

EUROPEAN PATENT SPECIFICATION

- ④ Date of publication of patent specification: **02.11.88** ⑤ Int. Cl.⁴: **G 08 B 17/06**
⑦ Application number: **84304549.3**
⑧ Date of filing: **03.07.84**

⑨ Improvements relating to smoke detection apparatus.

⑩ Priority: **04.07.83 AU 116/83**

⑪ Date of publication of application:
13.02.85 Bulletin 85/07

⑫ Publication of the grant of the patent:
02.11.88 Bulletin 88/44

⑬ Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

⑭ References cited:
EP-A-0 040 342
DE-A-3 237 021
US-A-3 765 842
US-A-4 170 189
US-A-4 241 282

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EP 0 132 969 B1

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Description

This invention relates to smoke detection apparatus.

Most modern furnishing materials can produce extremely dangerous fumes when burned including Carbon Monoxide, Hydrogen Cyanide and Hydrogen Chloride. Because of the highly toxic nature of these materials when burnt, time has become the crucial factor in preserving life and possessions against fire, almost everywhere indoors.

Economical, extremely sensitive, early-warning smoke detection devices have been developed to meet this modern day threat. The most effective detection device known to inventor employs an optical principle, whereby the light scattered off particles of smoke within a sampling chamber, is detected to produce an output proportional to smoke intensity. In this way, sensitivity to all forms of smoke, as rare as 0.01% per metre obscuration (i.e. 20 micrograms/cubic metre equivalent to a visual range of 40 kilometres) is made possible. The fundamental requirement is to transport a sample of the smoke-laden air to said sampling chamber, by means of a smoke transport system.

Said smoke transport system may take the form of a pipe or network thereof, configured to draw a continuous small sample of air from the areas within which fire detection is required. The aggregate of all said areas constitutes one fire zone. Said continuous sample of air from said zone is drawn by means of a fan, downstream from said sampling chamber. Each location where an opening is made to allow the passage of air into said smoke transport system, constitutes a sampling point.

Under normal, non-fire conditions, the atmosphere may be relatively clear of smoke depending upon the use of the premises. Dormitories in a school, or partitioned office blocks for example, would have a relatively clear atmosphere. However, the kitchen in each House Master's quarters of that school could have a smokey atmosphere at cooking times, while bathrooms would regularly become steamed. Furthermore, certain areas of a factory such as a main workshop may have a polluted atmosphere whereas other areas in the factor are relatively clear. Thus in one building, there could be a mixture of clear and laden atmospheres. The use of sensitive smoke detection apparatus in said areas would certainly lead to false alarms.

One solution could be to alternate the use of thermal and smoke detection devices appropriately throughout the zone. In practice this would complicate an installation, requiring two types of control panel and the individual wiring of thermal detectors and the running of pipework for smoke detection. These complications would increase the overall cost significantly.

The prior art contains proposals for fire alarm signalling systems in which attempts have been made to differentiate between steady state con-

ditions and conditions which call for the signalling of an alarm. EP—A—0040342 discloses the concept of controlling sampling apertures in a smoke detection system by providing manually adjustable devices. US—A—4,241,282 discloses a radiation sensitive smoke detector wherein a bimetallic element is provided in the radiation region to compensate for decrease in the sensitivity of the detector to smoke with temperature increase. US—A—4,170,189 discloses a heat sensitive assembly incorporating eutectic metal. Finally US—A—3,765,842 discloses a switchable air sampling system for withdrawing air samples sequentially from a supervised space and testing them for carbon monoxide.

The most effective, economical and versatile solution is embodied in the present invention by providing an improved smoke detection system which is independent of normal or ambient foggy and smokey conditions not associated with a dangerous rise in temperature.

There is provided according to the present invention a smoke detector system including a sampling pipe which is connected to an associated smoke detection device characterised by an apertured housing adapted for connection to said pipe at a point on said pipe remote from the connection of said pipe to said associated smoke detection device; plug means in said housing for controlling flow of ambient gaseous atmosphere to said sampling pipe such that under normal ambient conditions ambient gaseous atmosphere is blocked from said sampling pipe; said plug means consisting of or being retained by a low melting point substance such that when the ambient temperature exceeds the melting temperature of said substance, said plug means becomes ineffective to block the flow of ambient gaseous atmosphere, and ambient gaseous atmosphere is admitted to said sampling pipe for exposure to said associated smoke detection device.

Conveniently, the present invention utilises a housing, a suitable wax or low melting point metal such as "Woods metal" and a heat-collector plug, the wax or metal acting as an adhesive to retain said plug in such a manner that the sampling pipe is normally blocked. Said plug is configured, and is of suitable composition, to act as an efficient collector of heat from the surrounding atmosphere. Upon said plug collecting and conducting sufficient heat to melt said wax or metal adhesive, said plug falls away from said housing, to expose the sampling pipe. Using wax or metal of melting point 67 degrees Celsius, results in exposure of the sampling pipe in fifteen seconds to four minutes, depending upon the design of the heat activated sampling point (H.A.S.P.) components.

The variation in delay times result from variations in design parameters such as surface area of the plug, its mass conductivity and various other factors. However, factors such as ruggedness and appearance in use may be adversely affected in achieving extremely short reaction times. The present invention is seen as an effec-

tive compromise taking into account these parameters. Considerations of cost and aesthetics may dominate the design choice.

In practice said fire zone may utilize the heat activated sampling point (H.A.S.P.) technique in every area, whilst a building may contain several said zones. The H.A.S.P. technique would be appropriate in highly dusty areas, such as a joinery factory. Waxes of various melting points could be chosen in accordance with the maximum ambient temperatures prevailing. Thus, application in relatively hot and smokey environments such as boiler rooms or standby generator rooms would be possible.

Brief description of drawings

In the drawings Figure 1 is a sectional view of a sampling point mounting base;

Figure 2 is a sectional view of a sampling point cartridge assembly;

Figure 3 is a sectional view heat collecting plug;

Figure 4 is an elevational view of a sampling point assembly;

Figure 5 is a graphical representation of comparative thermal performance of conventional heat detectors and the sampling point assembly of the present invention;

Figures 6a, 6b, 6c, 6d, 6e, 6f are schematic representations of but a few examples of heat collector;

Figure 7 is a schematic view of smoke detection system.

Preferred embodiment

In a preferred embodiment of this invention, a convenient circular mounting base (1) is provided. Said base is adapted to be mounted to the ceiling in various possible ways to suit circumstances. Accordingly said base is sized to match a standard circular electrical junction box of a type which may be surface-mounted or may have been pre-cast into a concrete floor slab. Said base is also configured for direct surface-mounting.

Push-fit airtight coupling to the pipe network is facilitated by tapered holes (2) into said base, permitting top entry, side entry, or tee-junctioning. An annular rim (3) is provided for aesthetic appeal and where appropriate, to provide a ledge to hide the end of a run of surface-mounted rectangular conduit. The underneath of said base has a deep, tapered cylindrical recess (4), in the centre of which is the actual orifice (5) of said sampling point. A cylindrical cartridge assembly (6) consisting of said housing (7) with an integral well to contain said wax adhesive (8) and said heat-collecting plug (9), is adapted to be held by wax adhesion in said recess, to block said sampling point. Included with said housing is a ventilated protective guard means (10) to prevent damage from thrown objects, which might otherwise cause the seal of said wax to be broken and said heat collecting plug to fall away. Said mounting base is provided with counter bored

holes (11) positioned at right-angles to the cross-section shown, to facilitate attachment to the ceiling or junction box by means of two screws.

The heat collecting plug should be of high heat conducting material such as copper, aluminium or ceramic.

With reference to Figure 5 the curve indicates a thermal profile of temperature against time in a test chamber housing various test heads. As can be seen a conventional quartz bulb sprinkler head has a delay time of approximately 13 minutes whereas a conventional thermal detector is in excess of 100 seconds. The sampling point assembly of the present invention is a little less than 80 seconds in the arrangement shown.

Considerable advantage is gained by the use of a removable cartridge assembly 6 which may be a press fit or threaded. The fire brigade may conduct testing of every sampling point at any time, simply by removing said cartridge and introducing test smoke. Moreover, should conditions within the zone change or should initial predictions of air clarity prove incorrect, said bases may have said cartridges inserted or removed at will. For uniformity in appearance said cartridges are made available with and without said heat-collecting plug installed, such that a cartridge of either type is inserted into every said base.

Referring to Figures 6(a), 6(b), 6(c), 6(d), 6(e) and 6(f) these show schematically various examples of heat collecting plug or blocking means 9 housed in a recess 8 to shroud and block aperture 5.

The blocking member 9 is secured into the well by a wax adhesive for example TECHNIWAX 9210 which is an adhesive consisting of a long chain hydrocarbon wax having a melting point in the range of 64 to 68°C.

As mentioned previously various design parameters influence the delay time before the wax seal is melted and the blocking member 9 falls away to expose the aperture 5. Thus, the material may be thin and have a large surface area such as in Figures 6(a) and 6(f) resulting in relatively short delay times after 67°C is exceeded under test. Alternatively locking members of thin material and relatively small surface area such as Figures 6(b) and 6(d) take longer to break the seal. Blocking members having greater mass and relatively high surface area such as Figures 6(c) and 6(e) also exhibited long delay times before breaking away from the wax seal. The latent heat of the wax, its mass and the surface area and geometry of the plug all become factors affecting the reaction time of the unit. The delay resulting from said reaction time may be of benefit in avoiding false alarms caused by transient but safe rises in temperature. The delay time for each example in Figures 6(a) to 6(f) is shown on each Figure.

The example depicted in Figures 3 and 4 of a finned heat collecting blocking member 9 surrounded by a guard provides a good balance of robustness yet exhibits a low delay time of

approximately 78 seconds.

With reference to Figure 7 there is shown schematically a reticulation smoke transport system of sampling pipes 23 and 24 leading to various sampling areas to detect the presence of smoke in those areas.

The transport system leads back to a sampling chamber or tube 22 of the type initially referred to.

Gas is continually drawn from the system by a fan 20 drawing through a diffuser 21 to enhance the performance of the said fan. In an alternative embodiment of the invention the blocking means may include a temperature responsive bimetallic strip (not shown) blocking the opening to the air sampling pipe. The strip may be of various dissimilar metals, such as copper and steel, rivetted or welded together and arranged to distort upon the surrounding temperature level exceeding a predetermined level which is usually indicative of fire.

Claims

1. A smoke detector system including a sampling pipe (23, 24) which is connected to an associated smoke detection device (22), characterised by an apertured housing (6) adapted for connection to said pipe at a point on said pipe remote from the connection of said pipe to said associated smoke detection device; plug means (9) in said housing for controlling flow of ambient gaseous atmosphere to said sampling pipe such that under normal ambient conditions ambient gaseous atmosphere is blocked from said sampling pipe; said plug means consisting of or being retained by a low melting point substance (8) such that when the ambient temperature exceeds the melting temperature of said substance (8), said plug means (9) becomes ineffective to block the flow of ambient gaseous atmosphere, and ambient gaseous atmosphere is admitted to said sampling pipe (23, 24) for exposure to said associated smoke detection device.

2. A system according to Claim 1 characterised in that said apertured housing comprises a base (1) adapted for fastening to a support; orifice means (5) are provided in said base for admission of said ambient gaseous atmosphere; and a cylindrical cartridge assembly (6) is readily and detachably mounted on said base to be in communication with said orifice means; said cylindrical cartridge assembly (6) comprising said plug means (9) and said low melting point substance (8).

3. A system according to Claim 1 characterised in that said apertured housing comprises a base (1) adapted for fastening to a support; orifice means (5) are provided in of said base for admission of said ambient gaseous atmosphere; and a ventilated protective guard means (10) is mounted on said base to surround said plug means (9) and said orifice means (5), for protecting said plug means and said orifice means from thrown objects.

4. A system according to Claim 1 characterised

in that said apertured housing comprises a base (1) adapted for fastening to a support; orifice means (5) are provided in said base for admission of said ambient gaseous atmosphere, and said orifice means terminates in said apertured housing in branches (2), said branches (2) are adapted to be connected to a sampling pipe (22, 23) which is push-fitted into a branch in air tight manner.

5. A smoke detector system comprising smoke detection means including a sampling chamber (22) for automatically sensing the presence of smoke in said sampling chamber; a reticulation smoke transport system for continuously sucking ambient air samples from a plurality of spaced sampling locations (25), for combining said samples and for delivering said combined samples to said smoke detection means, said reticulation smoke transport system including an exhaust fan (2) for continuously sucking said combined samples out of said smoke detection means, a sampling pipe (23) connected to said sampling chamber for delivering said combined samples thereto and a plurality of branch sampling pipes (24) each connected at one end to said sampling pipe (23) and having the other end terminated at a respective one of said plurality of spaced sampling locations (25) whereby said exhaust fan (2) sucks individual air samples from said plurality of sampling locations, through the respective ones of said branch sampling pipes, through the sampling pipe (23), and out through said smoke detection device; and a sampling head connected to each branch sampling pipe (24) at the said sampling location (25); characterised in that a portion of said sampling heads comprises means (8, 9) to individually and selectively block the admission of air samples from the respective sampling location (25) to said respective branch sampling pipe (24) when the temperature at said sampling head is below a value which is individually and selectively matched to a temperature high enough to indicate a danger condition at the background of said respective sampling location; the remainder of said sampling heads having no means to block the admission of air samples to said respective branch pipe whereby smoke present at the said remainder of said sampling heads is promptly conveyed to said sampling chamber while smoke present at said portion of said sampling heads is delayed and not conveyed to said sampling chamber until the temperature at the individual sampling head exceeds the respective temperature high enough to indicate a danger condition at the background of the respective sampling location.

Patentansprüche

1. Ein Rauchdetektorsystem mit einem Probenrohr (23, 24), das mit einer zugehörigen Rauchdetektionsvorrichtung (22) verbunden ist, gekennzeichnet durch ein durchbohrtes Gehäuse (6), das an einer von der Verbindungsstelle des Rohres mit der zugehörigen Rauchdetektionsvorrichtung

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abgelegenen Stelle mit dem Rohr verbindbar ist; durch einen im Gehäuse angeordneten Stopfen (9) zur Regelung des Eintritts gasförmiger Umgebungsatmosphäre in das Probenrohr in einer solchen Weise, dass unter normalen Umgebungsbedingungen der gasförmigen Umgebungsatmosphäre der Eintritt in das Probenrohr versperrt ist, wobei der Stopfen von einer Masse (8) mit niedrigem Schmelzpunkt gebildet oder festgehalten wird, so dass, wenn die Umgebungstemperatur den Schmelzpunkt der Masse (8) übersteigt, der Stopfen (9) nicht länger imstande ist, der gasförmigen Umgebungsatmosphäre den Eintritt zu versperren und gasförmige Umgebungsatmosphäre in das Probenrohr (23, 24) eingelassen und der zugehörigen Rauchdetektionsvorrichtung ausgesetzt wird.

2. Ein System nach Anspruch 1, dadurch gekennzeichnet, dass das durchbohrte Gehäuse ein an einer Tragfläche befestigbare Montageplatte (1) aufweist; dass in dieser Montageplatte eine Öffnung (5) für den Eintritt der gasförmigen Umgebungsatmosphäre vorgesehen ist; und dass an dieser Montageplatte eine zylindrische Patronenbaueinheit (6) leicht und abnehmbar derart befestigt ist, dass sie mit der Öffnung (5) in Verbindung steht, wobei die zylindrische Patronenbaueinheit (6) den Stopfen (9) und die Masse (8) mit niedrigem Schmelzpunkt enthält.

3. Ein System nach Anspruch 1, dadurch gekennzeichnet, dass das durchbohrte Gehäuse eine an einer Tragfläche befestigbare Montageplatte (1) aufweist; dass in dieser Montageplatte eine Öffnung (5) für den Eintritt der gasförmigen Umgebungsatmosphäre vorgesehen ist; und dass an dieser Montageplatte eine belüftete Abschirmung (10) befestigt ist, die den Stopfen (9) und die Öffnung (5) umgibt, um den Stopfen und die Öffnung vor hochgeworfenen Gegenständen zu schützen.

4. Ein System nach Anspruch 1, dadurch gekennzeichnet, dass das durchbohrte Gehäuse eine an einer Tragfläche befestigbare Montageplatte (1) aufweist; dass in dieser Montageplatte eine Öffnung (5) für den Eintritt der gasförmigen Umgebungsatmosphäre vorgesehen ist, und dass diese Öffnung im durchbohrten Gehäuse in Verzweigungen (2) ausmündet, welche Verzweigungen (2) mit einem Probenrohr (23, 24) verbindbar sind, das luftdicht in eine Verzweigung eingepresst wird.

5. Ein Rauchdetektorsystem bestehend aus Rauchdetektionsmitteln mit einer Probenkammer (22) zur selbsttätigen Erfassung von Rauch in der Probenkammer; einem Rauchtransportnetzsystem, das kontinuierlich Umgebungsluftproben aus einer Vielzahl im Abstand angeordneter Probeentnahmestellen (25) absaugt, die Proben vereint und die vereinten Proben den Rauchdetektionsmitteln zuführt, und welches Rauchtransportnetzsystem besteht aus einem Sauglüfter (2), der kontinuierlich die vereinten Proben aus den Rauchdetektionsmitteln absaugt, einem mit der Probenkammer verbundenen Probenrohr (23), das die vereinten Proben der Kammer zuführt und

einer Vielzahl von Probenzweigrohren (24), die je mit einem Ende mit dem Probenrohr (23) verbunden sind und mit dem anderen Ende an jeweils einer der im Abstand angeordneten Probeentnahmestellen (25) ausmünden, wobei der Sauglüfter (20) einzelne Luftproben von der Vielzahl von Probeentnahmestellen, durch das jeweils betreffende Probenzweigrohr, durch das Probenrohr (23) und durch die Rauchdetektionsvorrichtung saugt; und aus einem Probeentnahmekopf, der an der Probeentnahmestelle (25) mit jedem Probenzweigrohr (24) verbunden ist; dadurch gekennzeichnet, dass ein Teil der Probeentnahmeköpfe Mittel (8, 9) aufweist, um individuell und selektiv den Eintritt von Luftproben von der jeweiligen Probeentnahmestelle (25) in das jeweils betreffende Probenzweigrohr (24) zu verhindern, wenn die Temperatur an diesem Probeentnahmekopf unter einem Wert liegt, der individuell und selektiv einer Temperatur entspricht, die hoch genug ist, um einen Gefahrzustand im Hintergrund der betreffenden Probeentnahmestelle anzuzeigen, während die übrigen Probeentnahmeköpfe nicht imstande sind, den Eintritt von Luftproben in das jeweilige Zweigrohr zu verhindern, wodurch an diesen übrigen Probeentnahmeköpfen vorliegender Rauch unverweilt der Probenkammer zugeführt wird, während am erstgenannten Teil der Probeentnahmeköpfe vorliegender Rauch aufgehalten und der Probenkammer erst dann zugeführt wird, wenn die Temperatur am einzelnen Probeentnahmekopf die jeweilige Temperatur übersteigt, die hoch genug ist, um einen Gefahrzustand im Hintergrund der betreffenden Probeentnahmestelle anzuzeigen.

Revendications

1. Système de détection de fumée comprenant un tuyau de prélèvement (23, 24) qui est relié à un dispositif de détection de fumée associé (22) caractérisé par un corps (6) muni d'une ouverture, apte à être raccordé audit tuyau en un point dudit tuyau situé à l'écart du raccord entre ledit tuyau et ledit dispositif de détection de fumée associé; un moyen d'obturation (9) placé dans ledit corps en vue de commander l'écoulement de l'atmosphère gazeuse ambiante dans ledit tuyau de prélèvement de façon telle que, dans des conditions d'ambiance normales, l'atmosphère gazeuse ambiante est empêchée de passer dans ledit tuyau de prélèvement; ledit moyen d'obturation consistant en une substance (8) à bas point de fusion, ou étant maintenu par une telle substance, de telle façon que lorsque la température ambiante excède la température de fusion de ladite substance (8), ledit moyen d'obturation (9) devient inefficace pour bloquer l'écoulement de l'atmosphère gazeuse ambiante, et que l'atmosphère gazeuse ambiante est admise dans ledit tuyau de prélèvement (23, 24) en vue d'être exposée audit dispositif de détection de fumée associé.

2. Système selon la revendication 1, caractérisé en ce que ledit corps muni d'une ouverture

comprend une base (1) apte à être fixée sur un support; que des moyens d'orifices (5) sont ménagés dans ladite base pour l'admission de ladite atmosphère gazeuse ambiante; et qu'un ensemble formant une cartouche cylindrique (6) peut être monté sur ladite base et en être détaché aisément de façon à se trouver en communication avec ledit moyen d'orifice; ledit ensemble (6) formant une cartouche cylindrique comprenant ledit moyen d'obturation (9) et ladite substance (8) à bas point de fusion.

3. Système selon la revendication 1, caractérisé en ce que ledit corps muni d'une ouverture comprend une base (1) apte à être fixée sur un support; que des moyens d'orifice (5) sont ménagés dans ladite base pour l'admission de ladite atmosphère gazeuse ambiante; et qu'un moyen de capot de protection ventilé (10) est monté sur ladite base pour entourer ledit moyen d'obturation (9) et ledit moyen d'orifice (5), en vue de protéger ledit moyen d'obturation et ledit moyen d'orifice à l'abri des objets lancés.

4. Système selon la revendication 1, caractérisé en ce que ledit corps muni d'une ouverture comprend une base (1) apte à être fixée à un support; que des moyens d'orifices (5) sont ménagés dans ladite base pour l'admission de ladite atmosphère gazeuse ambiante, et que ledit moyen d'orifice se termine dans ledit corps muni d'une ouverture par des ramifications (2), lesdites ramifications (2) étant aptes à être reliées à un tuyau de prélèvement (22, 23) qui est enfilé par poussée dans une ramification d'une façon étanche à l'air.

5. Système de détection de fumée comprenant un moyen de détection de fumée comportant une chambre d'échantillons (22) destinée à détecter automatiquement la présence de fumée dans ladite chambre d'échantillons; un système de transport de fumée formant un réseau destiné à aspirer en continu des échantillons d'air ambiant en provenance de plusieurs emplacements (25) de prélèvement espacés entre eux, pour combiner lesdits prélèvements et pour délivrer lesdits échantillons combinés dans ledit moyen de détection de fumée, ledit système de transport de fumée formant un réseau comprenant un ventila-

teur aspirant (20) destiné à aspirer en continu lesdits échantillons combinés hors dudit moyen de détection de fumée, un tuyau de prélèvement (23) relié à ladite chambre d'échantillons en vue de délivrer dans cette dernière lesdits échantillons combinés et une pluralité de tuyaux de prélèvement (24) formant une ramification, reliés chacun à une extrémité audit tuyau d'échantillonnage (23) et se terminant à l'autre extrémité à un emplacement de prélèvement respectif parmi les emplacements de prélèvement espacés entre eux (25), ledit ventilateur aspirant (20) aspirant des échantillons d'air individuels en provenance de ladite pluralité d'emplacements de prélèvement, en passant par les tuyaux de prélèvement formant ramifications respectifs, par le tuyau de prélèvement (23), pour sortir en passant dans ledit dispositif de détection de fumée; et une tête de prélèvement reliée à chaque tuyau de prélèvement formant une ramification (24) au dit emplacement de prélèvement (25); caractérisé en ce que une partie desdites têtes de prélèvement comprennent des moyens (8, 9) destinés à bloquer sélectivement individuellement l'admission d'échantillon d'air en provenance desdits emplacements respectifs de prélèvement (25) dans ledit tuyau de prélèvement formant une ramification respective (24) lorsque la température de ladite tête de prélèvement est inférieure à une valeur qui peut être comparée individuellement et sélectivement à une température suffisamment élevée pour indiquer une situation de danger dans l'environnement situé derrière ledit emplacement de prélèvement respectif; lesdites têtes de prélèvement restantes ne comportant pas de moyen pour bloquer l'admission de prélèvements d'air dans ledit tuyau formant une ramification respective, la fumée présente dans lesdites têtes de prélèvement restantes étant de ce fait rapidement transportée dans ladite chambre d'échantillons tandis que la fumée présente dans ladite partie des têtes de prélèvement est retenue et n'est pas transportée dans ladite chambre d'échantillons jusqu'à ce que la température à la tête de prélèvement individuelle soit suffisamment élevée pour indiquer une situation de danger à l'arrière des emplacements de prélèvement respectifs.

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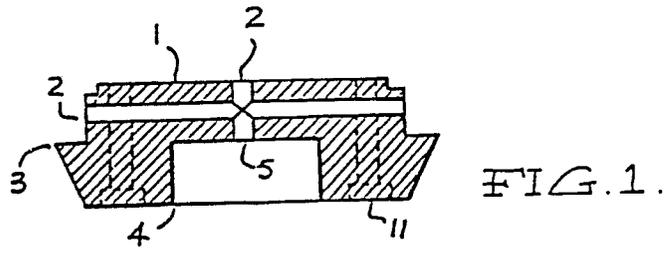


FIG. 1.

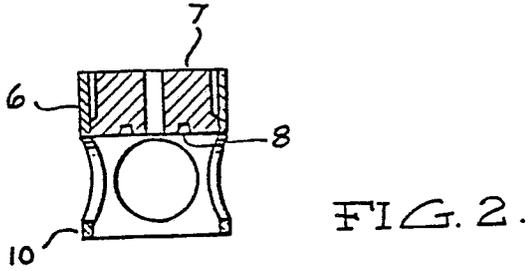


FIG. 2.

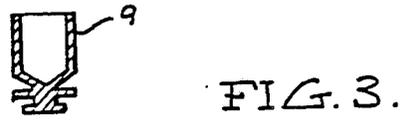


FIG. 3.

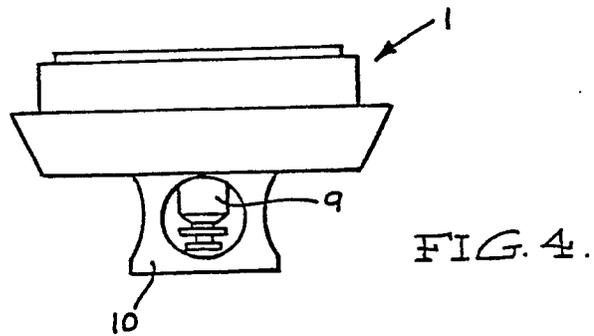


FIG. 4.

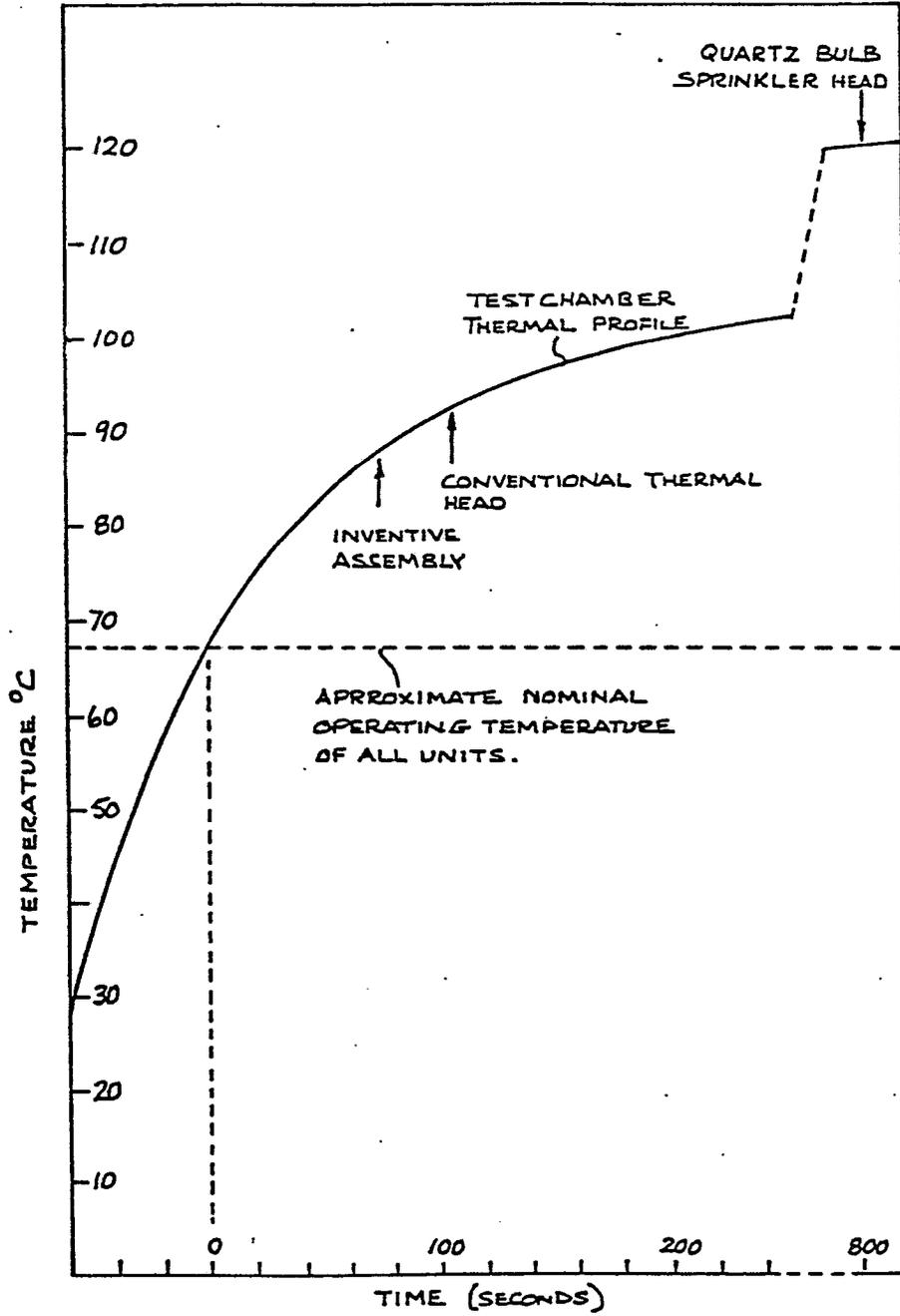
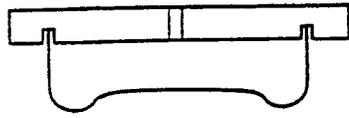
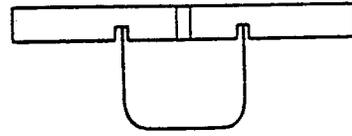


FIG. 5.



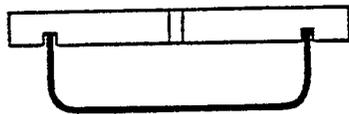
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FIG. 6a



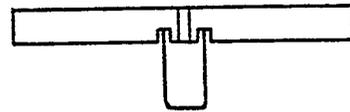
170 sec

FIG. 6b



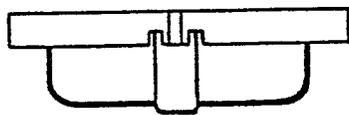
216 sec

FIG. 6c



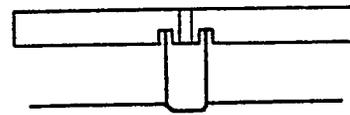
218 sec

FIG. 6d



217 sec

FIG. 6e



15 sec

FIG. 6f

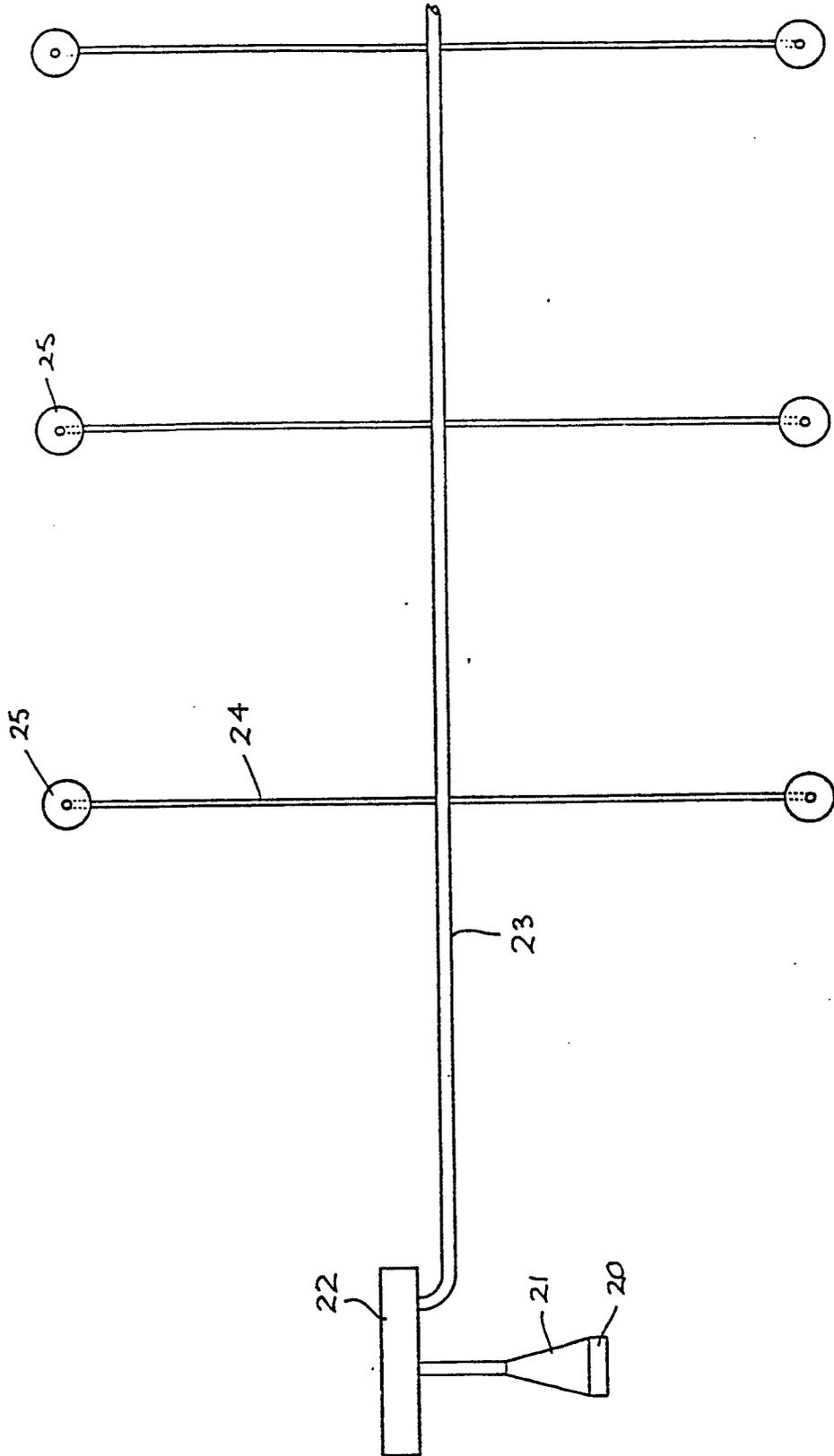


FIG. 7.