Dec. 13, 1966 P. E. MERRILL 3,291,216

THERMAL TRIGGER AND MEMBER TRIGGERED THEREBY

Filed March 11, 1965 2 Sheets-Sheet 1

FIG-1

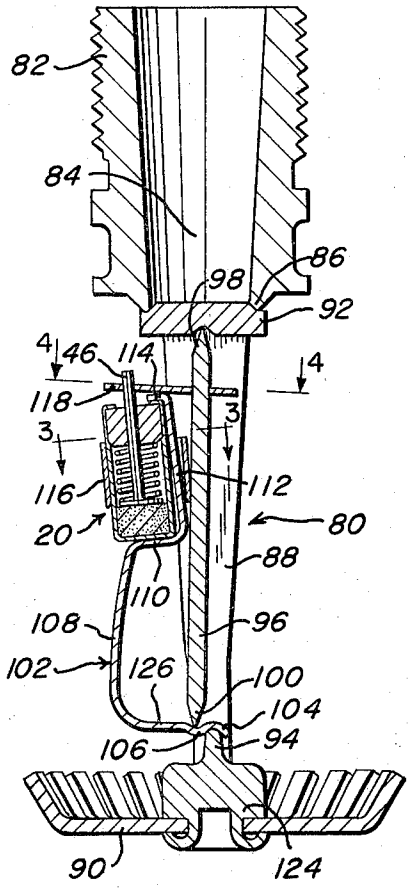
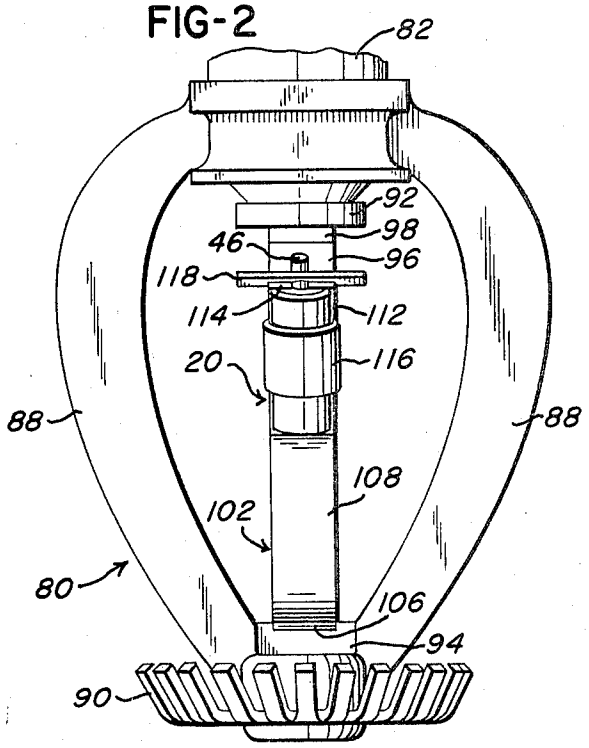


FIG-2



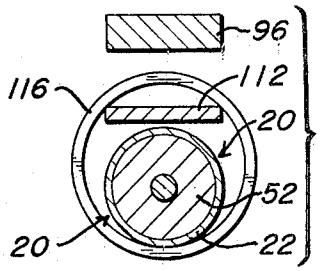
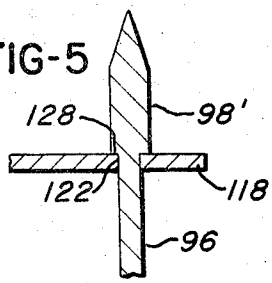


FIG-3

FIG-5



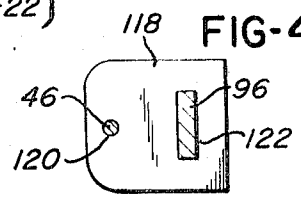


FIG-4

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THERMAL TRIGGER AND MEMBER TRIGGERED THEREBY

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FIG-6

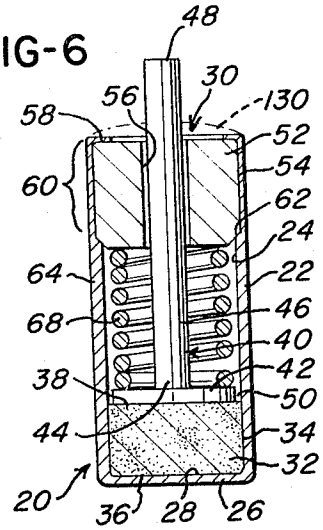


FIG-7

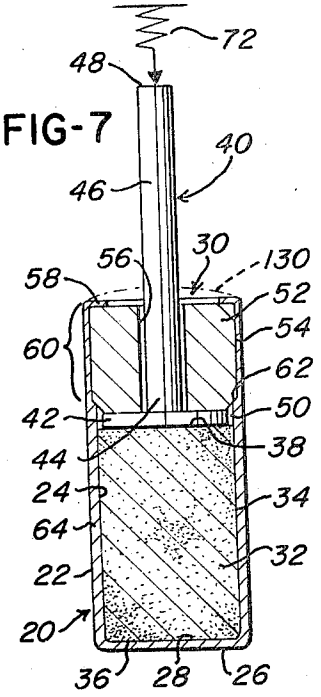


FIG-8

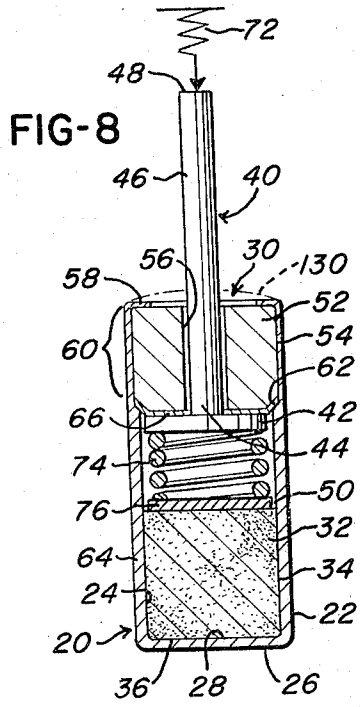
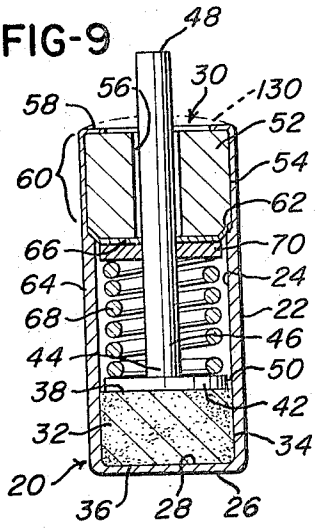


FIG-9



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3,291,216

THERMAL TRIGGER AND MEMBER TRIGGERED THEREBY

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19 Claims. (Cl. 169—39)

This invention relates to a thermal trigger and member triggered thereby.

One of the features of this invention includes a thermal trigger member which is easily constructed and is very effective and responsive to thermal conditions surrounding the trigger member. When the trigger member temperature is raised to the tripping temperature, a eutectic pellet changes its phase sufficiently to permit the trigger to be tripped and thereby actuate the member to be triggered.

The trigger member may include a cylindraceous, tubular, or cylindrical casing which has a pellet receiving bottom closed end, an open bushing receiving upper end, a plunger with a plunger head pressing against the pellet for creating a pressure against the pellet. Additionally, if desired, a compression spring may be provided inside the casing to push the plunger toward the pellet. Additionally, a spring may be interposed between the plunger and the pellet when conditions require such use.

Another feature of this invention includes a sprinkler head which may use a trigger member of this invention in a novel manner.

In the sprinkler head, the trigger member plunger shaft may be used to release a pilot release lever, which in turn permits a main lever to release the water valve and start a free flow of water and cause the sprinkler head to create a spray to extinguish any fire that may be in its neighborhood.

Other features of this invention are apparent from this description, the appended claimed subject matter, and/or from the accompanying drawings, in which:

FIGURE 1 is a vertical cross section of a sprinkler head embodying features of this invention.

FIGURE 2 is a side view of FIGURE 1, taken from the left-hand side of FIGURE 1.

FIGURE 3 is an enlarged horizontal cross section taken along the line 3—3 of FIGURE 1.

FIGURE 4 is a cross section taken along the line 4—4 of FIGURE 1.

FIGURE 5 is an enlarged detailed view of a modified form of main lever.

FIGURE 6 is a cross section of a trigger member embodying features of this invention.

FIGURES 7–9 are cross sections of other embodiments of this invention.

Certain words are used in this specification and in the claims indicating direction, relative position, etc. These words are used for the sake of brevity and clearness. However, it is to be understood that these words are used only in connection with the illustrations of the drawings, and that in actual practice the constructions, parts, etc., may have entirely different directions, relative positions, etc. Examples of such words are "upper," "lower," "vertical," "horizontal," etc.

Referring first to FIGURE 6, a trigger member 20 may have a casing with a side wall 22, with a cylindraceous inner surface 24, with a homogeneous lower end closure 26 with a flat casing inner surface 28 at a bottom casing end and with a top open casing end 30.

A eutectic pellet 32 may have a cylindraceous pellet outer side surface 34 closely engaging the cylindraceous casing inner surface 24. The pellet may have a bottom flat outer surface 36 closely engaging the flat casing inner surface 28. The pellet may have a flat outer top pellet surface 38.

A plunger 40 may be provided in the casing, which

plunger may have a disc shaped plunger head 42 connected to the bottom end 44 of the plunger shaft 46. The upper shaft end 48 extends out of the top open end 30 of the casing. The plunger head 42 exerts a pressure on the top surface 38 of the pellet.

A clearance 50 may be provided between the outer diameter of the plunger haed 42, and the inner diameter of the casing surface 24. This clearance is such that the pellet 32 must become practically liquid in form in response to heat applied thereto, before the material of the pellet 32 can ooze out through the clearance 50.

A cylindraceous open center bushing 52 may have an outer bushing surface 54 engaging the casing inner surface adjacent the open casing end 30. The bushing 52 may have a central inner bushing surface 56 which engages the plunger shaft 46, with such shaft 46 extending out of the bushing 52.

The top open end 30 of the casing may have an inward flange 58, which holds the bushing 52 in the casing.

The top open casing end 30 has an upper inner surface zone 60 of greater transverse cross section adjacent the flange 58. Such zone 60 has an inward lower shoulder 62 which is connected to a lower main casing body 64, which has an inner main surface of less transverse cross section than the zone 60.

The shoulder 62 may taper downwardly and inwardly. The bushing 52 may be engaged by the flange 58 at the top and by the shoulder 62 at the bottom, to be firmly held in place thereby.

Under certain conditions, a gasket seal 66 may be placed below the bushing 52 and between the bushing 52 and the shoulder 62, as shown in FIGURES 8 and 9.

It is to be noted that FIGURES 7, 8 and 9 show embodiments which are, in general, similar to the embodiment of FIGURE 6. In this connection, it is to be noted that the trigger member casing may be substantially identical in all of the embodiments of FIGURES 6–9. Also the pellet 32, the plunger 40 with its head 42, the bushing 52, are substantially similar in all of the embodiments. All of these members are held within the casing substantially in the same manner in all of the embodiments. Therefore, the details of such embodiments are not again specifically described, except where there is a material difference as will be apparent.

Turning again to FIGURE 6, a compression spring 68 surrounds the shaft 46 and exerts a pressure against the bottom of the bushing 52 and against the top of the plunger head 42. A similar spring 68 is provided in FIGURE 9, and a washer 70 may be placed between the spring 68 of FIGURE 9 and the gasket 66 of FIGURE 9 to protect the gasket. This washer 70 may be in the form of a disc washer if desired.

In the embodiment of FIGURE 7, the plunger head 42 directly engages the bottom surface of the bushing 52. The bottom surface of the plunger head 42 engages the top surface of the pellet 32. The plunger shaft 46 of FIGURE 7 must be downwardly pressed as by a spring 72 or the like, which may be a spring action produced by the member to be triggered by the trigger of FIGURE 7.

In FIGURE 8, a compression spring 74 engages the bottom of the plunger head 42, and also engages a disc washer 76. The spring 74 transmits the pressure from the plunger head 42 to the pellet 32. However, another spring 72 produces an inward pressure on the plunger shaft 46 in the same manner as in FIGURE 7. The main purpose of spring 74 is to hold the sealing gasket 66 tightly between the plunger head 42 and the bottom of the bushing 52 to prevent leakage. The spring 74 exerts more force than outside spring 72 as long as the trigger is not tripped. When the trigger is tripped, the spring 74 elongates and then yields to the downward force on shaft 40 produced by spring 72 or the like.

In the embodiment of FIGURE 9, the operation and construction is substantially identical to that of FIGURE 6, except that the gasket seal **66** and the washer **70** are provided. The washer **70** is provided between the spring **68** and the gasket **66** to prevent injury by the spring **68**. The pellet **32** may be made of any suitable material. Pellets of this type are on sale by various companies and can be made to liquefy or be destroyed in any other manner at substantially a selected melting temperature. Since pellets of this type are on the market and are readily available to the public, and can be purchased by merely specifying the melting point, and any other desired characteristics, it is believed unnecessary to give any chemical formula thereof.

The bushing **52** may be made of free machining brass or the like. The spring **68** may be made of stainless steel wire. The casing of the trigger member **20** may be made of red brass. Merely by way of example, the outer diameter of the casing may be .227 inch in diameter. The thinner part of the casing, in zone **60**, may be .217 inch in internal diameter and may have the same external diameter of .227 as in the main body. The internal diameter of the lower thicker part of the casing may be .201 inch in diameter. The taper of the shoulder **62** may be 45°. The length of the casing, before any flange is formed therein, may be .500 inch in length. The internal distance from the upper surface **28** of the bottom **26**, to the upper edge of the taper **62** may be .355 inch in length. The material of the plunger **40** may be stainless steel.

The internal diameter of the hole in the bushing may be .056 inch and the external diameter of the bushing may be .211 inch and the lower taper of the bushing may be 45°.

The diameter of the shaft of the plunger may be .050. The external diameter of the plunger head may be .190 inch, more or less, and the thickness of the head may be .020 inch. The entire length of the plunger may be .500 inch.

In operation of the trigger member **20**, the trigger member may be used with any device which is to be actuated by movement of the plunger shaft **46**. As long as the trigger member **20** is not subjected to a high enough temperature to cause the eutectic pellet **32** to melt or otherwise change its characteristics sufficiently, the trigger member will remain untripped, and in the position shown in FIGURE 6. However, if the temperature is raised sufficiently to properly alter the characteristic of the pellet **32**, the pellet will practically liquefy. The downward pressure of the spring **68** acting through the plunger head **42**, will cause the liquefied material of the pellet **32** to ooze out through the clearance **50**, which will allow the plunger **40** to move downward in FIGURE 6 substantially to the bottom surface **28** under the pressure of the spring **68**. This will cause the upper end of the shaft **48** to trigger the device which is being controlled by the trigger member **20**. For example, the device of FIGURE 6 may be used in connection with the sprinkler head shown in FIGURES 1–5, and as indicated therein.

The clearance **50** between the plunger head **42** and the inner surface **24** is sufficiently small to require the eutectic pellet to liquefy before any material of the pellet can pass into the space above the plunger head **42**. This is of great advantage because it prevents premature triggering. The difference between the casing inner diameter of surface **24** and outer diameter of plunger head **42** may be in the order of .010 inch.

Any of the trigger members shown in FIGURES 6–9 may have their upper surface covered with a material with a melting point temperature lower than the rated temperature of the actuator or, that is, the temperature at which the trigger will be tripped. For example, this may be covered with such material as indicated by the dotted line **130**. Preferably this material may be such as to prevent the passage of water or other liquids down along the shaft of the plunger or down along the outside edge of the bushing **52**.

Preferably the gasket material used for sealing, as indicated at **66** in FIGURES 8 and 9, is of well known construction and is of such a character that it prevents the passage of liquid and other undesirable materials both against the passage between the bushing and the outer casing as well as between the bushing and the shaft **46**.

Referring now to FIGURES 1–5, a sprinkler head construction **80** may have a water line connector tube **82** with a water passageway **84** and with a seal forming discharge lower end **86**.

A downward supporting open spray permeable frame **88** may be connected to the connector tube **82** at the upper frame end, and may support a sprinkle dispenser or scattering disc **90** at the lower frame end. The spray permeable frame **88** may include two downwardly directed arc-shaped members which are also designated by the refence numerals **88**. It is understood, however, that the exact shape of the frame may be changed, as is obvious.

A sealing valve means or valve member **92** may control the discharge of water out of the lower end of the tube or passageway **84** and is movable against and away from the seal forming discharge end **86**.

A lever fulcrum **94** may be supported below the valve means **92** and adjacent to the sprinkle dispenser **90**.

A main release lever or rod **96** may engage the valve means **92** at the upper lever end **98** and has its lower end **100** adjacent and slightly sidewise of the fulcrum **94**.

A pilot release lever **102** has a lower downwardly directed fulcrum recess **104** which engages the fulcrum **94**. The pilot lever **102** also has a laterally spaced upwardly directed main release lever receiving recess **106** which receives the lower end **100** of the main release lever **96**. The pilot lever **102** also has an upward extension **108** which is provided with a thermal trigger receiving shoulder **110**. The lever **102** also has a thermal trigger attaching vertical extension **112**, and also has an upper trigger locking flange **114**.

A thermal trigger member **20** may be secured to the pilot lever **102** with the trigger member on said trigger receiving shoulder **110**, adjacent to the trigger attaching vertical extension **112** and locked by the upper trigger locking means or flange **114**.

The thermal trigger member **20** may be of the character shown, for example, in FIGURES 6 and 9, and may be provided with the plunger shaft **46**, as elsewhere described.

The thermal trigger **20** may be secured to the pilot lever **102** by means of a ring **116**.

A locking latch or latch plate **118** may have an opening **120**, FIGURE 4, to receive the plunger shaft **46** of the thermal trigger **20** and may have another opening **122** which receives the main lever **96**.

The construction and operation of the sprinkler head **80** is such that when a fire is created near the sprinkler head, the thermal trigger **20** is tripped by the melting of the eutectic pellet **32** in the FIGURE 6, so that the shaft **46** is pushed down by the spring **68**, as described in connection with FIGURE 6, so that the shaft **46** is pulled out of the opening **120** in the latch **118**. This immediately releases the holding action on the pilot lever **102**, which pilot lever can then fly leftwardly about the fulcrum **94**, FIGURE 1. This in turn releases the main lever **96**, which can also fly in whatever direction it may take, so that it releases the valve **92** to allow a stream of water to be directed out of opening **86** against the sprinkler disc **90**, which scatters the stream of water in a well known manner, and in a spray form, to extinguish the fire.

In assembling the sprinkler head **80**, a compression is produced during the assembly of the fulcrum supporting member **124**, which produces an upward thrust on the fulcrum recess **104** and produces a bending action on the lower arm **126** of pilot lever **102**, which produces a compression on the lever **96** and a leftward force on the lever **102** about fulcrum **94** of sufficient force to cause lever

102 to fly leftwardly quickly, in FIGURE 1, when the trigger 20 is tripped by thermal action.

The trigger attaching extension 112 is at a slightly small angle with respect to the lever 96, so that the ring 116 is prevented from moving downwardly beyond the point illustrated in FIGURE 1, because of the convergency of members 112 and 96.

If desired, the main lever 96 may be provided with a slightly larger lateral dimension upper end 98', FIGURE 5, which has a shoulder 128, in FIGURE 5, which prevents the locking latch plate 118 from moving upwardly along the shaft 96 beyond the point illustrated in FIGURE 5. Under these conditions, if the sprinkler head 80 should be held upside down or the like, or shaken, the locking latch plate 118 cannot be shaken upwardly, to cause it to move upwardly beyond the end of the plunger shaft 46 accidentally to trip the water valve 92 to open position.

The word "trigger" as herein used in the specification and claimed subject matter is intended to include any construction which produces a desired motion in any member with which, or in which, it is used. For example such trigger may be an actuator for a fire door, electrical relay, sprinkler head, etc. Thus the "trigger" of this invention may be used in combination with any triggerable member which is to be triggered or actuated by such "trigger."

The plunger 40 of the triggers or actuators shown in FIGURES 6 and 9 may be used to pull a portion of the triggered or actuated member by the action of the spring 68. The plunger shaft 46 may be attached to, or be a part of, such portion of the triggered or actuated member.

The bottom of the bushing 52 can be tapered with a 45° angle, or the like, as illustrated in the drawings to facilitate assembly of such bushing into the casing wall before the flange 58 is formed. The taper guides the bushing into the casing during assembly. However, if such taper is not desired, the bottom of the bushing may be made completely flat, without such taper. Likewise the shoulder 62 may be made without taper, and may be a right angled shoulder or the like, if the taper is not desired.

The word "cylindraceous" as herein used in the specification and claimed subject matter in connection with the casing and other parts of the trigger is intended to include a square, rectangular, or other cross section such as a multisided cross section, or elliptical cross section or the like. The length of the casing may be varied as desired. The side wall 22 of the casing may be shorter than the top 30 and bottom 26 of the casing.

Thus a new and useful thermal trigger and member triggered thereby have been provided by this invention.

While the form of the invention now preferred has been disclosed as required by statute, other forms may be used, all coming within the scope of the claimed subject matter which follows:

What is claimed is:

1. In combination: a cylindraceous casing having a closed pellet receiving bottom and an open bushing receiving upper end; a cylindraceous eutectic pellet in said casing held in said pellet receiving bottom; a plunger in said casing having a plunger head connected transversely to a bottom end of a longitudinal plunger shaft, with the upper end of said shaft extending out of said open casing end, said plunger exerting a pressure on said top pellet surface; and a cylindraceous open center bushing held in said bushing receiving upper end of said casing, with said plunger shaft passing through said open center.

2. A combination according to claim 1 in which said casing has an inward flange at said upper end, and an inward shoulder below said bushing, said flange and shoulder holding said bushing against axial movement.

3. A combination according to claim 2 in which a sealing gasket extends along the bottom of said bushing with its edge between said shoulder and said bushing.

4. A combination according to claim 1 in which a compression spring surrounds said plunger shaft and exerts pressure on said bushing and said plunger head.

5. A combination according to claim 4 in which said spring engages the bottom of said bushing and the top of said plunger head.

6. A combination according to claim 4 in which a sealing gasket extends along the bottom of said bushing with its edge between said shoulder and said bushing.

7. A combination according to claim 6 in which a washer is located between one end of said spring and said gasket.

8. A combination according to claim 1 in which said plunger head has an outer edge extending closely adjacent the inner side surface of said casing and said plunger head has a bottom engaging the top of said pellet, and the clearance between said outer edge of said plunger head and said inner side surface of said casing is sufficiently small to allow only material of said pellet which is in liquid form to pass said clearance.

9. A combination according to claim 1 in which a transverse movable member in said casing has an outer edge extending closely adjacent the inner side surface of said casing and said movable member has a bottom engaging the top of said pellet and the clearance between said outer edge of said movable member and said inner side surface of said casing is sufficiently small to allow only material of said pellet which is in liquid form to pass said clearance.

10. A combination according to claim 9 in which said transverse movable member is a disc engaging the top of said pellet below said plunger head, and in which a compression spring is provided between said plunger head and said disc.

11. A combination according to claim 1 in which the top of said plunger head engages the bottom of said bushing and the bottom of said plunger head engages the top of said pellet.

12. In combination:

a casing having a side wall with a cylindraceous casing inner surface, a homogeneous lower end closure with a flat casing inner surface at a bottom casing end and with a top open casing end;

a eutectic pellet having a cylindraceous pellet outer side surface closely engaging said cylindraceous casing inner surface with a bottom flat pellet outer surface closely engaging said flat casing inner surface and having a flat outer top pellet surface;

a plunger in said casing having a disc shaped plunger head connected to a bottom end of a plunger shaft, the upper end of which shaft extends out of said top open casing end, said plunger head exerting a pressure on said top pellet surface;

a cylindraceous open center bushing having an outer bushing surface engaging said casing inner surface adjacent said open casing end, and having a central inner bushing surface engaging said plunger shaft with said shaft extending out of said bushing, said top open casing end having an inward flange engaging and holding said bushing in said casing.

13. A combination according to claim 12 in which said top open casing end has an upper inner surface zone of greater transverse cross section adjacent said flange, said zone having an inward lower shoulder connected to a lower main casing body having an inner main surface of less transverse cross section than said upper inner surface of said zone.

14. A combination according to claim 13 in which said shoulder tapers downwardly and inwardly.

15. A combination according to claim 13 in which said bushing is engaged by said flange and said shoulder.

16. In combination: a sprinkler head construction having

a water line connector tube with a water passageway with a seal forming discharge lower end,

a sprinkler dispenser,

a downward supporting open spray permeable frame connected to said connector tube at its upper end and supporting sprinkle dispenser at its lower end,

a sealing valve means movable against and away from said seal forming discharge end,

a lever fulcrum below said valve means and adjacent said sprinkle dispenser,

a main release lever engaging said valve means at its upper lever end and having its lower end adjacent and slightly sidewise of said fulcrum,

a pilot release lever having a lower downwardly directed recess engaging said fulcrum, said pilot lever having a laterally spaced upwardly directed main release lever receiving recess receiving said lower end of said release lever, said pilot lever having an upward extension provided with a thermal trigger receiving shoulder, with a thermal trigger attaching vertical extension and with an upper trigger locking flange,

a thermal trigger on said trigger receiving shoulder, adjacent to said trigger attaching vertical extension and locked by said upper trigger locking flange,

a locking latch connecting said trigger and said main release lever and holding said pilot lever in locked condition while said trigger is not thermally tripped,

and means on said trigger to cause said locking latch to release said pilot lever when said trigger is thermally tripped.

17. A combination according to claim **16** in which said trigger includes: a cylindraceous casing having a closed pellet receiving bottom and an open bushing receiving upper end; a cylindraceous eutectic pellet in said casing held in said pellet receiving bottom; a plunger in said casing having a plunger head connected transversely to a bottom end of a longitudinal plunger shaft, with the upper end of said shaft extending out of said open casing end, said plunger exerting a pressure on said top pellet surface; and a cylindraceous open center bushing held in said bushing receiving upper end of said casing, with said plunger shaft passing through said open center.

18. In combination: a sprinkler head construction having

a water line connector tube with a water passageway with a seal forming discharge lower end,

a sprinkler dispenser,

a downward supporting open spray permeable frame connected to said connector tube at its upper end and supporting sprinkle dispenser at its lower end,

a sealing valve means movable against and away from said seal forming discharge end,

a movable transmission means on said sprinkler head holding said valve means against said seal forming discharge end, said transmission means being biased to move said valve means away from said seal forming discharge means,

a thermal trigger locking said transmission means to hold said valve means against said seal forming discharge means and releasing said transmission means to move said valve means away from said seal forming discharge means when said trigger is thermally tripped, said thermal trigger including: a cylindraceous casing having a closed pellet receiving bottom and an open bushing receiving upper end; a cylindraceous eutectic pellet in said casing held in said pellet receiving bottom; a plunger in said casing having a plunger head connected transversely to a bottom end of a longitudinal plunger shaft, with the upper end of said shaft extending out of said open casing end, said plunger exerting a pressure on said top pellet surface; and a cylindraceous open center bushing held in said bushing receiving upper end of said casing, with said plunger shaft passing through said open center.

19. In combination: a triggerable member to be triggered, and a thermal trigger triggering said triggerable member, said thermal trigger including: a cylindraceous casing having a closed pellet receiving bottom and an open bushing receiving upper end; a cylindraceous eutectic pellet in said casing held in said pellet receiving bottom; a plunger in said casing having a plunger head connected transversely to a bottom end of a longitudinal plunger shaft, with the upper end of said shaft extending out of said open casing end, said plunger exerting a pressure on said top pellet surface; and a cylindraceous open center bushing held in said bushing receiving upper end of said casing, with said plunger shaft passing through said open center, said shaft triggering said triggerable member.

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