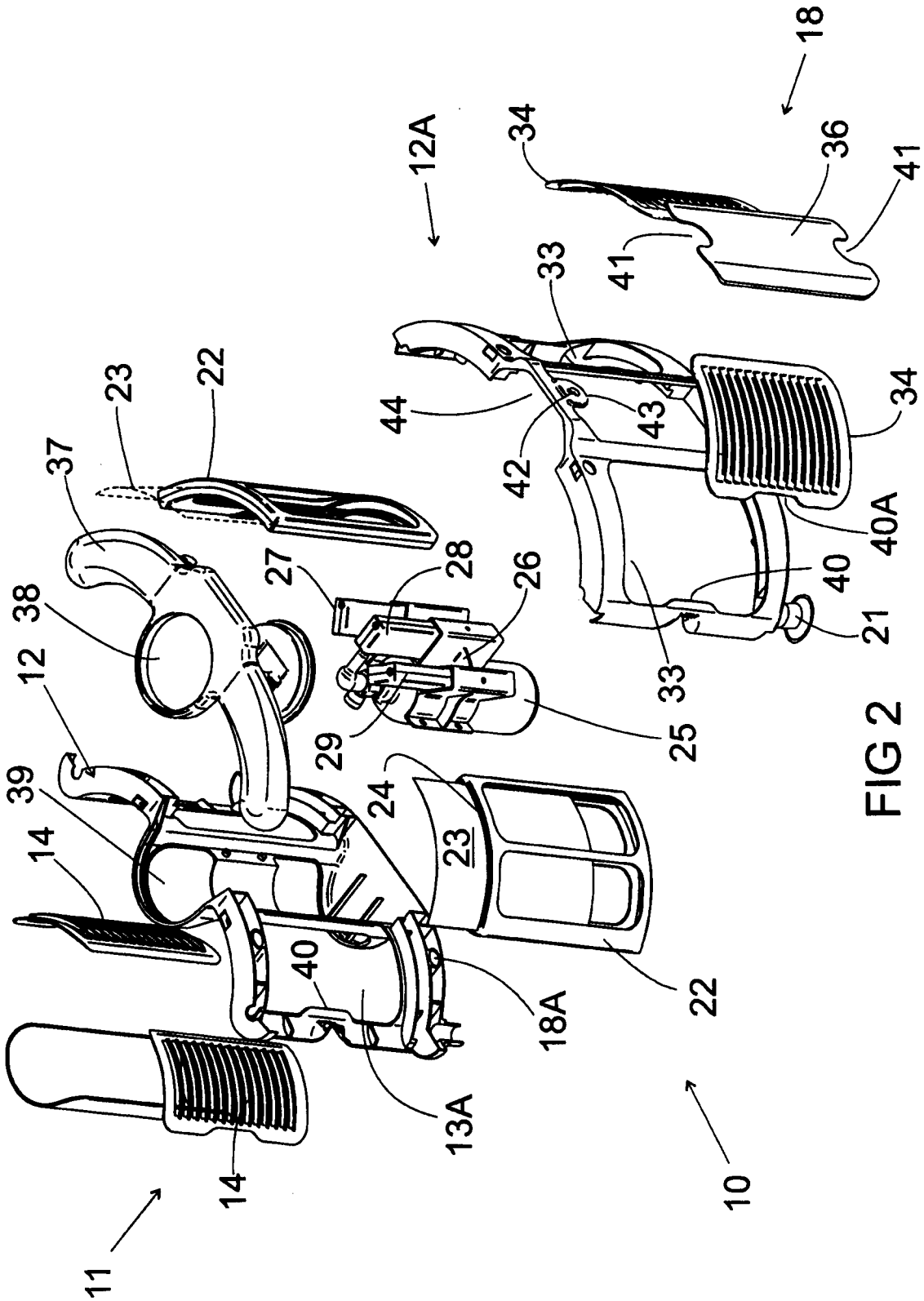
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FIG 2

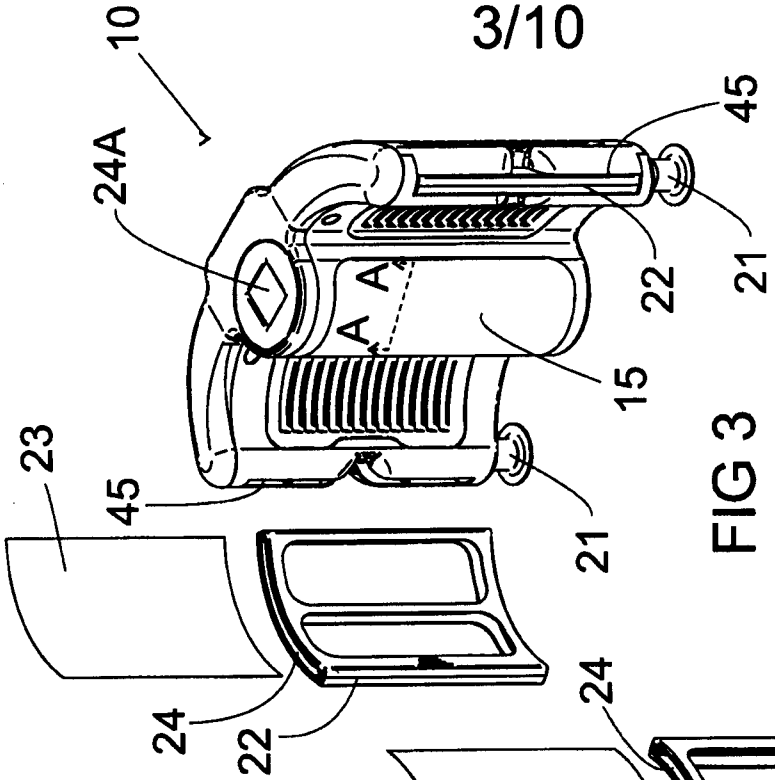
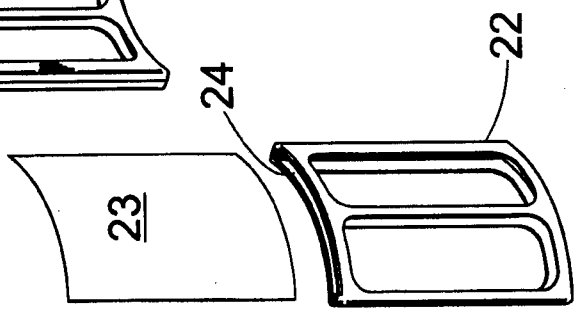


FIG 3



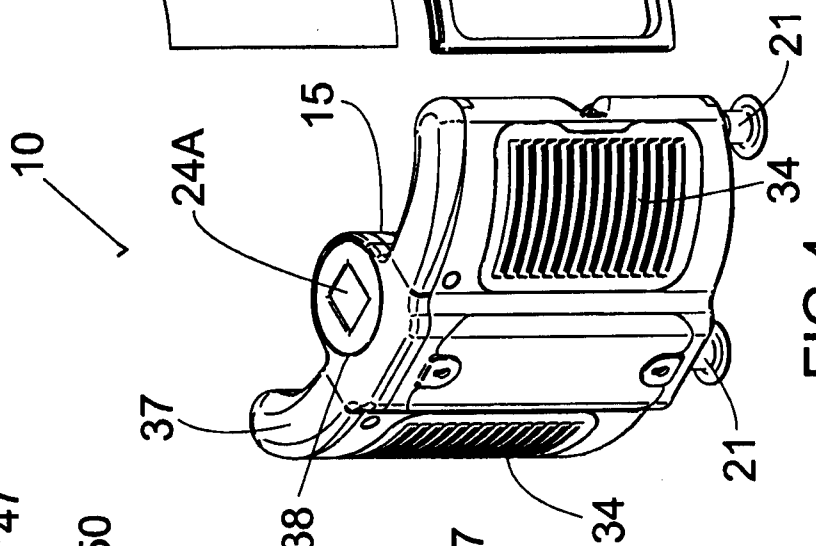


FIG 4

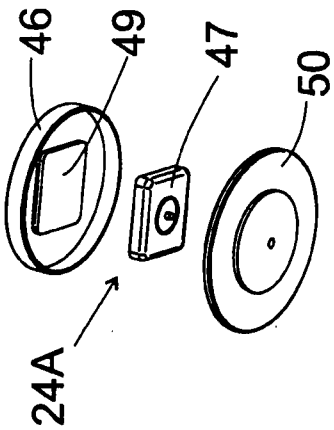


FIG 5

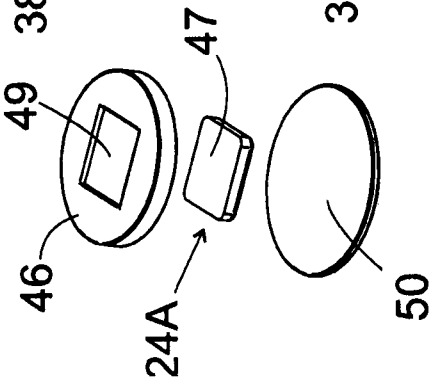


FIG 6

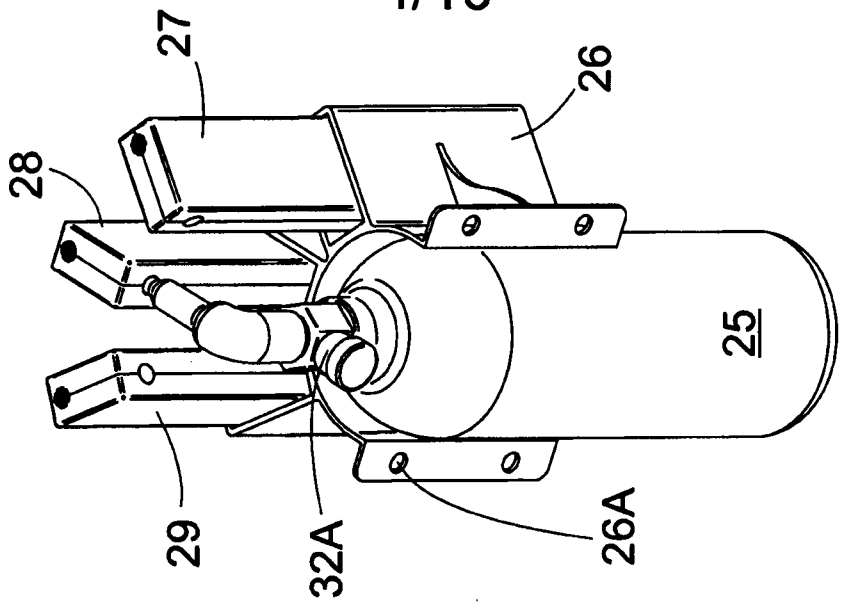


FIG 9

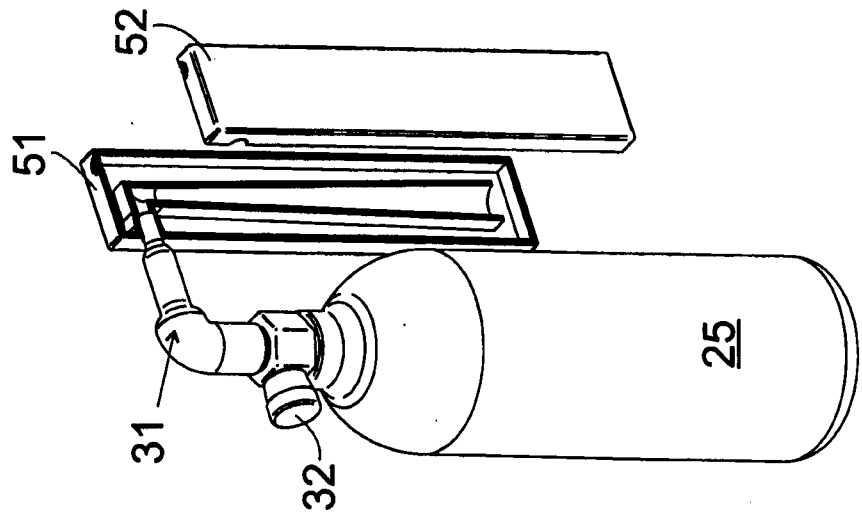


FIG 8

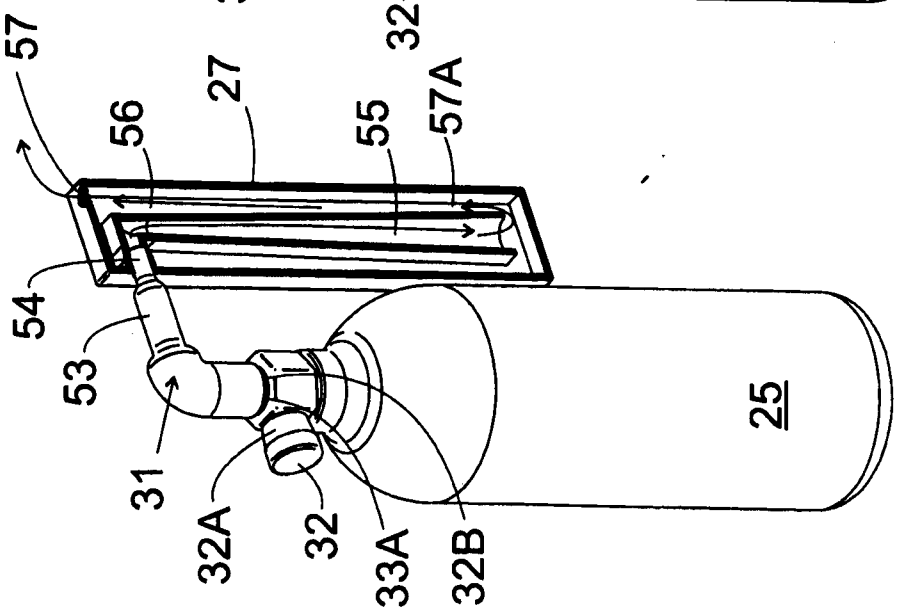


FIG 7

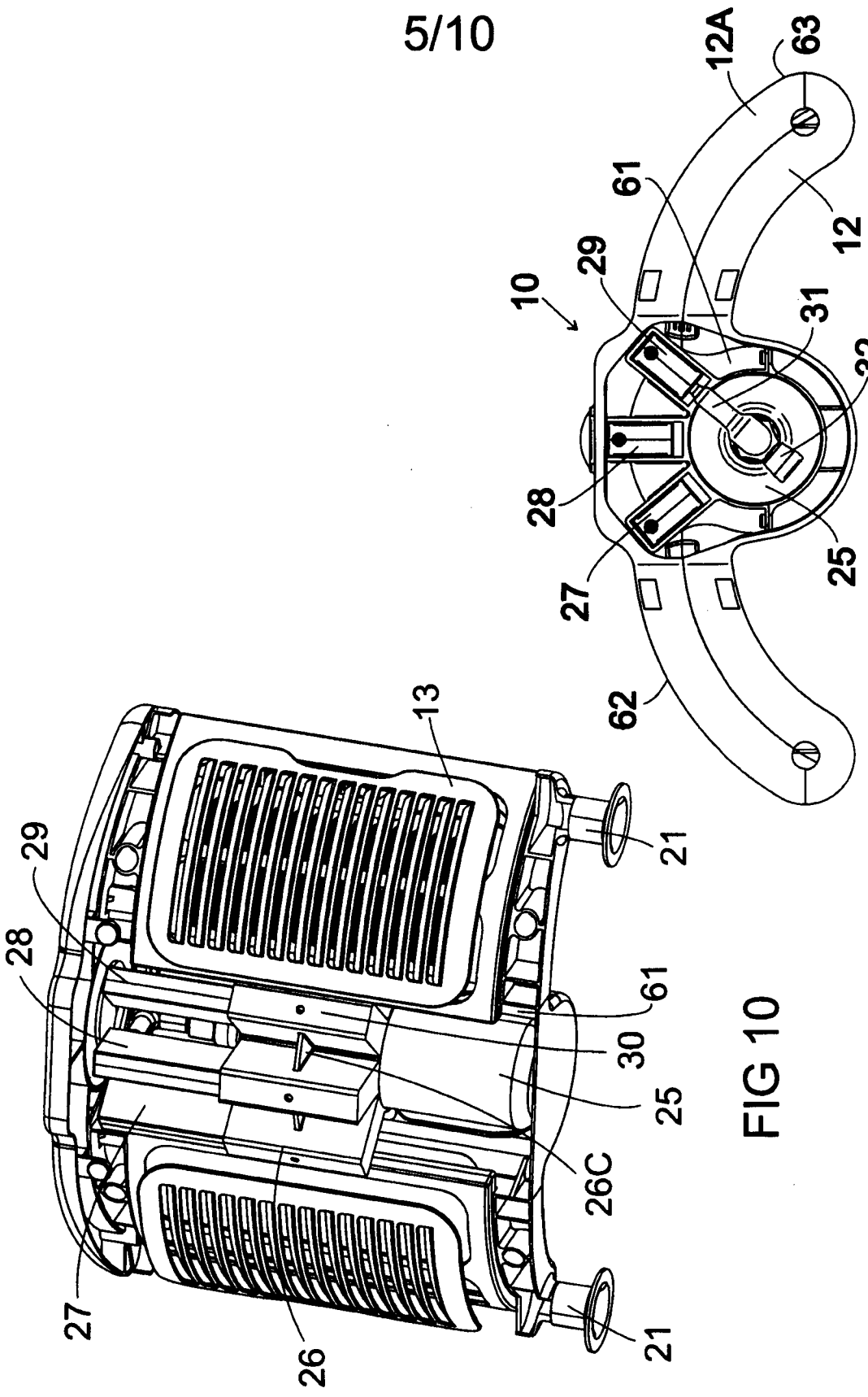


FIG 10

FIG 11

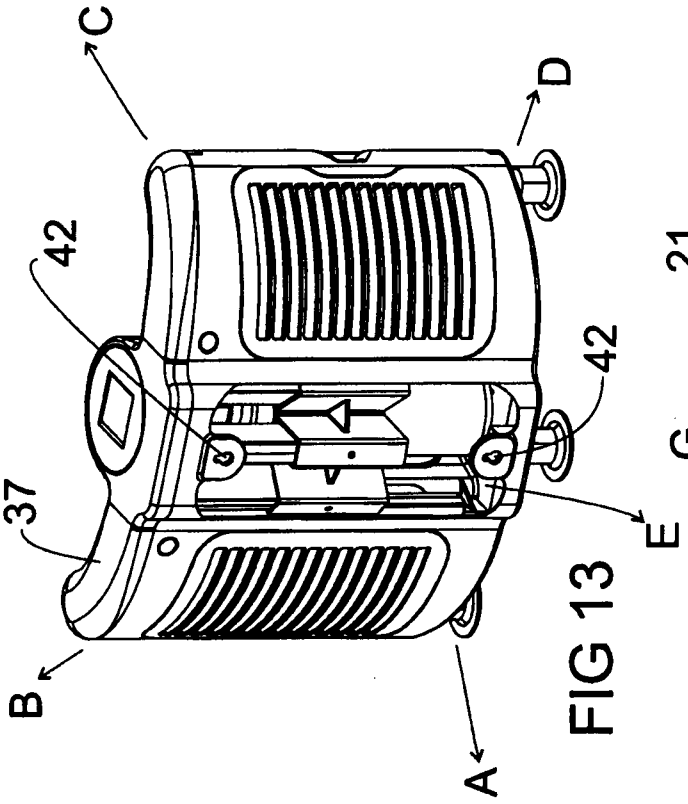


FIG 13

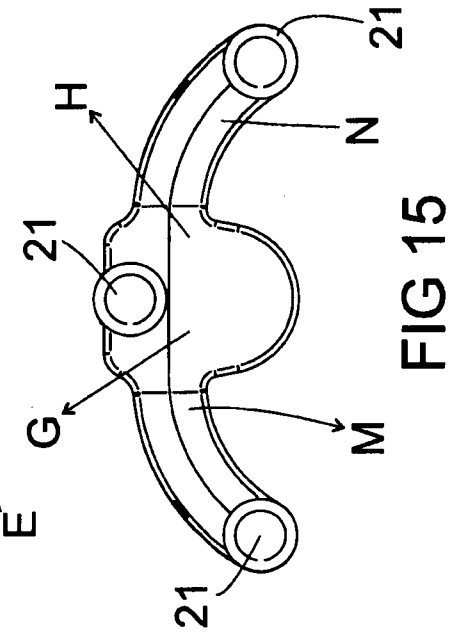


FIG 15

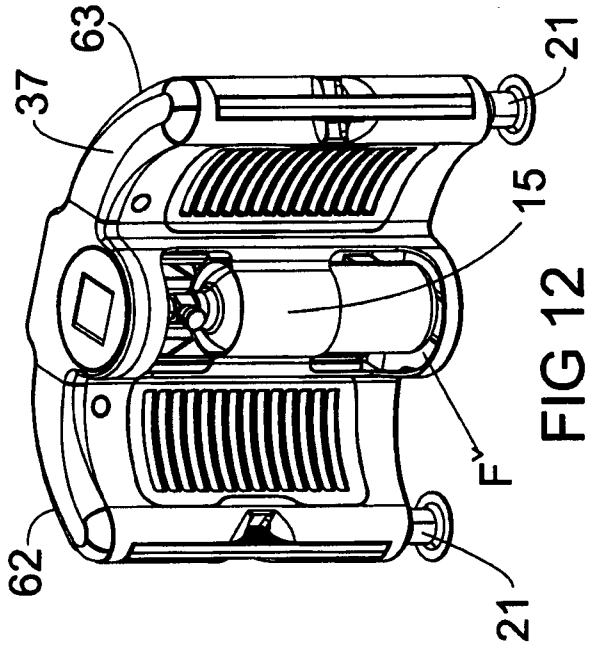


FIG 12

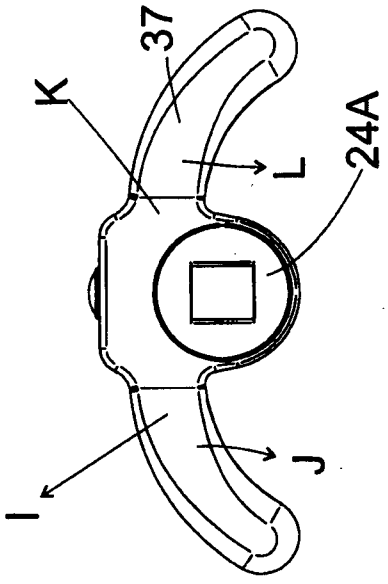


FIG 14

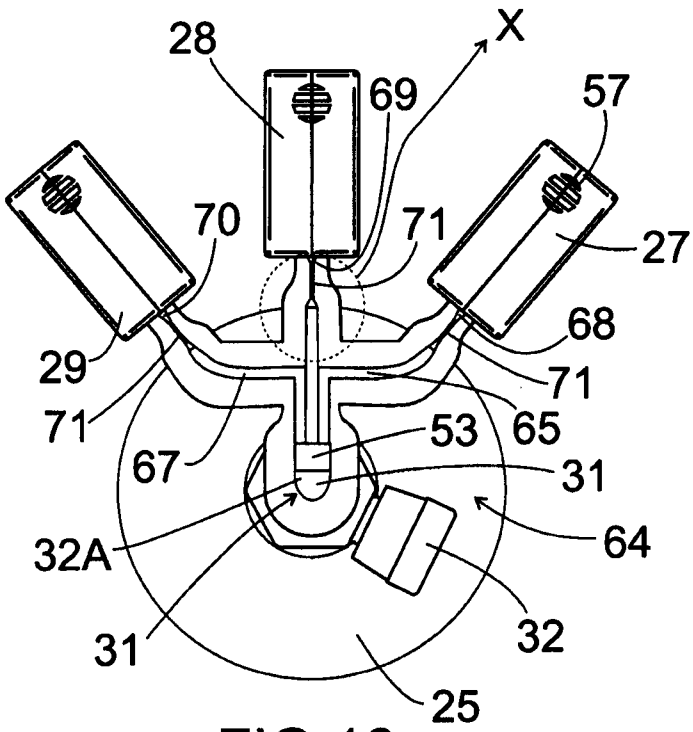


FIG 16

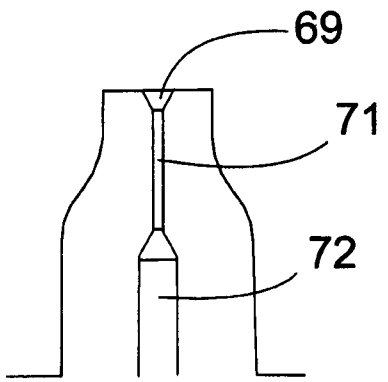


FIG 17

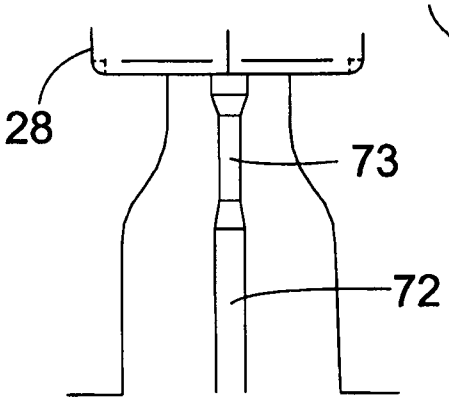


FIG 19

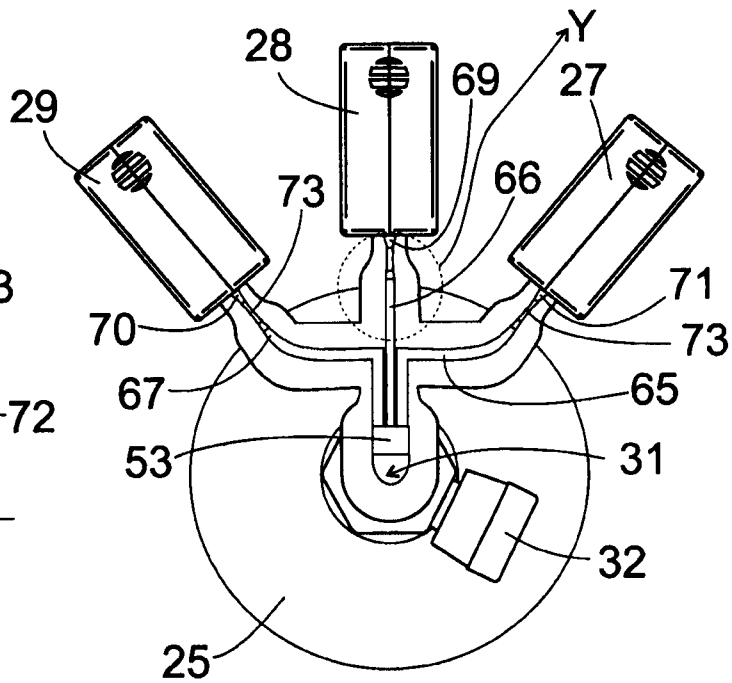


FIG 18

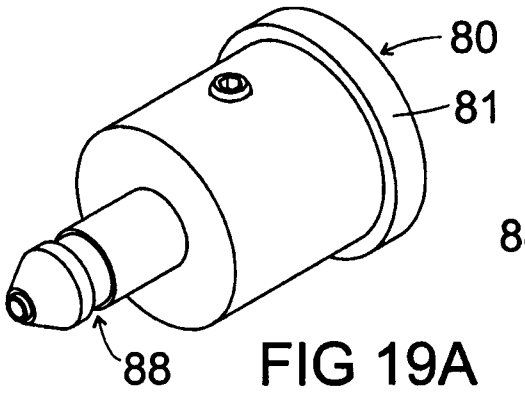


FIG 19A

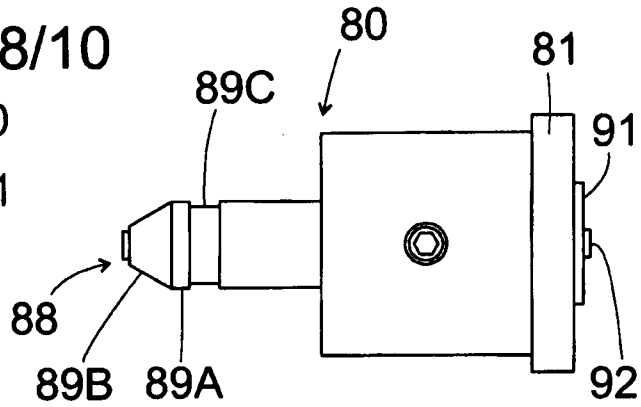


FIG 20

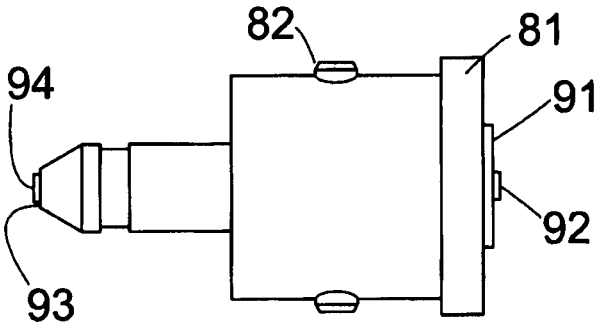


FIG 21

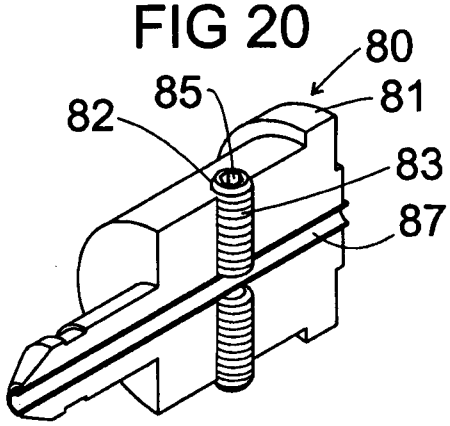


FIG 22

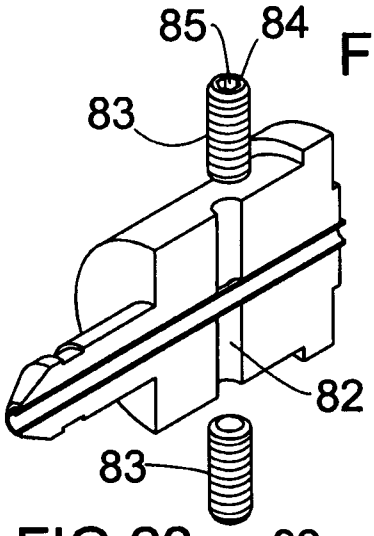


FIG 23

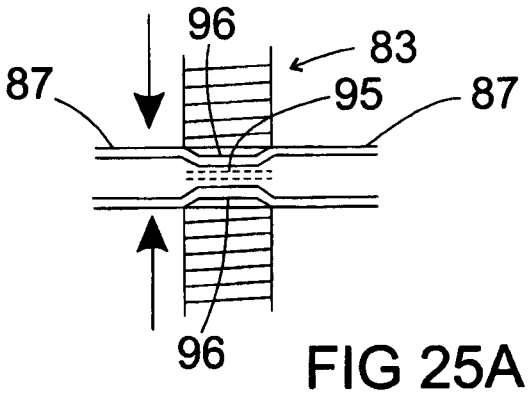


FIG 25A

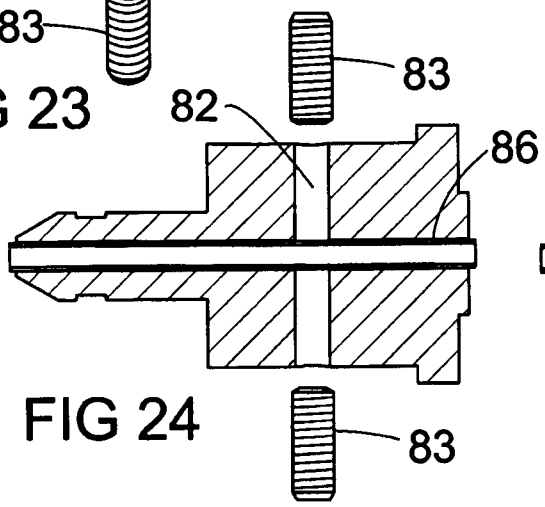


FIG 24

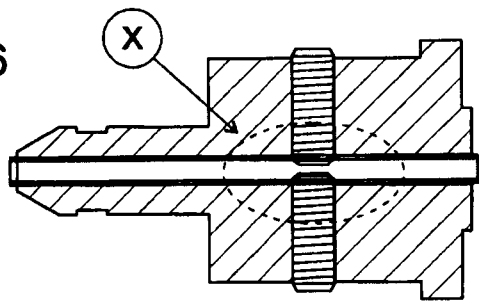


FIG 25

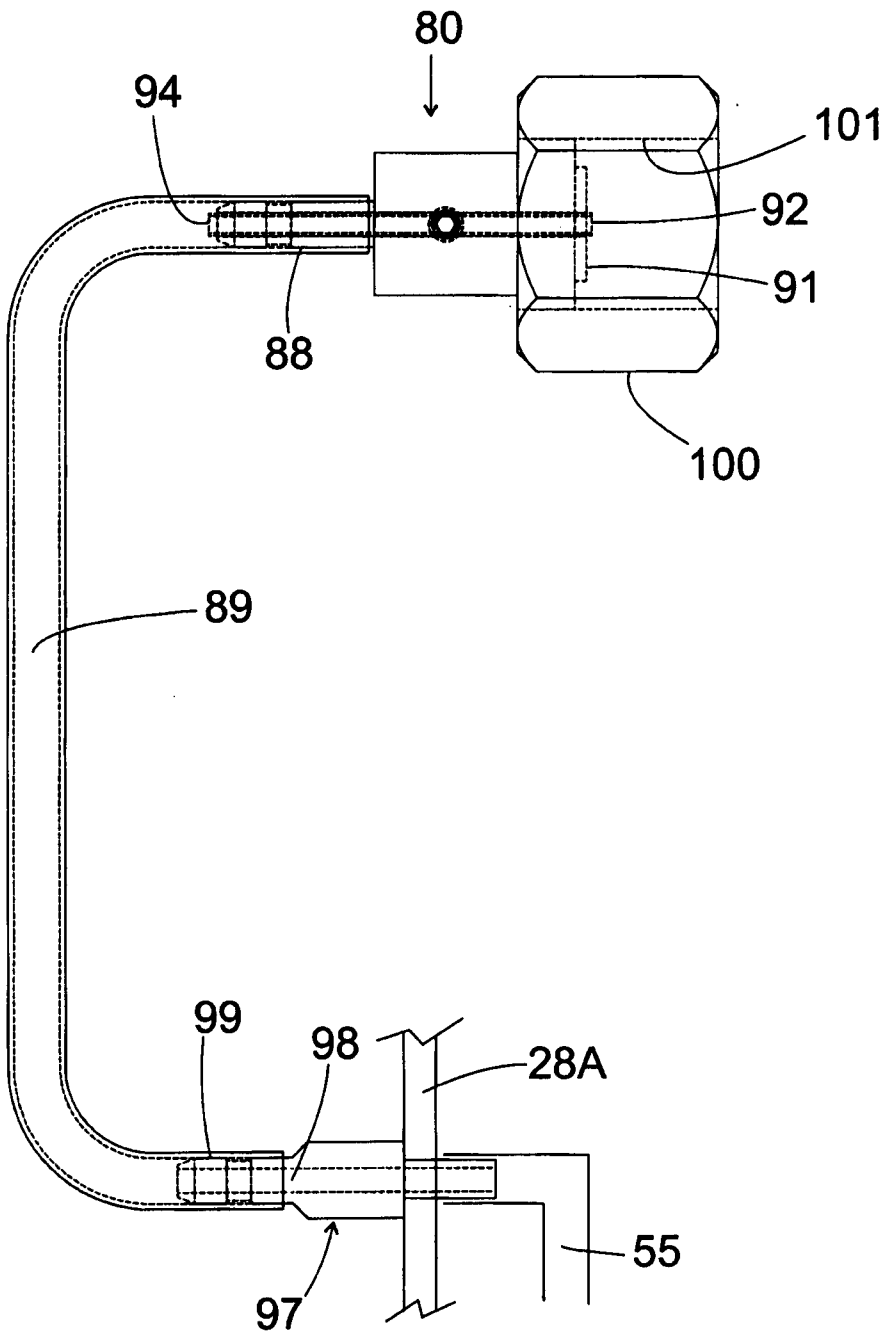


FIG 26

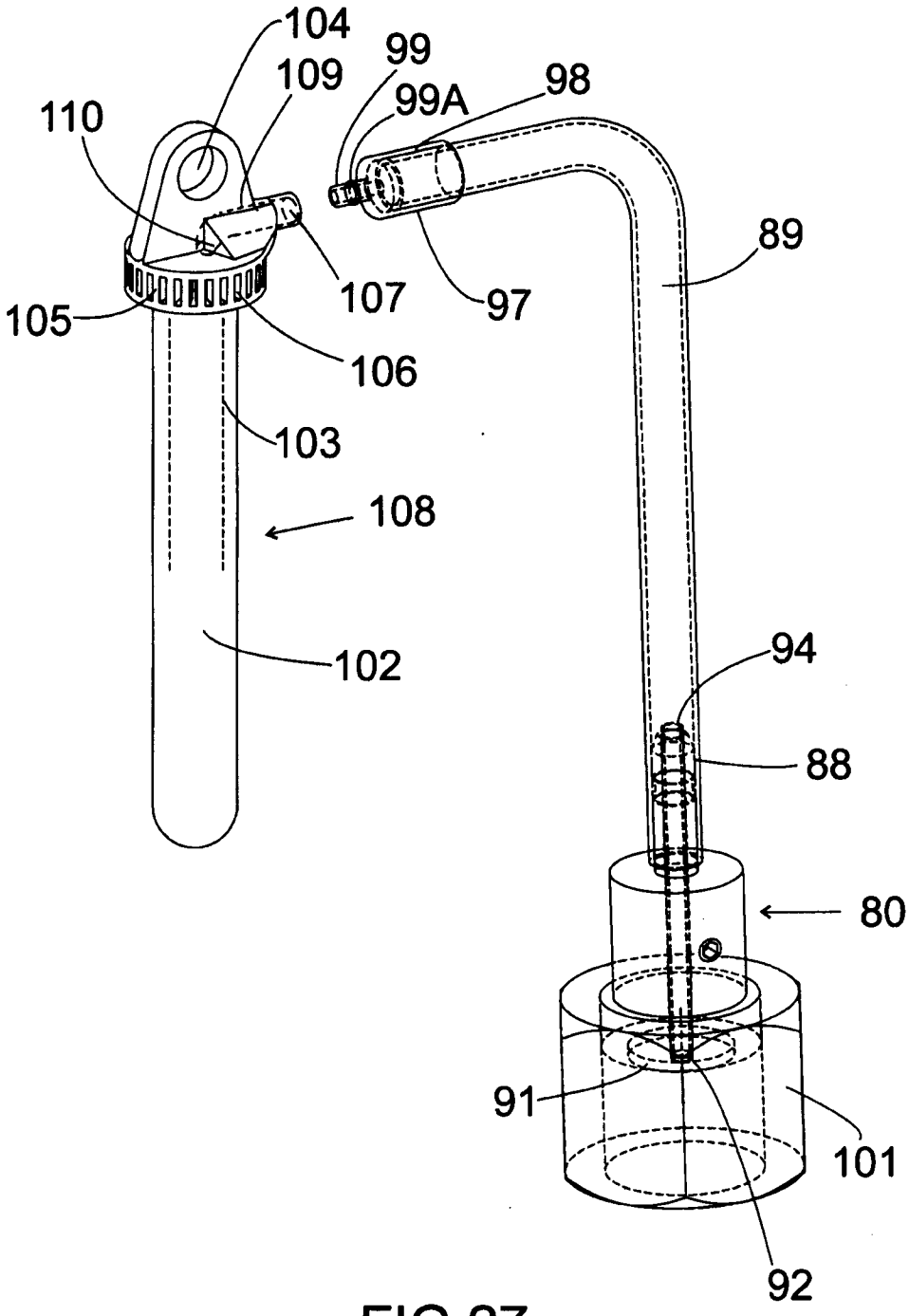

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FIG 27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2011/000381

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A01M 1/10 (2006.01) ***A01M 1/02*** (2006.01) ***A01M 1/04*** (2006.01) ***A01P 19/00*** (2006.01)
F16K 7/06 (2006.01) ***F16L 55/10*** (2006.01) ***F16L 55/172*** (2006.01) ***F16L 37/28*** (2006.01)
F16L 55/17 (2006.01) ***G01M 3/28*** (2006.01) ***G05D 16/06*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC, WPI IPC A01M1/- and KEYWORDS (gas, CO2, carbon dioxide, tube, pipe, passage, hose, conduit, restrict, modulate, reduce, constrict, modulator, viscous, honey, molasses, syrup and similar terms)
GOOGLE PATENTS: insect, trap, modulator, viscous

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2010/012031 A1 (BANTIX WORLDWIDE PTY LTD) 4 February 2010 Page 2, line 9 to Page 6, line 12 and figures	1 – 14, 16, 17, 22
Y	US 6199316 B1 (COVENTRY) 13 March 2001 Column 3, line 10 to Column 5, line 21 and figures	1 – 14, 16, 17, 22
Y	US 2007/0175085 A1 (CHEN) 2 August 2007 Para 0012 to Para 0013 and Figure 1	13

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 September 2011	14 SEP 2011
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **COLIN FITZGIBBON** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2226

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2011/000381

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3079954 A (KNAPP) 5 March 1963 Column 3, lines 18 to 24 and figures	14
X	FR 2888639 A1 (L'AIR LIQUIDE SOCIETE ANONYME POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE) 19 January 2007 Page 4, line 14 to Page 5, line 34 and Figures 2 and 3 (Machine translation)	18, 19
Y	JP 9-303582 A (MITSUBISHI HEAVY IND LTD) 25 November 1997 English abstract retrieved from EPODOC database Abstract	17
X	US 4548382 A (OTTING) 22 October 1985 Column 2, line 46 to Column 3, line 36 and Figures 2 and 3	21
X	US 4071039 A (GOOF) 31 January 1978 Column 2, line 49 to Column 3, line 12 and Figure 1	21
X	US 4044989 A (BASEL et al) 30 August 1977 Column 4, line 12 to Column 5, line 57 and Figure 2	21

Supplemental Box
(To be used when the space in any of Boxes I to IV is not sufficient)

Continuation of Box No. III Observations where unity of invention is lacking

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1 to 17 are directed to an insect trap including a housing having a gas bottle or container, one or more modulators having a viscous medium to produce a pulsed flow of gas, a capillary tube interconnecting the gas bottle or container and a respective modulator wherein the capillary tube has a restricted zone to decrease the flow of gas therethrough, whereby the pulsed flow of gas is caused to flow out of the housing at a greatly reduced rate compared to a flow rate that would be produced if the restricted zone was absent. Claim 22 is directed to a method of producing a pulsed flow of gas from a container or source of said gas which includes the steps of: reducing the flow rate of the gas by passing the gas through a capillary tube having at least one restricted zone; and passing said gas through one or more modulators containing a viscous medium to produce a pulsed flow of gas. The feature of one or modulators having a viscous medium to produce a pulsed flow of gas is specific to this group of claims.
- Claims 18 to 20 are directed to a conduit assembly interconnecting a modulator at one end and connectable to a gas bottle at another end, the conduit having (i) a connector body fittable to the modulator for discharge of gas such as carbon dioxide into a hollow interior of the modulator, and (ii) an attachment body having a capillary tube which incorporates a restricted zone for reducing the flow rate of the gas. The feature of a connector body fittable to the modulator for discharge of gas such as carbon dioxide into a hollow interior of the modulator is specific to this group of claims.
- Claim 21 is directed to an attachment body for attachment to a gas bottle or container having a longitudinal bore and a capillary tube located in the longitudinal bore and a passage located transverse to the longitudinal bore combining one or more pressurising devices for pressurising the capillary tube for forming a restricted zone wherein an amount of said gas pulses may be regulated as said gas pulses pass through the capillary tube in use. The feature of a passage located transverse to the longitudinal bore combining one or more pressurising devices for pressurising the capillary tube for forming a restricted zone wherein an amount of said gas pulses may be regulated as said gas pulses pass through the capillary tube in use is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is wherein the capillary tube has a restricted zone to decrease the flow of gas therethrough. However this feature does not make a contribution over the prior art because it is disclosed in:

FR 2888639 B1 (L'AIR LIQUIDE SOCIETE ANONYME POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE) 19 January 2007

Therefore in the light of this document this common feature cannot be a special technical feature. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a posteriori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2011/000381

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	2010/012031	AU	2009276287	US	2011/167711		
US	6199316	AU	47636/99	CA	2392551	MX	PA01005334
		US	2001/045052	US	2003/041506	WO	2000/32040
		ZA	200105101				
US	2007/175085	NONE					
US	3079954	NONE					
FR	2888639	NONE					
JP	9303582	NONE					
US	4548382	NONE					
US	4071039	DE	2611571	DK	118675	GB	1535362
US	4044989	US	3976277				

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX