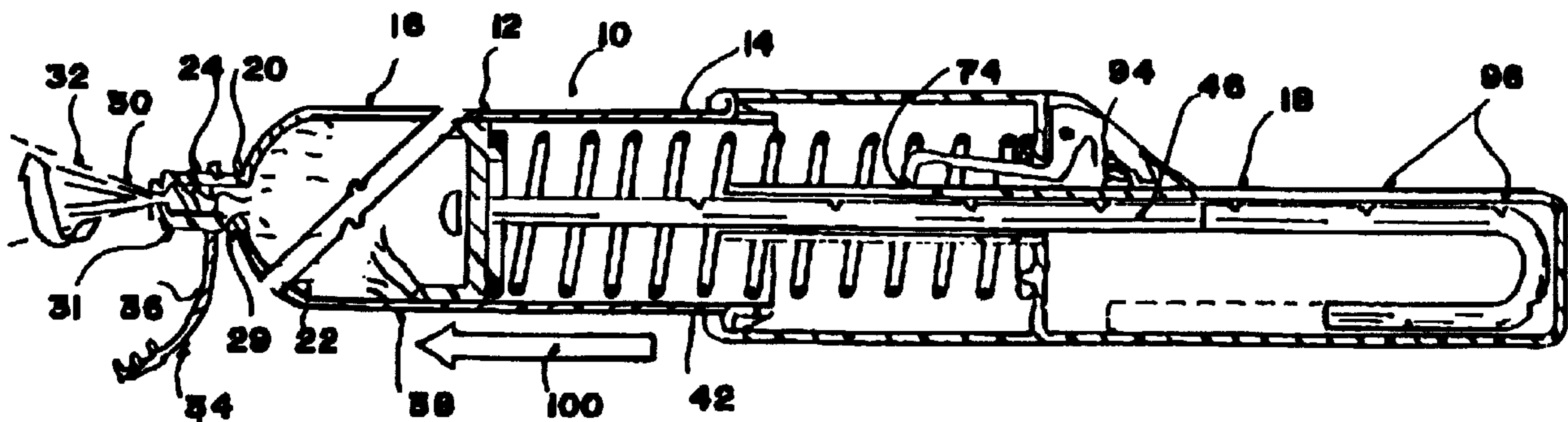




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(57) Abrégé/Abstract:

A fire extinguisher including a spring biased plunger controlled by a trigger mechanism wherein the plunger is mounted in a flame retardant compound container and the spring and plunger cooperate. When the trigger mechanism is activated, to discharge flame retardant compound from the container toward a fire. The extinguisher has a handle end and an outlet end at opposite ends of its length such that a user can hold the outlet end in a remote location away from the user when compound is discharged. The extinguisher can also be mounted and provided with a heat sensor for automatic activation.



ABSTRACT

A fire extinguisher including a spring biased plunger controlled by a trigger mechanism wherein the plunger is mounted in a flame retardant compound container and the spring and plunger cooperate. When the trigger mechanism is activated, to discharge flame retardant compound from the container toward a fire. The extinguisher has a handle end and an outlet end at opposite ends of its length such that a user can hold the outlet end in a remote location away from the user when compound is discharged. The extinguisher can also be mounted and provided with a heat sensor for automatic activation.

FIRE EXTINGUISHER

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY
SPONSORED RESEARCH OR DEVELOPMENT

5

Not applicable.

BACKGROUND OF THE INVENTION

10 The present invention relates to fire extinguishers generally and more particularly to a simple spring loaded tubular fire extinguisher which can be either hand held and manually operated or equipped with a heat sensitive fuse link and mounted for automatic operation.

15 There are many different hand held fire extinguisher systems which can be used to manually extinguish a fire. Most manual extinguishers include either a dry or wet flame retardant chemical compound placed under pressure within a cylindrical canister which includes an opening in a bottom end, a siphon tube connected at one end to the opening and at an opposite end to a valve sealed outlet, an activation device for opening and closing the 20 valve and a nozzle or a nozzle at the end of a hose which can be used to direct the compound toward a flame to extinguish the flame.

25 In operation, to extinguish a fire, a user directs the nozzle end of the hose toward the base of the fire and triggers the activation device to open the valve. Where the extinguisher includes a hose, the compound is forced therethrough and out the nozzle end to extinguish the fire. Usually, because the compound must travel 30 through the hose prior to being discharged, hose length is limited so that activation time is reduced, pressure required to force the compound through the hose is minimal and minimal compound is wasted within the hose.

These types of extinguishers only work if pressure
35 inside the canister is maintained at a high level. To
ensure that pressure is sufficient, most of these types
of extinguishers include, in addition to the hardware
identified above, a pressure gauge fitted on the valve to
visually indicate canister pressure. When canister
40 pressure drops below a threshold level the canister must
be recharged prior to use.

While these types of extinguishers are relatively
inexpensive, unfortunately, they have a number of
shortcomings. For example, while these extinguishers can
45 put out relatively small fires efficiently, they are
typically not suitable for extinguishing larger fires.
These extinguishers require a user to be located
relatively close to a fire in order to extinguish the
fire. While a user can get close to a small fire without
50 suffering heat related effects, large fires generate
dangerous levels of heat which can scorch a person even
though actual contact with the fire is avoided. It is
particularly dangerous when an extinguisher is not
equipped with an extension hose connected to the nozzle
55 as a user must hold the nozzle adjacent a fire during
extinguishment. Even when a hose is provided, as
indicated above, to minimize activation time, reduce
required canister pressure and minimize wasted compound,
most extinguisher hoses are relatively short which means
60 a user has to be near the fire during extinguishment.

Another problem with these types of extinguishers is
that required components are expensive. For example, the
pressure gauge is expensive. Another relatively
expensive component is the canister which must maintain
65 the compound under extreme pressure for extended periods.
In addition to meeting pressure requirements under normal
conditions, canisters must also meet varying pressure
requirements which depend on ambient temperatures which
can vary from below freezing to temperatures above 100° F.
70 Moreover, because many of the extinguisher chemical

compounds are corrosive, the canisters have to be formed from materials which do not deteriorate when in contact with corrosive chemicals. All of these limitations require specifically constructed canisters which, due to
75 their special construction are relatively expensive.

The task and related expense of providing a suitable canister is even more problematic when exotic canister shapes are desired. For example, space limitations might restrict the depth of a canister even though a space can
80 accommodate a greater relative width. In this case, a canister having an oval or rectangular cross section might be most advantageous. Unfortunately, while such shapes are possible, they are usually cost prohibitive.

In addition, canisters which have to withstand high
85 pressure tend to be heavy. Heavy metals which maintain their shape under pressure are typically used to form the canisters. For example, to provide a canister which can maintain ten pounds of extinguisher material under pressure for an extended period, extinguisher hardware
90 will typically weigh as much as fifteen to twenty pounds for a total loaded canister weight of between twenty-five and thirty pounds.

Another related problem is that heavy extinguishers are difficult to operate. For example, where a large
95 fire occurs or fire exists in a relatively high location (e.g., 6 or more feet above floor level), a user must lift an extinguisher up above the user's head in order to direct retardant compound at the fire. The task of lifting a heavy extinguisher is exacerbated by the
100 necessity that extinguisher position must be relatively controlled so that compound is delivered in intended directions.

Moreover, the task of directing the extinguisher toward a fire is made more difficult by the reality that
105 these extinguishers have to remain upright in order to operate properly. When upright, the retardant compound is located above the canister opening and the pressure

causing gas is located thereabove as desired. When the valve is opened, the gas forces the compound out the opening.

Unfortunately, when the canister is not upright, the compound therein shifts under the force of gravity and will assume the lowest possible position inside the canister. For example, if the canister is upside down so that the opening is at the top of the canister, the compound will be opposite the opening. In this case, when the valve is opened the gas, not the compound, is discharged and the extinguisher is ineffective. This is also true where the canister is oriented longitudinally.

To overcome the weight limitations associated with these extinguishers, the pressure inside these extinguishers and the nozzle design are such that compound is discharged at extremely high speeds so that it can travel several feet relatively quickly.

Unfortunately, a high pressure compound can often lead to "fire blast" and spreading. "Fire blast" is a term used herein to refer to the occurrence wherein fire can be spread from its original location when combustible materials thereat are blasted from their location. For example, where an extinguisher is used to extinguish a grease fire, the impact of high speed discharged compound can cause ignited grease to be splattered all over an adjacent area which, instead of extinguishing a fire, can spread the fire to the adjacent area.

Yet another problem with these extinguishers is that they have to be routinely maintained in order to remain operable. At the very least, pressure gauges have to be checked every few months to ensure canister pressure is above the required threshold level. Where canister pressure is insufficient, the canister has to be recharged prior to use.

One other problem with these extinguishers which is related to their having to be upright to operate properly is that they malfunction in zero gravity environments.

145 For example, in outer space, where there is no gravity,
even when oriented in an upright position with the
canister opening at the bottom, because there is no
gravitational force on the compound, the compound tends
to float inside the canister, compound and gas inside the
150 canister mix and, when the valve is opened, the mixture
is discharged instead of pure compound.

In addition to hand held fire extinguishers there
are also many different types of mounted fire
extinguisher systems configured to automatically
155 extinguish a fire. For example, there are water
sprinkler systems which, when heat or smoke are sensed,
deliver water through plumbing to one or more areas in a
building to extinguish a perceived fire. While these
systems are effective, they typically are the most
160 expensive systems available as the plumbing hardware
required can be extensive, particularly in large
buildings.

Another example of a mounted extinguisher is
described in U.S. patent No. 4,979,572 entitled FIRE
165 EXTINGUISHER INSTALLATION which issued on December 25,
1990 to the present inventor. That system includes a
compact design wherein an extinguisher canister is
secured by a two bolt bracket within a stove hood and is
connected at an outlet end to a complex configuration of
170 pipes, cables and one or more heat sensitive fuse links.
The fuse links are located above the stove so that a fire
on or near the stove will melt at least one link. When a
link melts the cables cooperate with a trigger mechanism
to open the outlet end of the canister. When opened the
175 canister dispenses its contents (i.e. flame retardant
compound) through the outlet and pipe configuration
downwardly toward the stove to extinguish the fire.

This and other stove mounted systems are extremely
important as a large majority of fires occur on or around
180 a stove. By extinguishing stove fires rapidly most fire

damage can be minimized and many fire related deaths and injuries can be avoided.

This system had many advantages over prior art stove top extinguishers including compact size, relatively
185 unobtrusive appearance and ease of installation. Nevertheless, through use it has become apparent that this system has a number of shortcomings.

First, while requiring smaller and fewer components than the prior art, this system is still relatively
190 complex and therefore expensive to manufacture. For example, this system requires at least two interconnected pipes for dispensing retardant material, several cable sections located outside the pipes and connected by fuse links, and a complex connection system for linking the
195 canister to the pipes. In addition, the gas and electricity shut off mechanisms require many different mechanical components which are subject to breakdown.

Second, this system is still difficult to install. When installed the canister is located up and in a back
200 portion of the hood. To install this system the bracket has to be fastened to a rear area of the hood's internal under surface. Where the hood is deep enough to facilitate installation access, to the hood's rear area is difficult. In addition, because the canister outlet
205 must be at a specific angle and location with respect to the pipe system, the bracket must be adjustable and must be adjusted through trial and error during installation.

Third, once installed, this system may not have an appealing appearance. For example, where the internal
210 portion of the hood is not sufficiently deep, the pipe and cable configuration might be readily observable below the front portion of the hood. In addition, the canister may be observable. This is particularly true where the hood is not deep enough to accommodate both the bracket
215 and the canister.

Fourth, this system has some operational constraints. For example, the fuse links and cable

220 sections are generally unprotected and could accidentally break dispensing canister material.

Fifth, after a fuse link breaks, the entire cable and fuse link assembly must be replaced in order to reset the trigger mechanism.

Sixth, part of the trigger mechanism is located outside a protective housing (e.g., pipe or other rigid housing). In this case, if the system is installed in a small area the moving
225 trigger mechanism could be placed adjacent a hood section which might hinder triggering action thus rendering the system ineffective when the link breaks.

Seventh, these system have many of the shortcomings that are described above in relation to the hand held extinguishers. For example, the high pressure canisters and gauges for these systems are typically expensive. In addition, the canisters are usually heavy so that
230 mounting hardware has to be extensive and these systems have to be routinely maintained.

Thus, it would be advantageous to have a hand held extinguisher which is light weight, relatively inexpensive which is light weight, relatively inexpensive to manufacture, has a small size and is suitable for use in extinguishing large and small fires. In addition, it would be advantageous to have a mounted and automatic system which is also light in weight,
235 inexpensive, small and overcomes the other limitations associated with mounted systems above.

BRIEF SUMMARY OF THE INVENTION

Accordingly, in one aspect of the present invention, there is provided a An apparatus
240 for extinguishing fires via a retardant material, the apparatus comprising:

a container forming a material chamber having first and second ends and forming at least one outlet at the second end;

a plunger positioned for movement within the container essentially between the first and the second ends;

245 a motivator for selectively moving the plunger through the chamber from the first to the second ends, said motivator activated by a trigger which includes an engagement member located completely within said container and operatively connected to the plunger, said engagement member comprising two separate sections, a rigid section and a deformable section connected by a link, said deformable section at least partially deformed within said
250 container when said plunger is positioned proximate said first end; and

a seal for the outlet, the seal openable to permit retardant material to pass through the outlet.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

255

Fig. 1 is a perspective view of an inventive hand-held fire extinguisher;

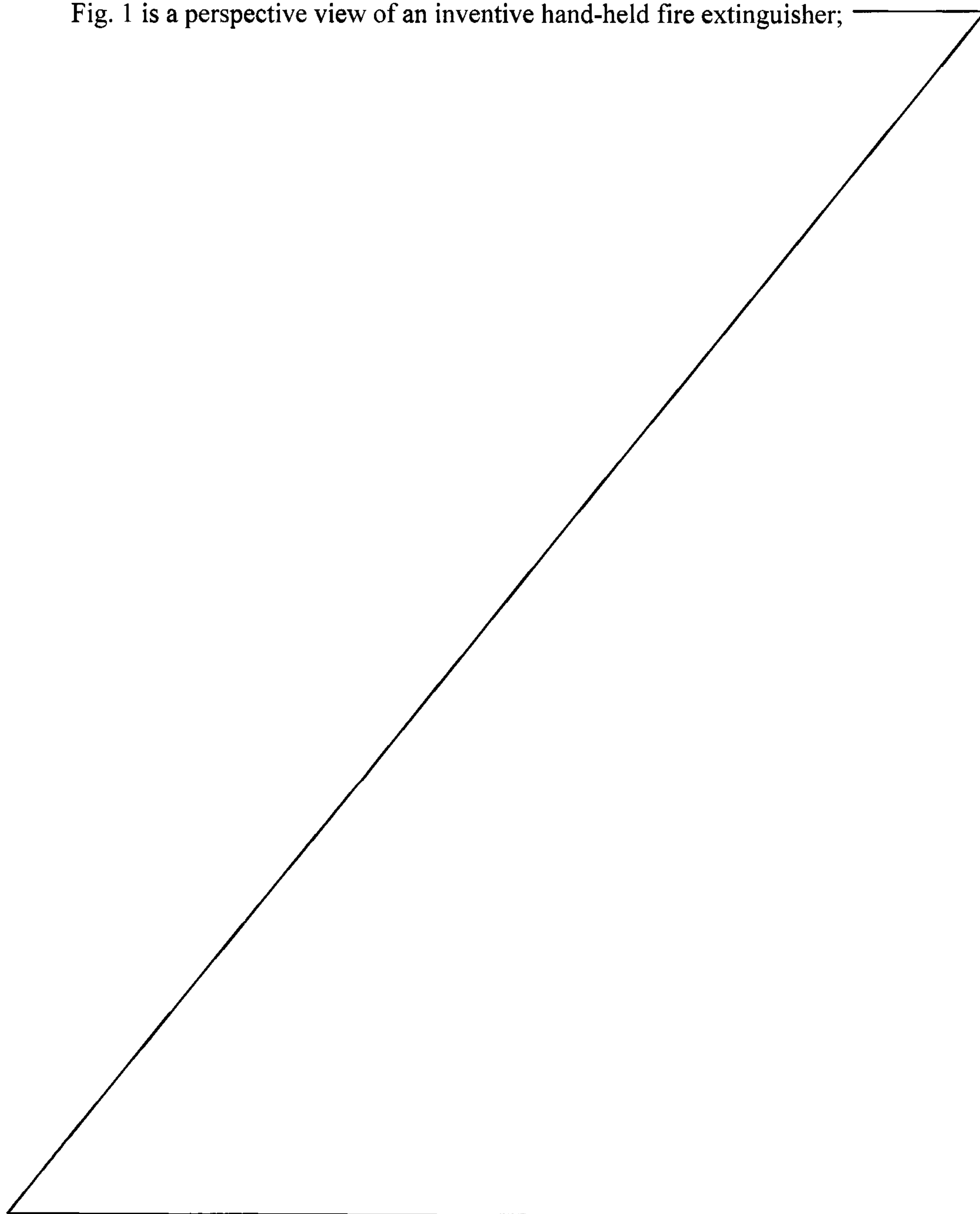


Fig. 2 is a cross sectional view taken along the line 2-2 of Fig. 1 with the extinguisher in a loaded configuration;

Fig. 3 is similar to Fig. 2, albeit with the
400 extinguisher in a partially discharged configuration;

Fig. 4 is a plan view of the nozzle insert of Fig. 2;

Fig. 5 is a perspective view of the second hand-held extinguisher embodiment;

405 Fig. 6 is a cross sectional view of the extinguisher of Fig. 5 in a fully loaded configuration;

Fig. 7 is a view similar to Fig. 6, albeit with the extinguisher in a partially discharged configuration;

Fig. 8 is a partially exploded view of the
410 extinguisher of Fig. 5;

Fig. 9 is a perspective view of a third embodiment of the present invention;

Fig. 10 is a cross sectional view taken along a line 10-10 of Fig. 9;

415 Fig. 11 is similar to Fig. 10 except that it is a partial view;

Fig. 12 is a cross sectional view taken along the line 12-12 in Fig. 10;

Fig. 13 is a perspective view of a fourth embodiment
420 of the present invention;

Fig. 14 is a cross sectional view taken along the line 14-14 of Fig. 13; and

Fig. 15 is a cross sectional view taken along the line 15-15 of Fig. 13.

425 DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, wherein like reference characters represent corresponding elements throughout the several views, and more specifically, referring to Figs. 1 through 4, a first manual and hand-
430 held embodiment of the inventive extinguisher 10 is

illustrated. This extinguisher 10 generally includes a tubular and elongated retardant chemical compound container 12 and a handle/trigger assembly 18.

The container 12 has first and second opposite ends 435 14, 16, respectively. The first end 14 is open and forms a radially outward extending flange 25 adjacent its distal edge 27 about its circumference. The second end 16 is substantially closed and forms a single outlet 20 which opens into a cylindrical nozzle extension 31. 440 Extension 31 has a distal reduced radius end 30. A frangible rubber seal 29 is provided in the outlet 20. Seal 29 is typically closed when there is little pressure inside the container 12 but opens readily when container pressure is increased. Container 12 forms a retardant 445 material chamber 22.

Referring to Figs. 2, 3, and 4, an outlet insert 24, typically formed of plastic, metal or some other rigid material, is provided inside outlet 20. Insert 24 is formed of a single piece of material including two arm- 450 like members 26 and 28 which are configured in a spiral configuration which tends to increase the velocity of flame retardant material forced therethrough, as will be explained in more detail below. Distal end 30 and insert 24 cooperate to atomize compound forced through outlet 20 455 and provide a rotating high-velocity spray as illustrated by numeral 32.

A simple plastic cap 34 is provided to close and seal end 30 when extinguisher 10 is not in use. Preferably, cap 34 includes a strap member 36 which 460 connects the cap 34 to container 12 even when the cap 34 is not inserted in end 30.

Referring now to Figs. 2 and 3, handle/trigger mechanism 18 generally includes a plunger 38, a handle housing 40 and a motivator for selectively moving plunger 465 38 through chamber 22 from the first end 14 to the second end 16 of container 12. The motivator includes a biasing

means, typically in the form of a spring 42, a trigger 44, and an elongated engagement member or extension 46.

Plunger 38 typically takes the form of a piston and
470 includes a base wall 48 and a dome wall 50, and is sized to have a radius which is slightly less than the radius of chamber 22, such that plunger 38 fits snugly within chamber 22. An annular extension 77 is provided on a surface of base wall 40 opposite wall 50 which is sized
475 to be received within one end of spring 42. Plunger 38 should be formed of rubber or a resilient plastic such that it forms a seal around its outer surface with the internal wall of chamber 22. However, the plunger 38 should be formed of a material which has a minimal
480 coefficient of friction with the material that chamber 22 is formed of such that plunger 38 movement within chamber 22 is essentially uninhibited by plunger 38 contact with chamber 22. Handle housing 40 includes a spring housing section 52 and an extension housing section 54. Section
485 52 is essentially cylindrical, having a radial wall 56 with first and second ends 58, 60, respectively. At the second end 60, a radially inward flange 62 is provided which forms an aperture 64 having a diameter which is slightly greater than the diameter of the outer surface
490 of container 12 but is less than the diameter of flange 25 extending off container 12. At the first end 58, another radially inward flange 66 is provided. Flange 66, however, extends inwardly much further than flange 62, forming a reduced diameter opening 68 which is
495 concentric with opening 64.

An internal cylinder 70 is provided at opening 68 and extends from first end 58 substantially to second end 60 forming an internal cylinder channel 72 which is concentric with openings 64. Cylinder 70 is open at both
500 ends. A single aperture 74 is provided in cylinder 70 approximately one third or one half way along its length on a trigger side 70a of cylinder 70. In addition to cylinder 70, an annular flange 76 extends from flange 66

toward second end 60. Flange 76 is approximately the
505 same size as flange 77 so that it is suitable to receive
one end of spring 42.

An aperture 78 is provided in flange 66 between
flange 76 and cylinder 70 which is aligned with aperture
74 (i.e. is at the same radial position.)

510 Housing section 54 preferably has a reduced radius
when compared to section 52. Section 54 extends from
section 52 forming a hollow cylinder about an internal
chamber 80. Section 54 is not concentric with section
52, but instead includes a cylinder having opposite
515 sections 54a and 54b which define a diameter therebetween
which extends from trigger side 70a of cylinder 70 which
is aligned with section 54a across channel 72 to a distal
section of section 52 which is aligned with section 54b.
Thus, the axis about which apertures 64 and 68 are formed
520 extends into chamber 80 and is relatively closer to
section 54a than it is to section 54b. Section 54a forms
an annular extension 82 near flange 66 which is radially
aligned with apertures 74 and 78. (i.e. is at the same
radial position.)

525 Two walls 84 (only one is shown) extend from flange
66 to section 54a and form a trigger channel
therebetween. A post 86 is provided between the two
walls 84 which supports trigger 44 as will be described
below.

530 Trigger 44 includes a button section 88 and an
extension 90 having a pawl 91 at its distal end. Trigger
44 also forms an annular extension 92 which is
substantially identical to annular extension 82. A
second spring 94 which is much smaller than spring 42 is
535 provided.

Extension 46 is essentially an elongated ratchet
assembly having recesses collectively referred to by the
numeral 96 which are equi-spaced along its length. In
the embodiment illustrated, extension 46 includes two

540 separate sections, a rigid section 46a and a deformable section 46b, which are connected via a link 98.

When assembled, trigger 44 is mounted on post 86 with spring 94 between extensions 82 and 92 and pawl 91 aligned with aperture 74. The spring forces section 88
545 outwardly and forces pawl 91 through aperture 74 when section 88 is not depressed. Extension 46 is centrally connected to the base wall 48 of plunger 38 in any manner known in the art. Spring 42 is placed so that one end is around flange 76, and the length of the spring is around
550 cylinder 70. Extension 46 is placed through channel 72 such that the free end of spring 42 receives flange 77. The spring 42 is compressed while plunger 38 is forced toward housing 40. As spring 42 is compressed, section 46b is forced into chamber 80 and curls up therein as
555 illustrated. In addition, as spring 42 is compressed, extension 46 will force pawl 91 out of channel 72 unless pawl 91 is aligned with one of the recesses 96. When the pawl 91 is aligned with a recess 96, pawl 91 extends into the recess and effectively "locks" the extension 46 in
560 its instantaneous position unless a user purposefully causes pawl 91 to be removed from the recess 96 by either pushing on section 88 or forcing the plunger 38 to further compress spring 42. Plunger 38 is forced toward housing 40 until pawl 91 is aligned with and extends into
565 the recess 96 closest to plunger 38.

To connect container 12 to housing 40, container 12 is configured such that container 12 extends through aperture 64 with flanges 25 and 62 interlocked as illustrated. In this configuration, outlet 20 is at one
570 end of the extinguisher and handle housing 54 (i.e. a handle) is at an opposite end (see Fig. 1).

With the extinguisher assembled as described above, cap 34 is removed from distal outlet end 30 and chamber 22 is filled via outlet 20 with a flame retardant
575 chemical compound. Once filled, cap 34 is positioned so as to block end 30.

In operation, when the extinguisher 10 is to be used to put out a fire, a user picks up the extinguisher 10 via handle section 54 with a thumb or finger placed over section 88. Cap 34 is removed from end 30. Moving to an area within the vicinity of the fire, the user holds out his or her arm and points end 30 directly at the base of the fire. The user pushes on section 88 causing spring 94 to contract. When spring 94 contracts, pawl 91 is removed from recess 96. (See Fig. 3.) When pawl 91 is removed from recess 96, pawl 91 no longer locks extension 46 in its instantaneous orientation. Spring 42 begins to expand forcing plunger 38 from the first end 14 in a direction toward the second end 16 as illustrated by arrow 100. When plunger 38 is moved, pressure inside chamber 22 instantaneously increases forcing seal 29 to open (see Fig. 3) so that retardant compound is forced therethrough. The compound is forced through insert 48 and then out distal end 30 forming spray 32.

Where a user only wants a small amount of retardant compound to be forced out of chamber 22, the user can simply depress section 88 for a short time. When section 88 is depressed for a short time, spring 94 contracts, pawl 91 is removed from recess 96 and spring 42, plunger 38 and extension 46 begin to move as illustrated in Fig. 3. However, immediately after section 88 is released, pawl 91 is forced through aperture 74 and will be forced via spring 94 back into channel 72 again once the next aperture 96 is aligned therewith. Thus, by depressing and immediately releasing section 88, the spring 42 will only be allowed to expand until the next recess 96 is aligned with pawl 91.

Where the user wishes to discharge all of the compound in chamber 22, the user can simply hold down section 88 for an extended period allowing spring 42 to expand until plunger 38 has reached end 16.

Importantly, when retardant compound is placed inside chamber 22, the compound is under virtually no

pressure until the extinguisher 10 is activated. All
615 spring pressure is sustained by extension 46 and pawl 91.
Therefore, container 12 can be formed of a relatively
inexpensive and light material, such as plastic. In
addition, because container 12 can be formed of plastic,
the container can be formed of a transparent plastic so
620 that a user can immediately visually determine whether or
not the extinguisher 10 is fully charged, partially
charged, or completely discharged. For this reason, the
present extinguisher does not require a pressure gauge to
identify whether or not it is charged.

625 Referring now to Figs. 5 through 8, a second hand-
held and manually-operated extinguisher 110 is
illustrated. This embodiment is similar to the
embodiment illustrated in Figs. 1 - 4, in that it relies
on spring pressure and a plunger as opposed to high
630 pressure flame retardant material to discharge retardant
compound. The extinguisher 110 includes a housing 112, a
material canister 114, a handle/trigger assembly 116, a
plunger, a discharge hose 120, and various other
components which will be described in more detail below.

635 The housing 112 includes first and second sections
112a and 112b. The first section 112a includes a half
cylinder wall 123 and a bottom circular floor member 122.
There is a channel 124 formed in section 112a which has a
first end 126 concentrically positioned in member 122,
640 and a second end 127 at wall edge 128. Annular fittings
132 and 134 are provided, one at each of the first and
second ends 126, 127, respectively. Second section 112b
consists of a wall which is substantially identical to
wall 123 except that it does not form a channel
645 therethrough and does form an elongated hose storage
recess 137 along its length. Sections 112a and 112b also
form connecting mechanisms (not identified by numbers)
which allow the two sections 112a and 112b to be securely
connected together forming a housing cylinder as
650 illustrated in the figures.

Canister 114 is a cylindrical canister which forms a compound chamber 172. Canister 114 is formed so that it will fit snugly within the space defined by sections 112a and 112b when the sections 112a and 112b are connected to each other. Canister 114 forms a central outlet 138 in its lower wall 140 which has an elastomeric O-ring 142 positioned therein. Outlet 138 is formed so that when canister 114 is positioned in housing 112, the outlet 138 receives fitting 132 and the O-ring 142 forms a seal therebetween. Canister 114 has first and second ends 143, 144, respectively. Canister 114 is essentially open at its first end 143.

Referring still to Figs. 6 and 7, plunger 118 in this embodiment includes a single wall which is formed such that, when placed inside canister 114, the lateral edges 146 form a seal with the internal surface of canister 114. As in the first embodiment, in this embodiment, plunger 118 should be formed of a rubber or resilient plastic which has a relatively low coefficient of friction with the material that canister 114 is formed out of so that plunger 118 can move between the first and second ends 143 and 144 of canister 114 uninhibited by contact therewith.

Handle/trigger assembly 116 includes a housing section 148, a trigger 150, an extension 152, a spring 154 and a relatively larger spring 156. Housing 148 has an upper section which forms a handle 158 and a lower section which forms an extension housing 160 having a tangent channel 171 and a lower, substantially circular, base wall 162. In addition, housing 148 forms a post 164 on which trigger 150 is mounted, an annular extension 166 for receiving spring 154 and an axially-extending annular flange 168 which extends downwardly from wall 162 for receiving spring 156.

An aperture 170 is provided centrally within wall 162 and provides a pathway between channel 171 and chamber 172. An aperture 174 is provided in channel 171.

Referring to Figs. 5, 6 and 7, trigger 150 includes a trigger section 178, an extension 180, an annular
 690 extension 182 for receiving and supporting spring 154 and a pawl 184 at the distal end of extension 180. The trigger 150 is mounted on post 164 such that section 178 is adjacent handle 158 and can be easily depressed thereat. In addition, the trigger 150 is mounted such
 695 that pawl 184 is forced via spring 154 through aperture 174 into channel 171 when section 178 is not depressed.

In this embodiment, extension 152 consists of a single deformable and resilient element which curls up in chamber 160 as illustrated in Figs. 6 and 7 when spring
 700 156 is compressed but which can also assume an elongated configuration when spring 156 expands. Extension 152 includes a plurality of recesses equispaced along its length which are collectively identified by numeral 186. A first end 152a on extension 152 is not connected but a
 705 second end 152b is securely connected to plunger 118.

Discharge hose 120 includes a deformable section 120a and a rigid wand section 120b at the end thereof. The two sections 120a and 120b can be used by an operator to direct a nozzle end 190 of the hose 120 toward the
 710 base of a fire. The end of the hose opposite the nozzle end 190 includes a fitting which is suitable for connection to fitting 134.

When assembled, trigger 150 is mounted on post 164 with spring 154 between extensions 166 and 182 such that
 715 pawl 184 is forced via spring 154 through aperture 174 and into channel 171. End 154b is connected to plunger 118. Spring 156 is received by flange 168 so that one end of spring 156 rests on wall 162. Extension 152 is inserted through spring 156 and through channel 171.
 720 Extension 152 and plunger 118 are forced toward housing 148 compressing spring 156 while extension end 152a curls up inside housing 160. As end 152a is forced into housing 160, pawl 184 is periodically received in recesses 186 which cooperate to lock the extension 152 in

725 its instantaneous configuration. Eventually, the recess
186 closest to plunger 118 is aligned with pawl 184 and
pawl 184 is received therein locking the plunger 118,
spring 156 and extension 152 in a loaded and untriggered
configuration.

730 Next, chamber 172 is approximately 4/5ths filled
with retardant compound (assuming spring 156 and plunger
118 require approximately 1/5th of the space inside
canister 114). If desired, canister 114 can be slightly
over filled so that when assembly 116 is forced onto the
735 first end 143 of the canister, some of the compound
therein is forced into hose 120. In this case, when the
extinguisher 110 is activated, discharge will be
immediate. Assembly 116 is secured to the first end 143
of canister 114 with plunger 118 near the first end and
740 at the top of the compound chamber 172.

With assembly 116 securely attached to canister 114,
the canister is placed over fitting 132 and seal 142
forms a liquid tight seal between fitting 132 and outlet
138. Wall 112b is then connected to section 112a so that
745 the housing 112 completely surrounds canister 114.

Fitting 192 is connected to fitting 134 and wand
120b is secured in channel 137 via a pressure fitting or
the like (see Fig. 6). Referring to Figs. 5 and 8, a pin
194 is provided and apertures are provided in handle 158
750 and trigger 150. The apertures align when trigger 150 is
in an untriggered configuration and pin 194 can be
inserted therethrough to ensure that trigger 150 is not
triggered inadvertently when extinguisher 110 is being
transported.

755 In operation, when a fire occurs, a user transports
extinguisher 110 to an area proximate the fire by picking
up the extinguisher via handle 158. When proximate the
fire, the user removes pin 194 from handle 158, freeing
trigger 150 so that section 178 can be depressed. The
760 user removes wand 120b from channel 137. Holding wand
120b at an end 196 opposite nozzle end 190, the user

directs nozzle 190 at the base of the fire. The user depresses section 178. When section 178 is depressed, trigger 150 rotates about post 164 against the force of
 765 spring 154 causing pawl 184 to be removed from recess 186 and channel 171. When pawl 184 is removed from recess 186, spring 156 and plunger 118 are no longer locked in a single configuration. At this point, spring 156 begins to expand, forcing plunger 118 toward second end 144 of
 770 canister 114. The plunger 118 in turn forces retardant compound from inside chamber 172 into channel 124 and through hose 120 and nozzle 190 toward the fire.

Again, if the user only wishes to discharge a small amount of material from chamber 172, the user can depress
 775 section 178 for a short time. In this case, pawl 184 is removed from recess 186, spring 156 begins to expand extending extension 152 such that pawl 184 is no longer aligned with one of the recesses 186. However, when section 178 is released, pawl 184 is forced against
 780 extension 152 and, when the next recess 186 becomes aligned with pawl 184, pawl 184 is forced into the recess 186 once again locking extension 152, spring 156 and plunger 118 in a single configuration until section 178 is again depressed.

785 In addition, as with the first embodiment, with this embodiment, if a user intends to discharge all of the compound in chamber 172, the user simply depresses section 178 for a long period enabling spring 156 to expand until plunger 118 reaches end 144.

790 Referring now to Figs. 9-12, there is illustrated yet another embodiment 250 of the inventive fire extinguisher system. This embodiment, unlike the first two is meant to be mounted in a ceiling, stove hood or the like. In addition, this embodiment is different in
 795 that it is meant to be an automatic as opposed to a manual extinguisher. In this embodiment 250, instead of providing a single canister 12 which must be connected to rail 14, two canisters are provided inside an extruded

800 rail. This embodiment includes a rail 252 and two canisters 254 and 256 in addition to other components which will be described in more detail below.

805 Referring to Figs. 10, 11 and 12, the rail 252 is an elongated extruded member, preferably of aluminum, having first 252a and second 252b ends. Rail 252 forms three channels including a canister channel 258, a retardant guiding channel 260 and a cable channel 262. Channel 258 has a relatively large radius so that it can accommodate canisters 254 and 256. In the middle of rail 252, the rail 252 forms an opening 264 (see Fig. 17) between
810 channels 258 and 262. In addition, rail 252 forms two openings 266, 268 between channels 258 and 260, opening 266 formed at end 252a and opening 268 formed at end 252b.

815 Rail 252 generally has a lower surface 270 and forms a plurality of discharge outlets collectively referred to by the numeral 272 in surface 270. Outlets 272 extend through surface 270 into channel 260. The ends 274, 276 of channel 260 are threaded.

820 Each of the two canisters 254, 256 is constructed in and functions in substantially the same manner and therefore only canister 256 will be described in detail. Referring specifically to Fig. 18, canister 256 includes a shell 278 with an outlet end 280 and a spring loaded end 282. A threaded cap 284 closes the spring loaded end
825 and forms a central opening 286. A plunger 290 and a spring 288 are positioned inside shell 278 adjacent cap 284. A plunger extension 292 extends through the central portion of the spring 288 and out opening 286. The extension forms an aperture 294 perpendicular to its
830 length.

Prior to discharge the plunger 290 is forced into a position wherein spring 288 is completely compressed and extension 292 extends out of opening 286. In this position, there is a large area within canister 256 where
835 flame retardant material is stored. Prior to discharge,

the extension 292 and associated plunger 290 are held in the spring compressed configuration by both a pin 296 and a cable 298. The pin 296 extends through aperture 294 while the cable 298 is connected to the extension 292 via
840 an eyelet 300.

Referring still to Figs. 9 through 12 the cable 298 extends through opening 264 into channel 262, extends out of channel 262 (see Fig. 9) and is connected to one-half of a fuse link 302. The other half of link 302 is
845 connected to another cable 304 which extends to the opposite end of channel 262, enters channel 262 and extends there along to opening 264 and is connected to an extension 306 associate with canister 254 (see Fig. 10).

Referring to Figs. 10 and 11, two end plugs 308 and
850 310 are provided, a separate end plug 308 or 310 closing each end of channel 258. Both end plugs are substantially identical and therefore only one of the two end plugs 310 will be described here in detail. Plug 310 includes an internal end 314, an external end 316 and an
855 external surface 318 which, when plug 310 is received in the end of channel 258 forms a tight seal with the internal surface of channel 258. Plug 310 also forms a channel 312 which has an inlet end centrally located in end 314 and has an outlet in its circumferential surface
860 318 (i.e. channel 312 bends from its inlet to its outlet ends). The internal surface of channel 312 forms a circumferential recess 318 adjacent its input end. When assembled, an elastomeric seal 320 is provided in recess 318 and the input end of channel 312 receives the outlet
865 end 280 of canister 256. In addition, when assembled, the outlet end of channel 312 should be aligned with outlet 268. The plugs 308 and 310 can be secured in the ends of channel 258 in any manner known in the art including threading, glue, or some other mechanical
870 means.

In addition to the components discussed above, this embodiment should include some type of mounting mechanism

(not shown) to maintain the rail/canister assembly 250 above an area to be monitored. The system also includes
 875 two threaded end plugs 322, 324 that are securely received in threaded channel ends 274, 276 and a plurality bolt/nozzle assemblies 326 (see Fig. 12), one assembly for each discharge outlet 272.

Referring to Figs. 9 and 10, when installing this
 880 embodiment, pin 296 should remain in the position illustrated so that the canisters 254, 256 do not accidentally discharge. After the assembly 250 has been installed above a stove or some other area to be monitored, the pin 296 can be removed so that all of the
 885 tension in spring 288 (and the other spring in canister 254) stretches cables 298 and 304 with fuse link 302 therebetween.

In operation, during a fire the excessive heat from the fire will cause link 302 to explode releasing the
 890 tension on cables 298 and 304. At this point the springs in canisters 254 and 256 (i.e. spring 288 in Fig. 11) expand forcing associated plungers 290 away from cap 284. Retardant material in canisters 254, 256 then is discharged through outlets (280) and channels (312) into
 895 channel 260 and out outlets 272 to extinguish the fire.

Importantly, with the embodiment shown in Figs. 9 through 12, if the rail 252 is formed of a relatively inexpensive extruded material, this entire system may be disposable after use so that the system would simply be
 900 replaced after discharge. This would eliminate the need for a user to determine how to recharge and reset the system.

Referring now to Figs. 13, 14 and 15, a fourth embodiment 197 of the present invention is illustrated.
 905 This extinguisher 197, like the one described in the third embodiment above, is meant to be mounted in a ceiling or a stove hood and is meant to be automatic as opposed to manual. This extinguisher 197 includes a rail 200, two canisters 198, 199, two end plugs 230, 231, a

910 heat sensitive fuse assembly 203 and a C-clamp 224. The internal components of canisters 198 and 199 are substantially identical to the internal components of the canisters in the third embodiment and therefore they will not be described again here in detail.

915 Rail 200 forms an internal surface 206 which defines a single channel 201 having a radius such that when a canister 198 or 199 is positioned therein, the canister is tightly received within the channel 201. In addition, rail 200 forms a flange 202 of increased thickness at its
920 midsection on one side and forms an aperture 207 through the central portion of flange 202. This flange 202 is provided as a connection area for fuse assembly 203.

In addition, referring specifically to Fig. 15, internal surface 206 also defines two retardant guiding
925 channels 204 and 205. Each channel 204 and 205 extends from one of the rail ends toward the other rail end along a short section of rail length (e.g. three to five inches). In the embodiment illustrated, two apertures are provided through rail 200 within each channel 204 and
930 205 for a total of four apertures. The apertures are collectively identified by the numeral 208. Also, preferably, nozzles like those illustrated in Fig. 12 are provided, one nozzle for each of the separate apertures 208 so that material flowing therethrough can be directed
935 in specific directions.

Referring to Figs. 13 and 14, fuse assembly 203 includes a heat sensitive link 209 mounted in a link housing 210. Link 209 explodes when an ambient temperature there around reaches a predetermined
940 threshold value. Housing 210 has two lateral walls (i.e., posts) 211, 212 and upper and lower walls, 213, 214, respectively. An internal surface 215 of wall 213 forms a pressure receiving surface configured as a centrally located recess 216. A body member or coupler
945 217 is integrally connected to housing 210 extending below wall 214. The coupler 217 is configured so that it

can be securely and tightly received within aperture 207 (e.g., via threads, a snap ring, welding, crimping, or some other process known in the art). Coupler 217 forms
 950 a channel 218 which extends from an internal surface of lower wall 214 down through coupler 217.

A linker in the form of a trigger rod 219 is positioned within channel 218 and has proximal and distal ends 220, 221, respectively. Proximal end 220 forms a
 955 second fuse receiving surface in the form of a recess 222 similar to recess 216. Link 209 is receivable between recesses 216 and 222 and, when installed is under extreme pressure therebetween. When so received, distal end 221 extends below coupler 217.

960 C-clamp 224 includes two parallel legs and a back member which connects ends of the legs and traverses the distance there between. A recess 225 is formed in the midsection of the back member.

Extensions 226 and 227 which extend from canisters
 965 198 and 199 are wider than the extensions 292 in the third embodiment. In addition, these extensions 226 and 227 each form a recess 228, 229, respectively.

Referring now to Fig. 15, end caps 230 and 231 like the end caps illustrated in Fig. 10, each form a channel
 970 232, 233, respectively, which, when assembled, receives at one end an outlet of an adjacent canister 198 or 199. Each channel 232, 233 includes a bend typically of 90° or greater so that the opposite ends open radially as opposed to axially. When installed properly, channels
 975 232 and 233 should open into channels 204 and 205 when the end plugs 230 and 231 are secured in opposite ends of rail 200.

When assembled, the canisters 198 and 199 are positioned inside channel 201 with their extension 226
 980 and 227 extending below flange 202. C-clamp 224 is forced down such that each of its two distal ends is received in a separate one of the recesses 228, 229. In this position, when pressure is applied to C-clamp 224

within recess 225, the C-clamp 224 maintains extensions
985 226 and 227 in a locked positions. With C-clamp 224 so
positioned, fuse assembly 203 is securely attached in
aperture 207 such that distal end 221 of rod 219 is
received in recess 225 and applies pressure thereto.
Next, end caps 230 and 231 are secured in the ends of
990 rail 200 in any manner known in the art such that
canister outlets are received in channels 232 and 233 and
the opposite ends of those channels open into channels
204 and 205.

After extinguisher 197 is assembled as described
995 above, the extinguisher can then be mounted in any manner
known in the art above an area to be monitored and, if
nozzles have been provided in outlets 208, the nozzles
can be arranged such that they are directed at
specifically fire prone areas. When so mounted, fuse
1000 assembly 203 should be substantially horizontal (see Fig.
13) such that heat rising from the area being monitored
surrounds link 209.

When a fire occurs, heat from the fire rises and
surrounds link 209. When the heat exceeds a threshold
1005 level required to burst link 209, link 209 is destroyed.
At this point, rod 219 is no longer forced downwardly
into recess 225 and therefore rod 219 rises up into link
housing 210. In response to movement of rod 219, C-clamp
224 is also released which allows extensions 226 and 227
1010 to be moved via springs (not illustrated) inside
canisters 198 and 199. Retardant compound inside
canisters 198 and 199 is forced via plungers through the
canister outlets into channels 232 and 233, into channels
204 and 205 and out of rail 200 via outlets 208.

1015 Thus, it should be appreciated that a simple,
reliable and inexpensive extinguisher has been described
which is lightweight, can be formed in many different
shapes, does not require a pressure gauge, can be
operated in any orientation and independent of gravity,
1020 can be partially discharged, provides a "soft touch"

spray and can be mounted for automatic use or hand operated manually.

It should be understood that the apparatuses described above are only exemplary and do not limit the scope of the invention, and that various modifications could be made by those skilled in the art that would fall under the scope of the invention. For example, while the hand-held manual extinguishers are described as having an extension member with a plurality of recesses so that less than all extinguisher compound can be discharged when desired, clearly the present invention will include a system wherein such metered amounts could not be discharged and wherein all canister content must be discharged at once. In addition, the invention also includes systems wherein the ratchet extension member would include a single rigid piece of material. Moreover, while not shown, the automatic extinguisher systems could include a mechanism whereby, when a fire is detected, the system also triggers an alarm indicating that a fire has occurred. Furthermore, while all of the preferred embodiments have been illustrated as having circular plungers and cylindrical canisters or containers holding retardant compound, clearly the present invention should not be so limited and should, instead, include all embodiments having different shapes and sizes of plungers and canisters. For example, the plungers and canisters could be rectangular, triangular, polygonal, etc. In fact, in many applications it may be desirable to have a noncylindrical shaped extinguisher (e.g., in the hood of a stove, on the ceiling in a room, etc.). Moreover, while two automatic triggering mechanisms have been illustrate above, clearly any type of automatic triggering mechanism could be used with the present invention. In addition the inventive extinguisher may be large enough to discharge enough retardant compound to extinguish a fire in a large room. To this end, the extinguisher may be mounted in a ceiling, wall, or a

floor with an exposed fuse link and one or more outlets.
Moreover, while the mounted extinguisher is illustrated
1060 as being entirely automatic, the extinguisher could
include a manual release for manually triggering the
extinguisher when a fire is detected.

To apprise the public of the scope of this
invention, I make the following claims:

5 WHAT WE CLAIM IS:

1. An apparatus for extinguishing fires via a retardant material, the apparatus comprising:

10 a container forming a material chamber having first and second ends and forming at least one outlet at the second end;

a plunger positioned for movement within the container essentially between the first and the second ends;

15 a motivator for selectively moving the plunger through the chamber from the first to the second ends, said motivator activated by a trigger which includes an engagement member located completely within said container and operatively connected to the plunger, said engagement member comprising two separate sections, a rigid section and a deformable section connected by a link, said deformable section at least partially deformed within said container when said plunger is positioned proximate said first end; and

20 a seal for the outlet, the seal openable to permit retardant material to pass through the outlet.

2. The apparatus of claim 1, wherein the motivator includes a biaser for biasing the plunger toward the second end and a trigger linked to the plunger and moveable between at least triggered and untriggered positions, in the untriggered position, the trigger maintaining
25 the plunger in a position within the chamber and in the triggered position, the trigger allowing the biaser to move the plunger toward the second end.

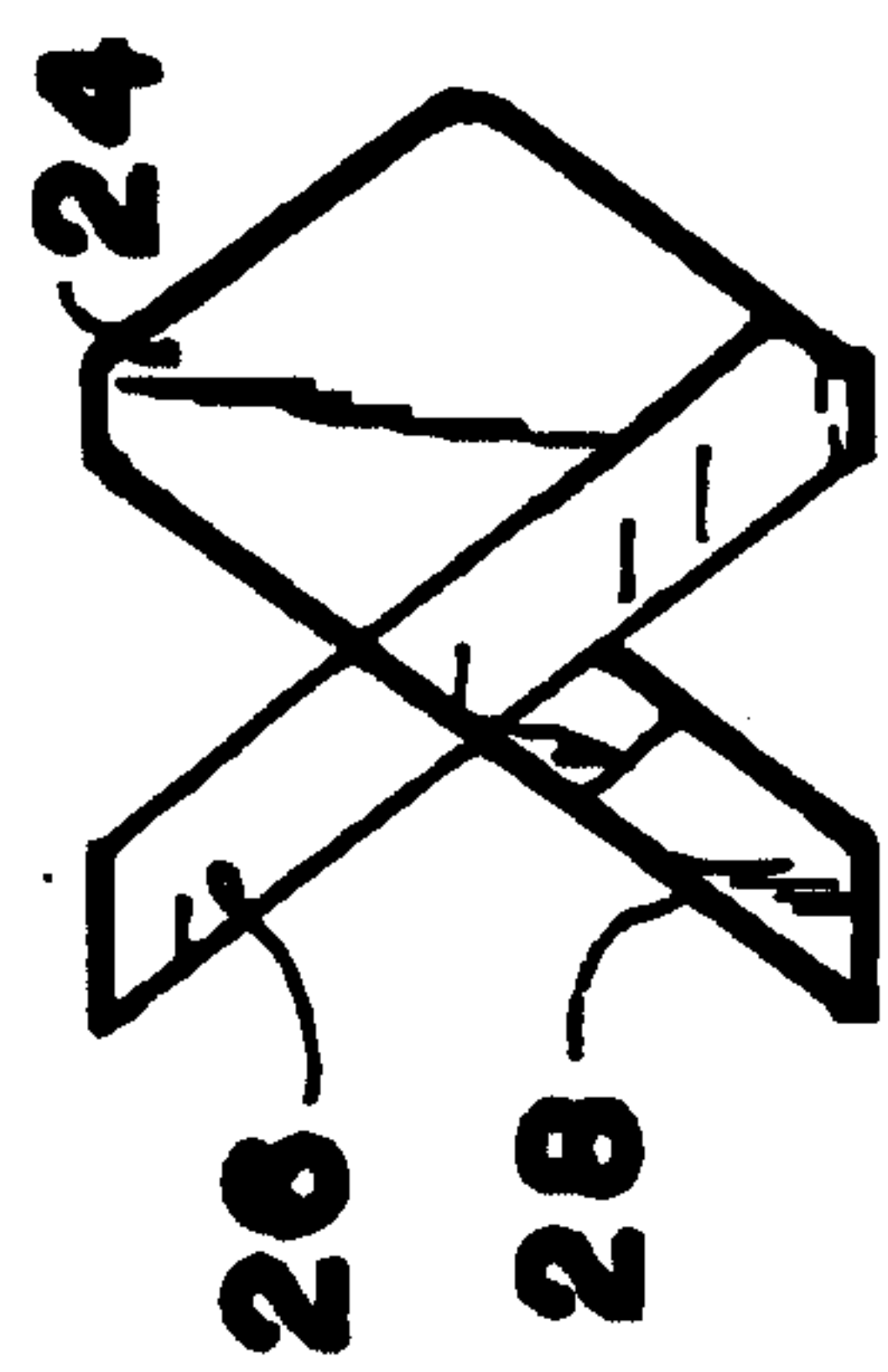
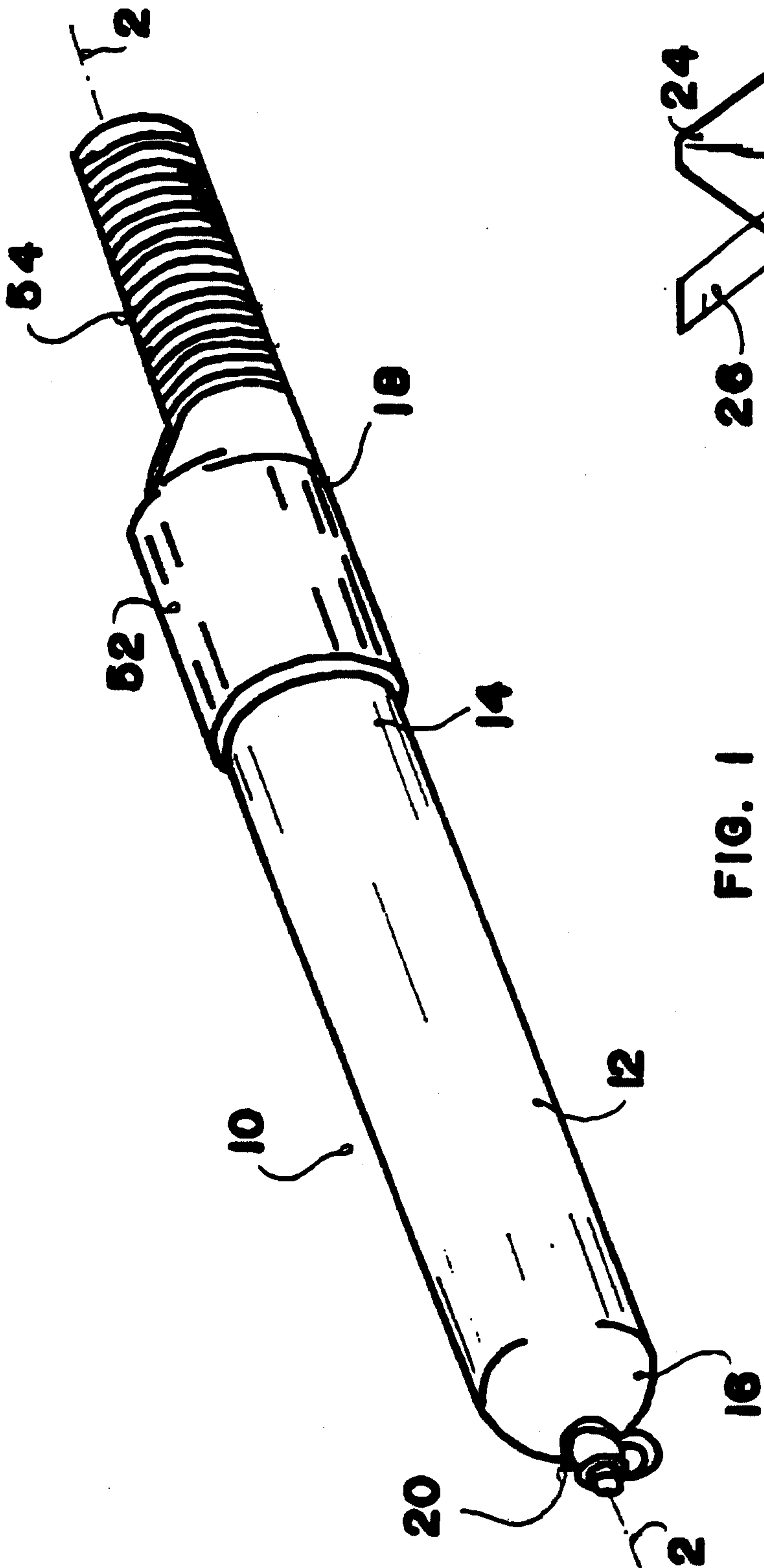
3. The apparatus of claim 2 wherein the biaser is a spring.

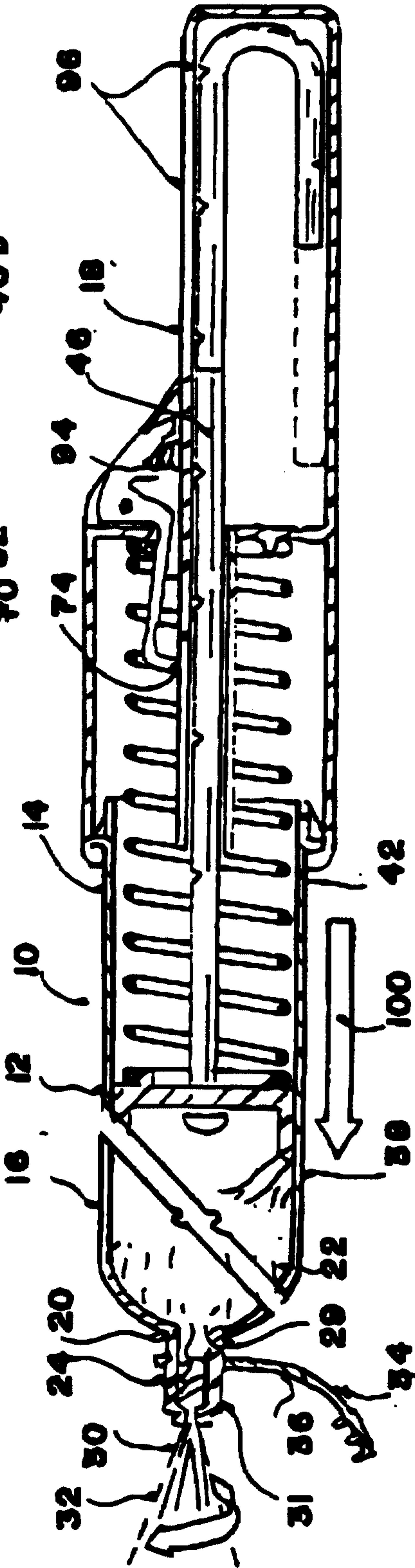
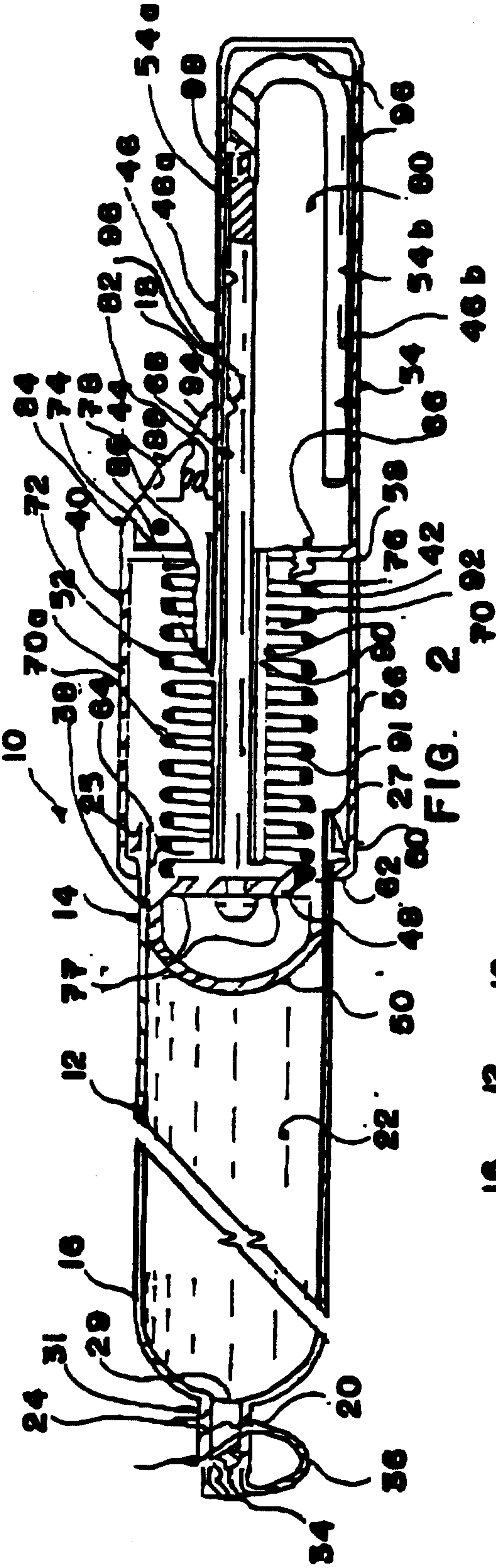
30 4. The apparatus of claim 3 wherein the elongated engagement member is operatively connected to the plunger which is acted upon by the spring, the engagement member having a plurality of openings, and the trigger further comprises a pawl movable into and out of the openings to selectively engage the engagement member and prevent movement of the spring and the plunger.

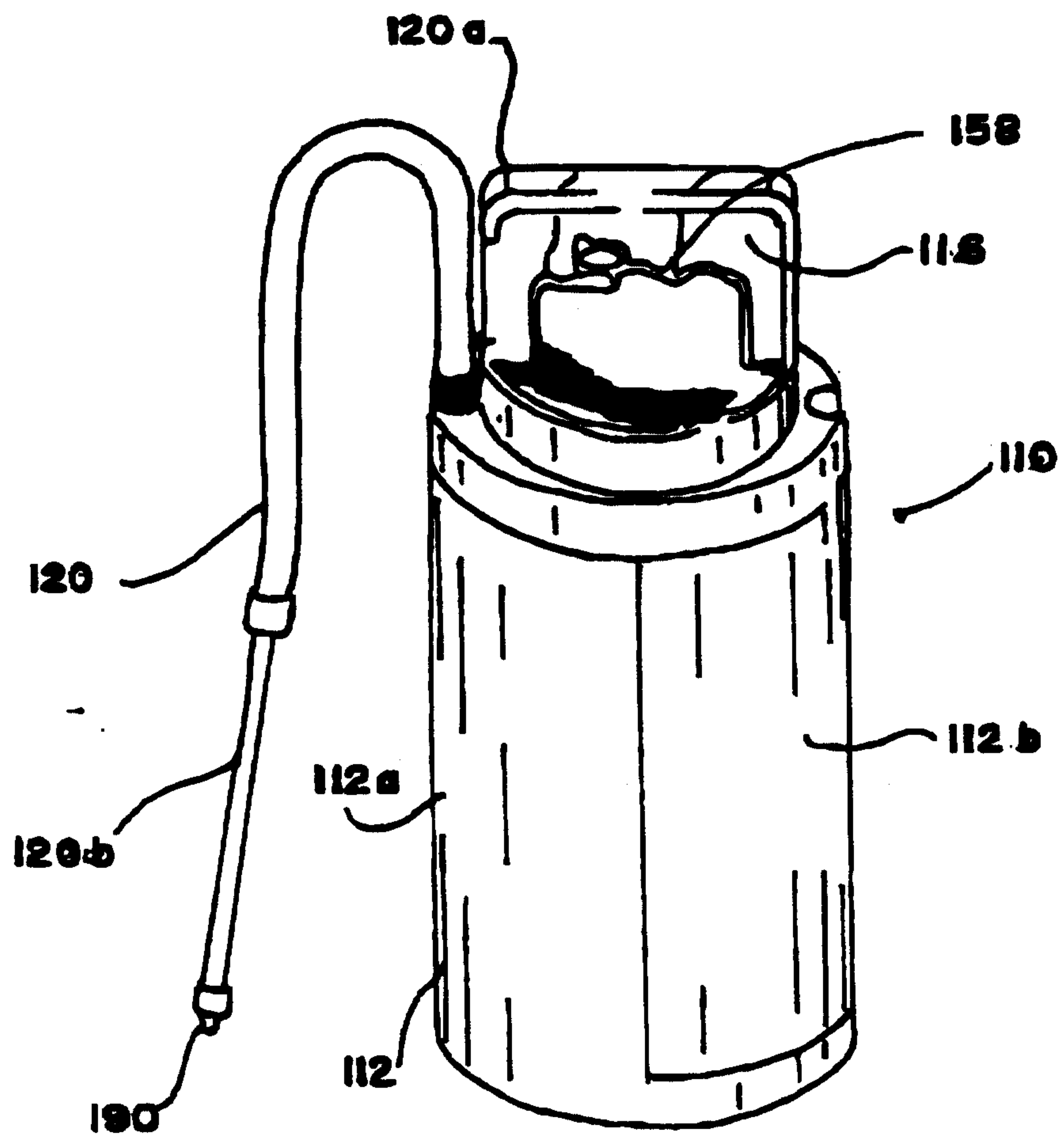
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- 5 5. The apparatus of claim 4 wherein the engagement member is an elongated ratchet member and said openings are located both in said rigid section and said deformable section.
6. The apparatus of claim 4 further comprising a handle fixed to the container, the handle forming a handle chamber, the engagement member and spring being at least partially
10 positioned in the handle chamber, the pawl extending through the handle so as to be operable by the finger of a user to move the pawl out of engagement with the engagement member to release the plunger.
7. The apparatus of claim 6 wherein the pawl is biased for engagement to the
15 engagement member.
8. The apparatus of claim 1 further comprising a liquid fire extinguishing substance in the container.
- 20 9. The apparatus of claim 1 further comprising a liquid dispersing nozzle at said outlet.
10. The apparatus of claim 1 wherein the seal opens in response to pressure within the container.
- 25 11. The apparatus of claim 10 wherein the seal is frangible, and movement of the plunger into the material chamber creates pressure sufficient to break the seal.
12. The apparatus of claim 1 wherein the plunger is a piston and the container is a cylinder, the piston sealing against the sides of the container to prevent the leakage of material
30 past the piston.
13. The apparatus of claim 1 further comprising a reclosable cap for the outlet.
14. The apparatus of claim 1 wherein the container is at least partially transparent.
- 35

- 5 15. The apparatus of claim 1 wherein the container is formed of plastic.
16. The apparatus of claim 1 wherein the container is elongated.
17. The apparatus of claim 16 wherein the container is at least two feet long.
- 10 18. The apparatus of claim 1 wherein the shape of the container and plunger is rectangular.
19. The apparatus of claim 1 wherein the shape of the container and plunger is triangular.
- 15 20. The apparatus of claim 1 wherein the shape of the container and plunger is oval.
21. The apparatus of claim 1 wherein the retardant material includes a liquid fire extinguishing substance.





**FIG. 5.**

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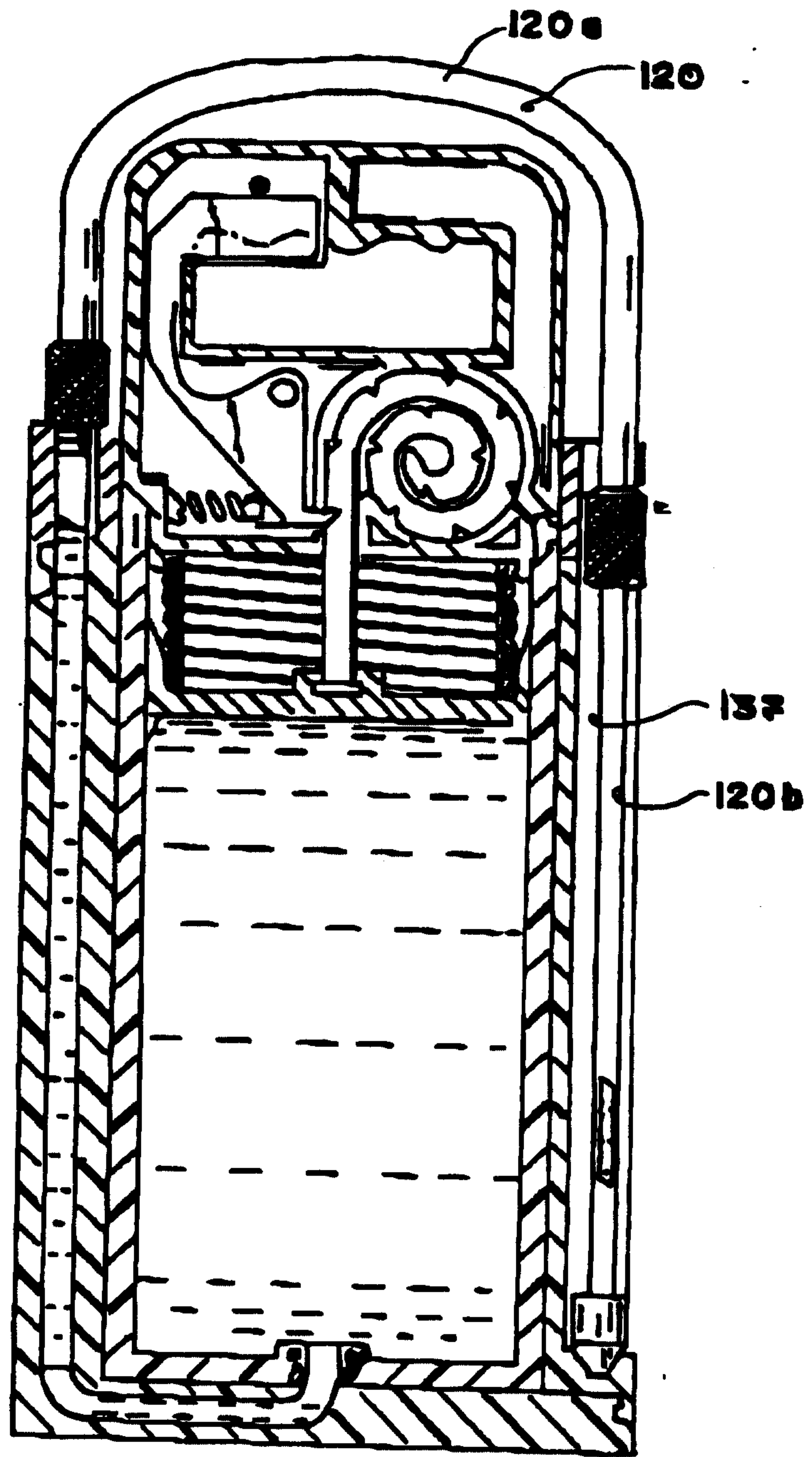


FIG. 6

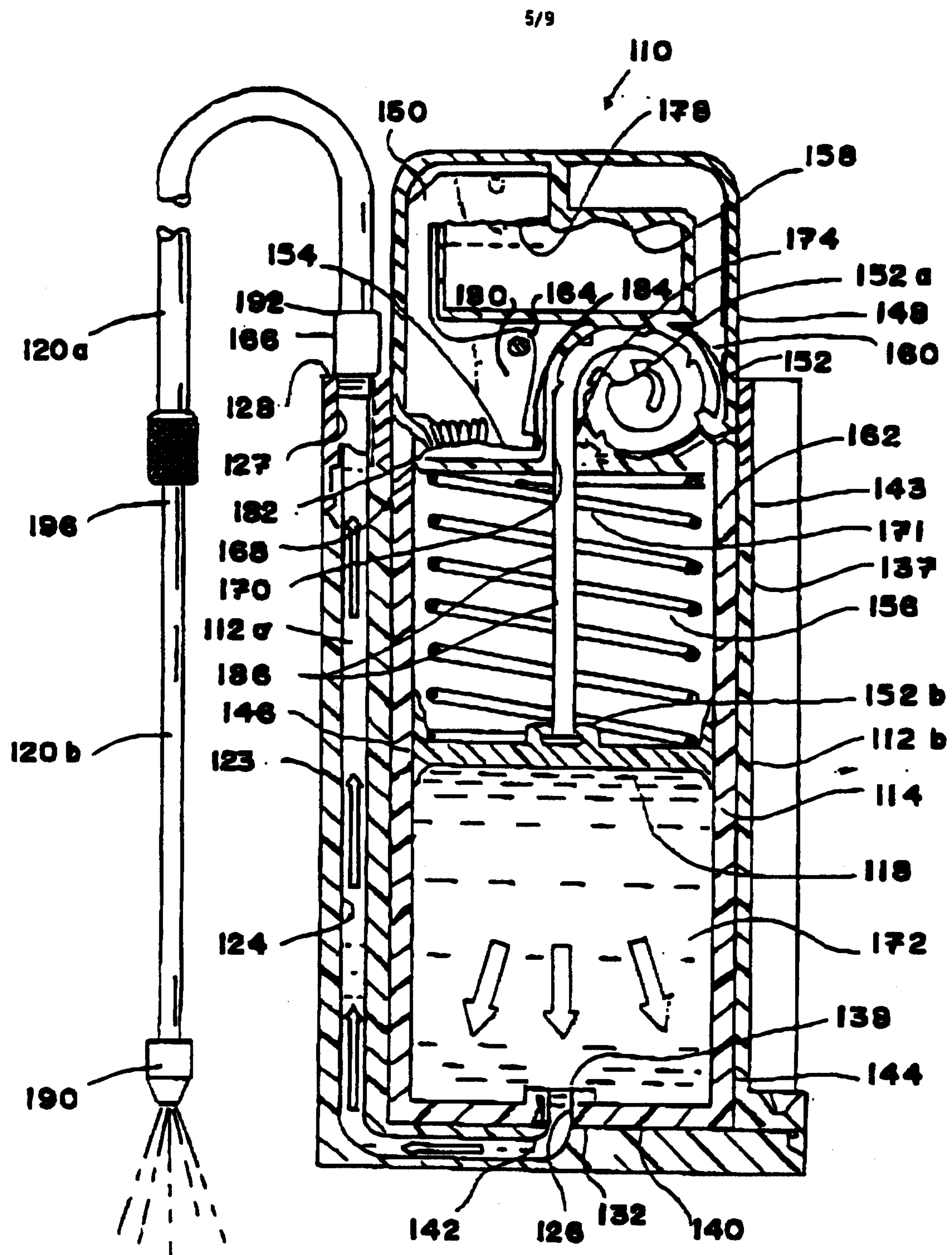


FIG. 7

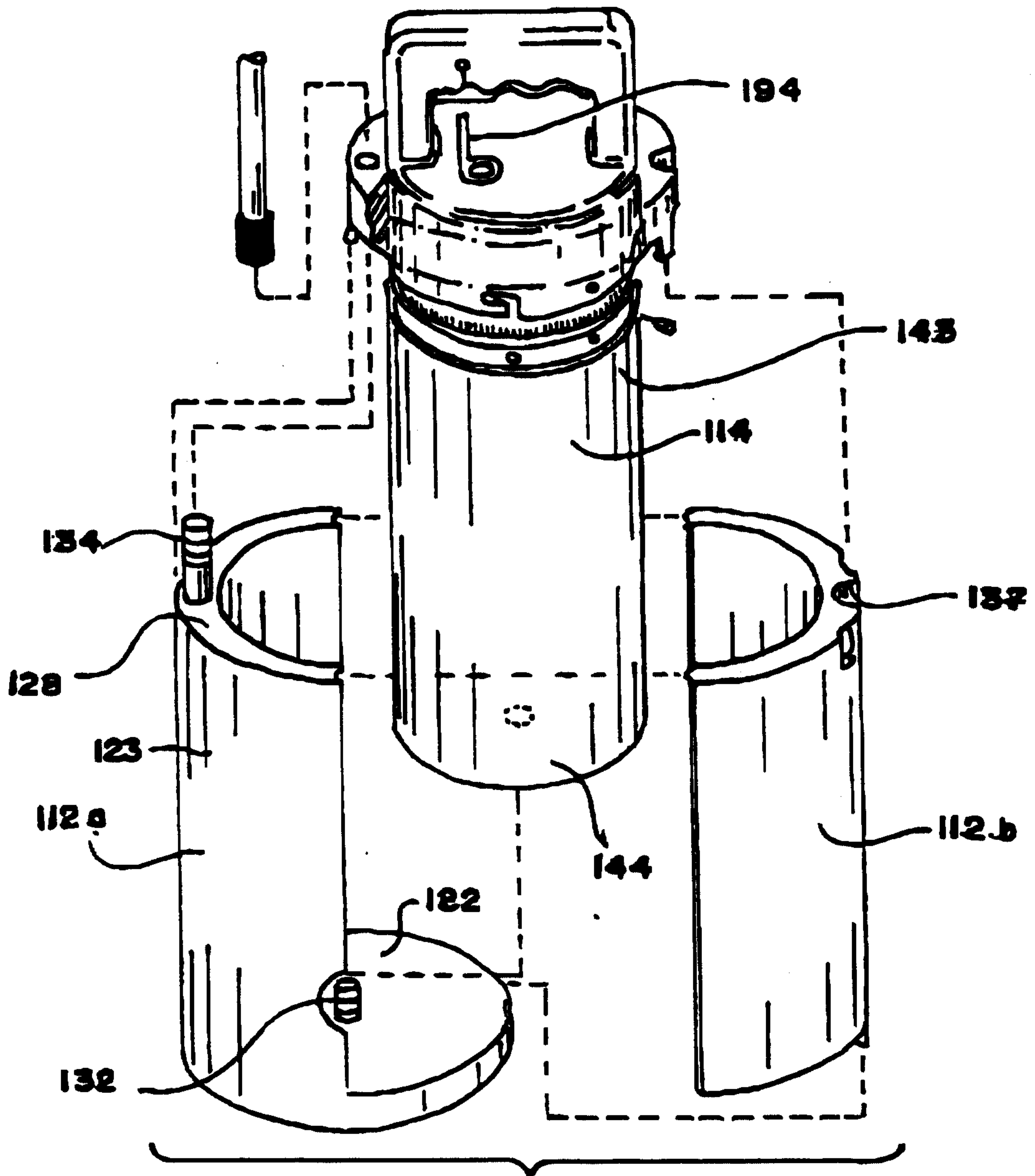


FIG. 8

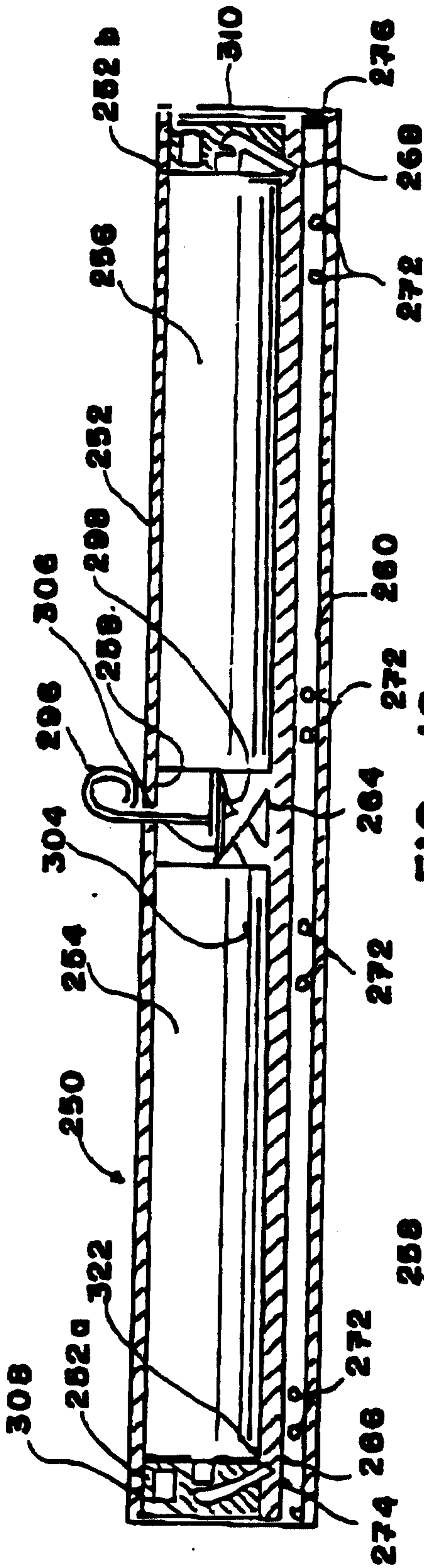


FIG. 10

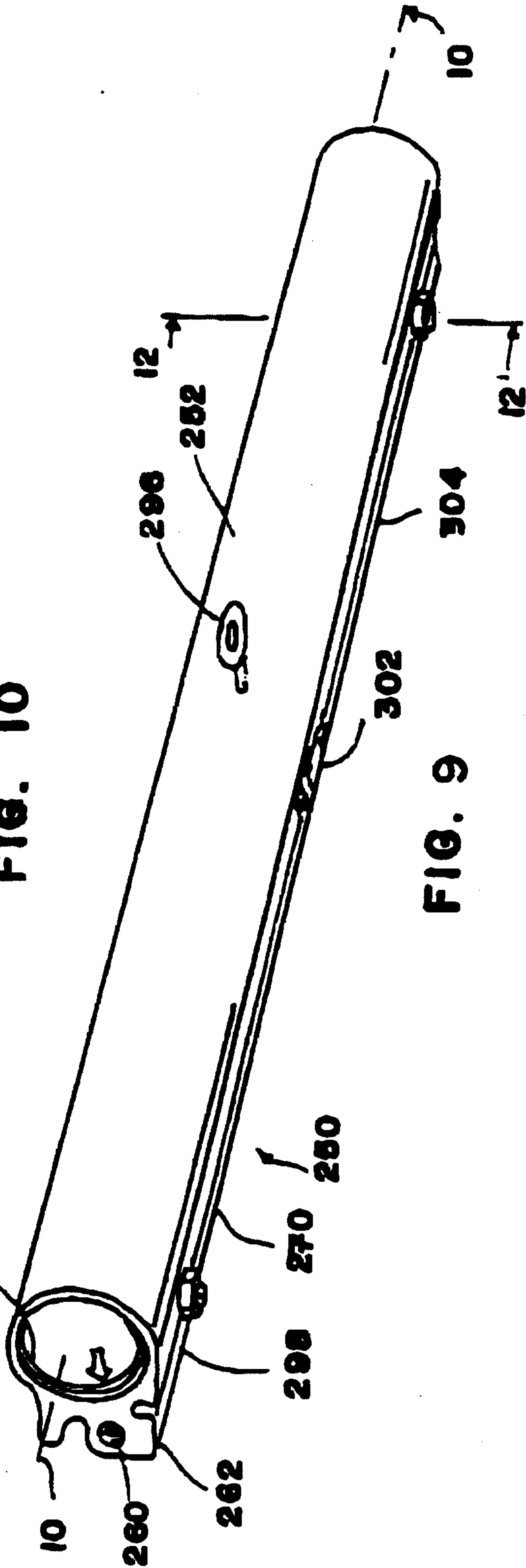
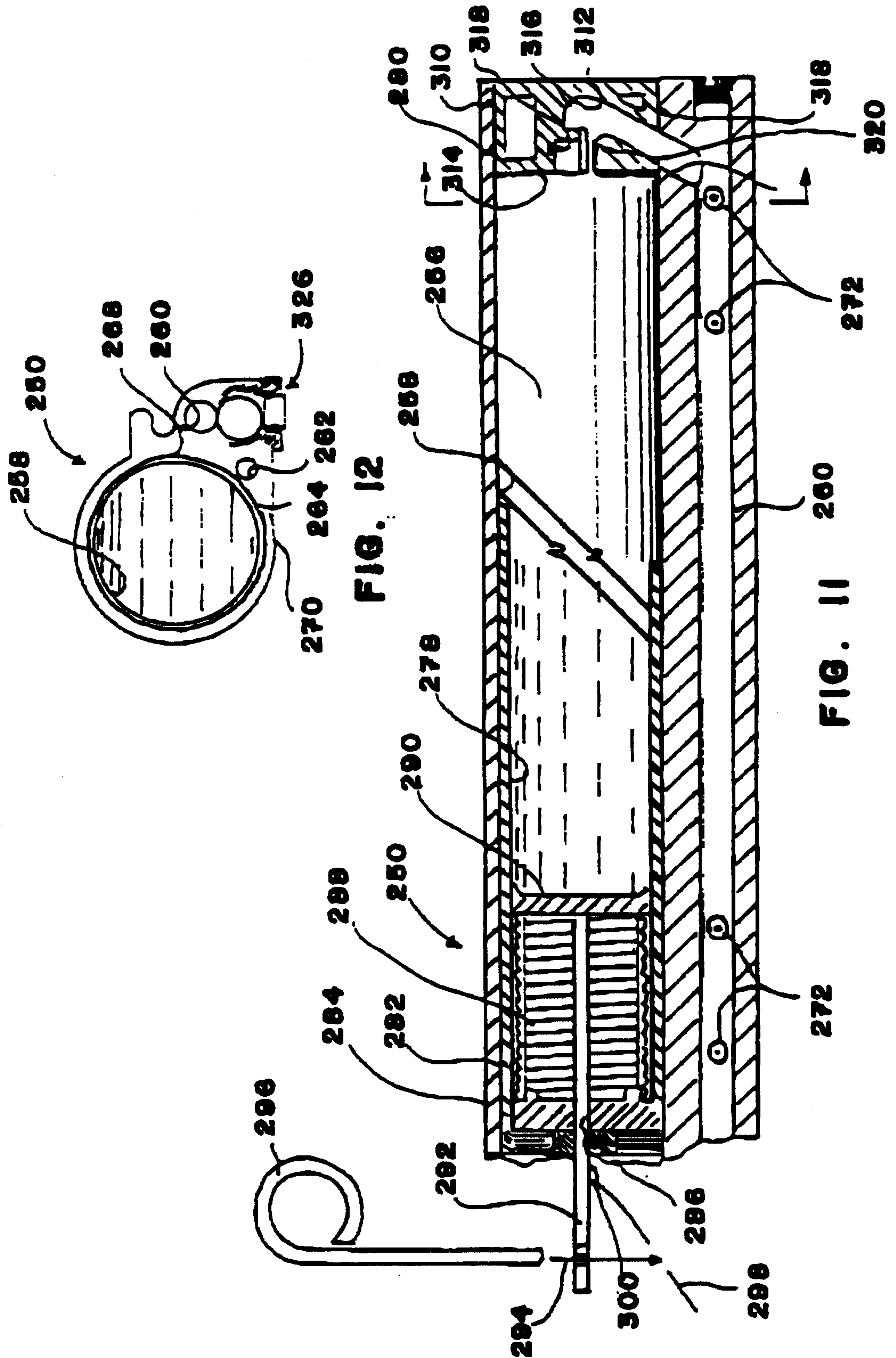


FIG. 9



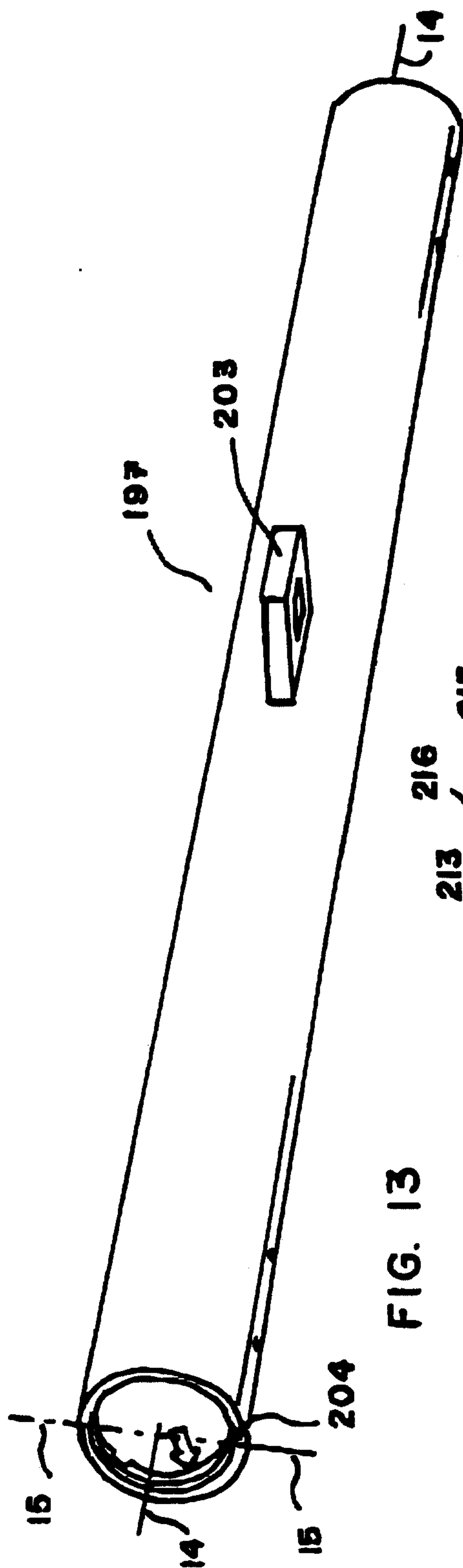


FIG. 13

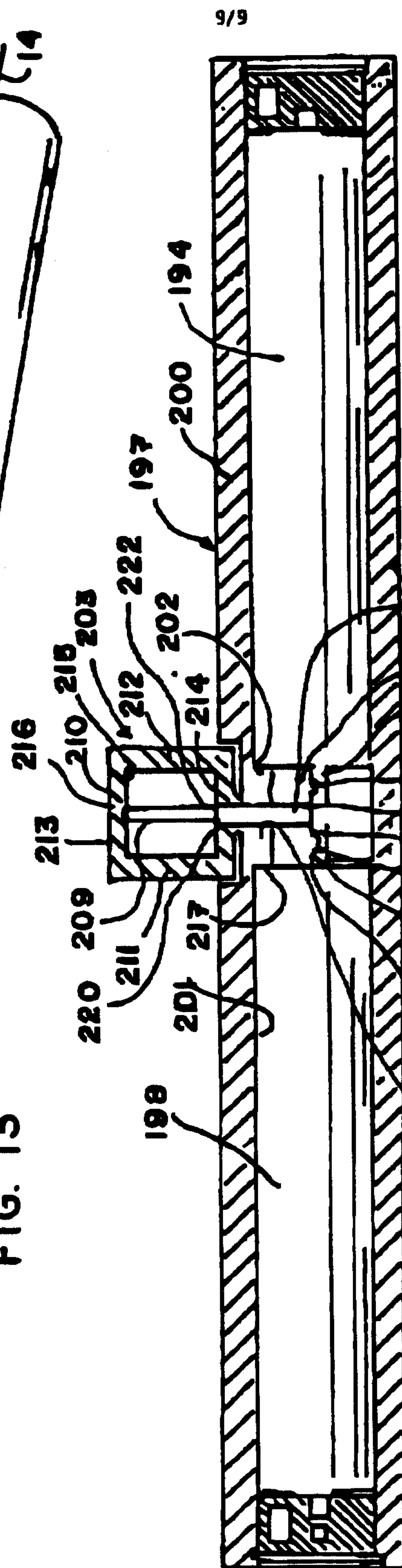
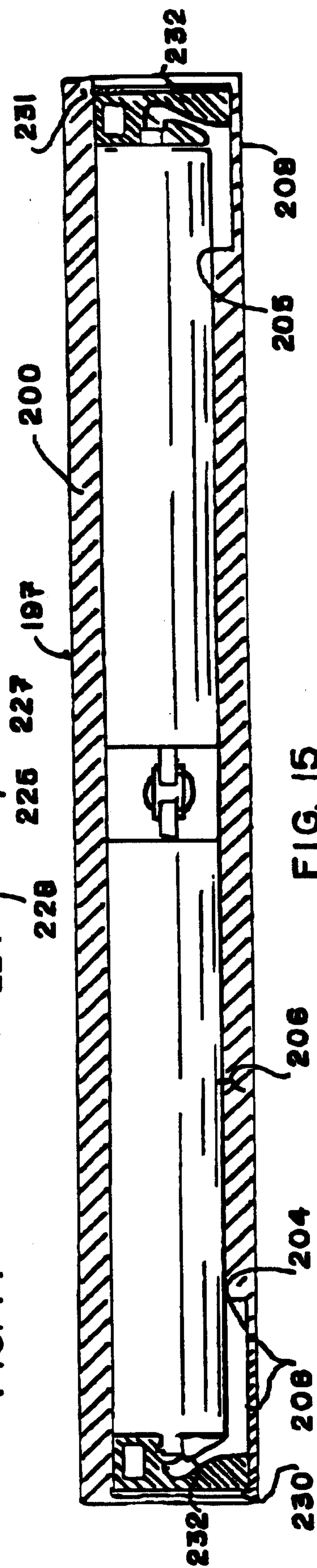


FIG. 14



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