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(54) Improvements relating to smoke detection apparatus.

(57) A heat sensitive air/gas sampling device including an apertured housing (1) for connection to a pipe leading to a smoke detector device, the housing including a blocking device (9) for preventing air/gas to enter the housing, the blocking device being ineffective to prevent ingress of air/gas when the surrounding temperature exceeds a predetermined maximum for a predetermined period of time. The blocking device may be held by, or composed of, a low melting point wax. The blocking device may be comprised of a bimetallic strip.

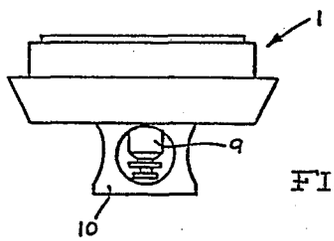

FIG. 4.

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IMPROVEMENTS RELATING TO SMOKE DETECTION APPARATUS

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. A sampling chamber is disclosed in my co-pending application No. PG 0820/83 filed 12th August, 1983.

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 factory 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 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 in a smoke detection system including an air sampling pipe and an associated smoke detection device the improvement comprising, an apertured housing adapted for connection to said pipe, a plug means in said housing controlling flow of ambient air to said air sampling pipe such that under normal ambient conditions ambient air is blocked from said air sampling pipe, said plug means consisting of, or being retained by, a low melting point substance such that when the ambient air temperature exceeds said melting temperature said air is admitted to said sampling pipe for exposure to said detection device.

In one aspect of the invention there is provided a heat activated sampling device for gaseous fluids including an apertured housing adapted to connect to a sampling pipe for transporting gas, heat sensitive means for controlling

flow of gas through the apertured housing, said means being ineffective to control the flow of gas when the surrounding gas temperature exceeds a predetermined minimum.

There is also provided in a smoke detection system requiring a gas sampling pipe; a device comprising a heat collecting blocking means retained in a housing by a stable temperature responsive substance adapted to block the flow of gas into said gas sampling pipe, said blocking means being ineffective to block the flow of gas when the surrounding gas temperature exceeds a predetermined maximum.

Conveniently, the present invention utilises a housing, a suitable wax or low melting point metal such as "Woods metal" and a heat-collector plug. Said wax or metal acting as an adhesive to retain said plug in such a manner that said sampling point 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 said aperture. Using wax or metal of melting point 67 degrees Celsius, results in exposure of said sampling point 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 effective 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 blocking 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 described in my co-pending Australian Patent Application No. PG0820/83 filed 12th August 1983 entitled "Smoke Detection Apparatus".

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.

I CLAIM

1. In a smoke detector system including a sampling pipe and an associated smoke detection device the improvement comprising, an apertured housing adapted for connection to said pipe, a plug means in said housing controlling flow of ambient gaseous atmosphere to said sampling pipe such that under normal ambient conditions ambient 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 said melting temperature said plug means becomes ineffective and gas is admitted to said sampling pipe for exposure to said detection device.

2. In a sensitive smoke detection system requiring a gas sampling pipe; a device comprising a heat-collecting blocking means retained in a housing by a temperature responsive means adapted to block the flow of gas into said gas sampling pipe, said blocking means being ineffective to block the flow of gas when the surrounding gas temperature exceeds a predetermined maximum for a predetermined time.

3. A heat activated sampling device for gaseous fluids including an apertured housing adapted to connect to a sampling pipe for transporting gas, a plug means for controlling flow of gas through the apertured housing to said pipe such that under normal ambient conditions ambient gas is blocked from said pipe, said plug means including, or being retained by, a low melting point substance such that an increase in ambient temperature above a predetermined limit renders the plug means ineffective and gas is admitted to said sampling pipe.

4. A heat activated sampling device for gaseous fluids including an apertured housing adapted to connect to a sampling pipe for transporting gas, heat sensitive means

for controlling flow of gas through the apertured housing, said means being ineffective to control the flow of gas when the surrounding gas temperature exceeds a predetermined minimum.

5. A device according to claim 2, 3 or 4 wherein the temperature responsive substance of low melting point is wax.

6. A device according to claim 1 or 2 wherein said plug means is manufactured from aluminium, copper or ceramic.

7. A device according to claim 2 or 3 wherein said heat-collecting plug and/or the said stable substance of low melting-point are one and the same, by choice of a low melting-point metal such as "Woods metal".

8. A device according to claim 3 or 4 wherein said housing includes a protective guard means to prevent accidental damage.

9. A device according to claims 2 or 4 wherein the temperature responsive element is a bimetallic strip.

10. A device according to claim 2 or 3 wherein the said mounting base is adapted to provide for tee-junctioning or branching off said pipe or tube.

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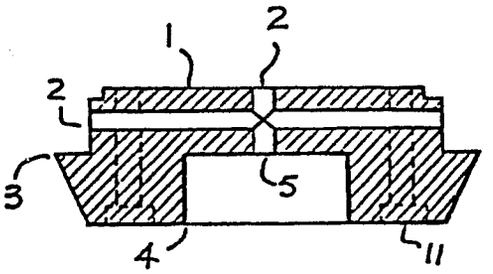


FIG. 1.

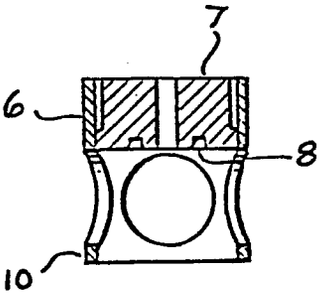


FIG. 2.

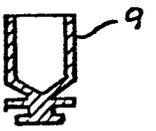


FIG. 3.

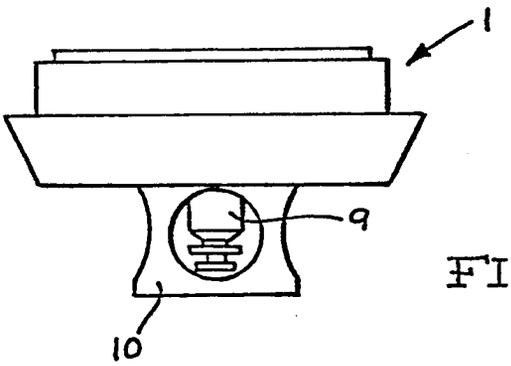


FIG. 4.

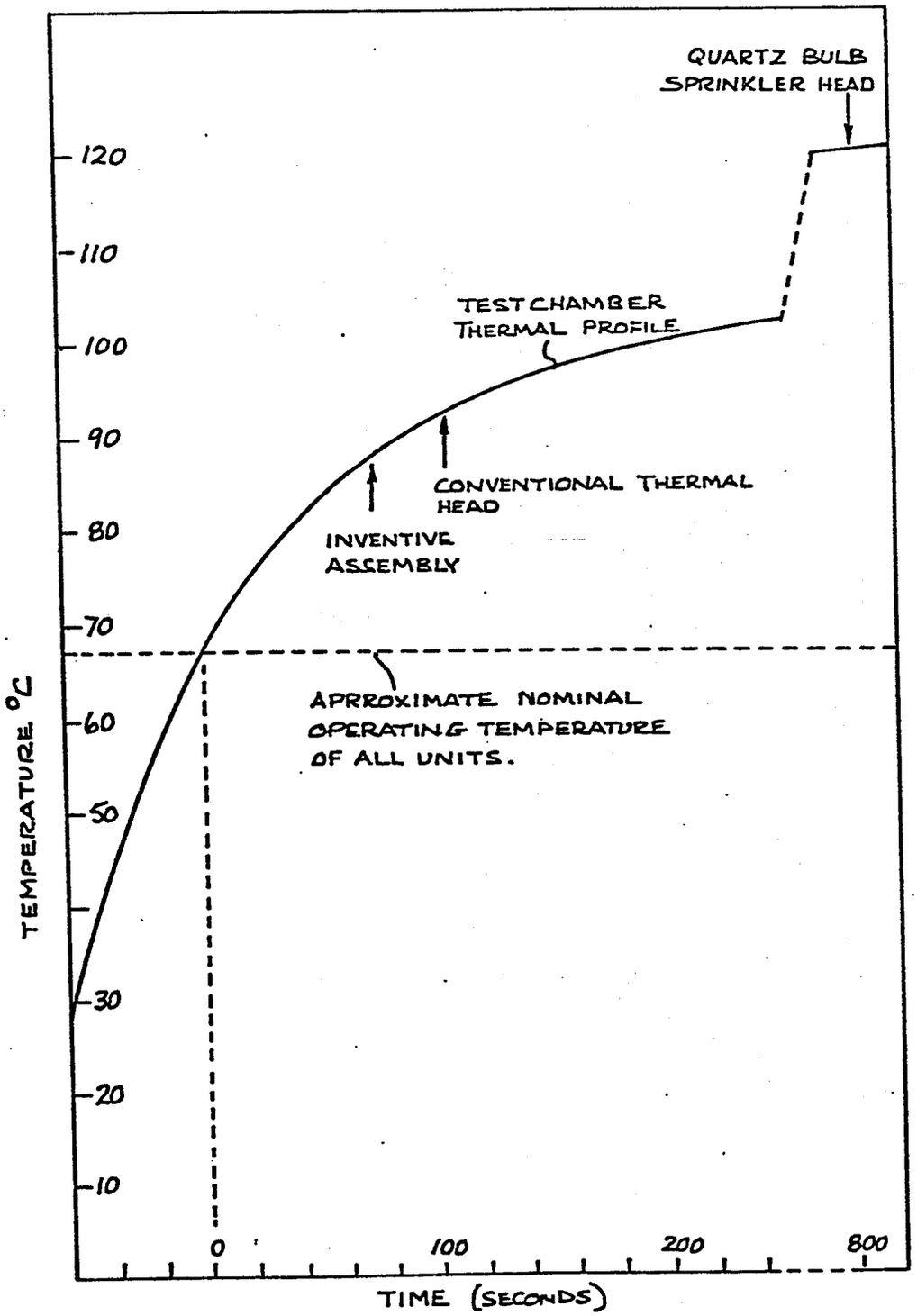
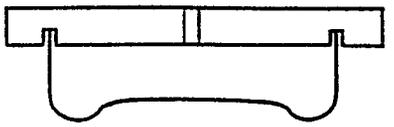
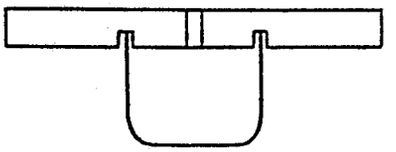

QUARTZ BULB SPRINKLER HEAD
120
110
100
90
80
70
60
50
30
20
10
TEMPERATURE °C
TEST CHAMBER THERMAL PROFILE
CONVENTIONAL THERMAL HEAD
INVENTIVE ASSEMBLY
APRROXIMATE NOMINAL OPERATING TEMPERATURE OF ALL UNITS.
0
100
200
800
TIME (SECONDS)

FIG. 5.



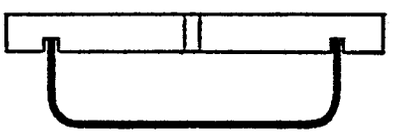
140 sec

FIG. 6a



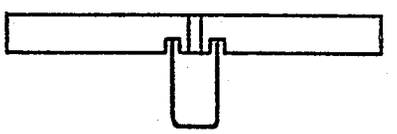
170 sec

FIG. 6b



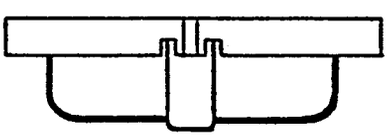
216 sec

FIG. 6c



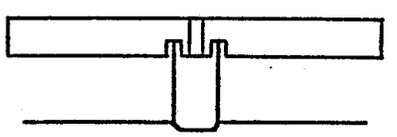
218 sec

FIG. 6d



217 sec

FIG. 6e



15 sec

FIG. 6f

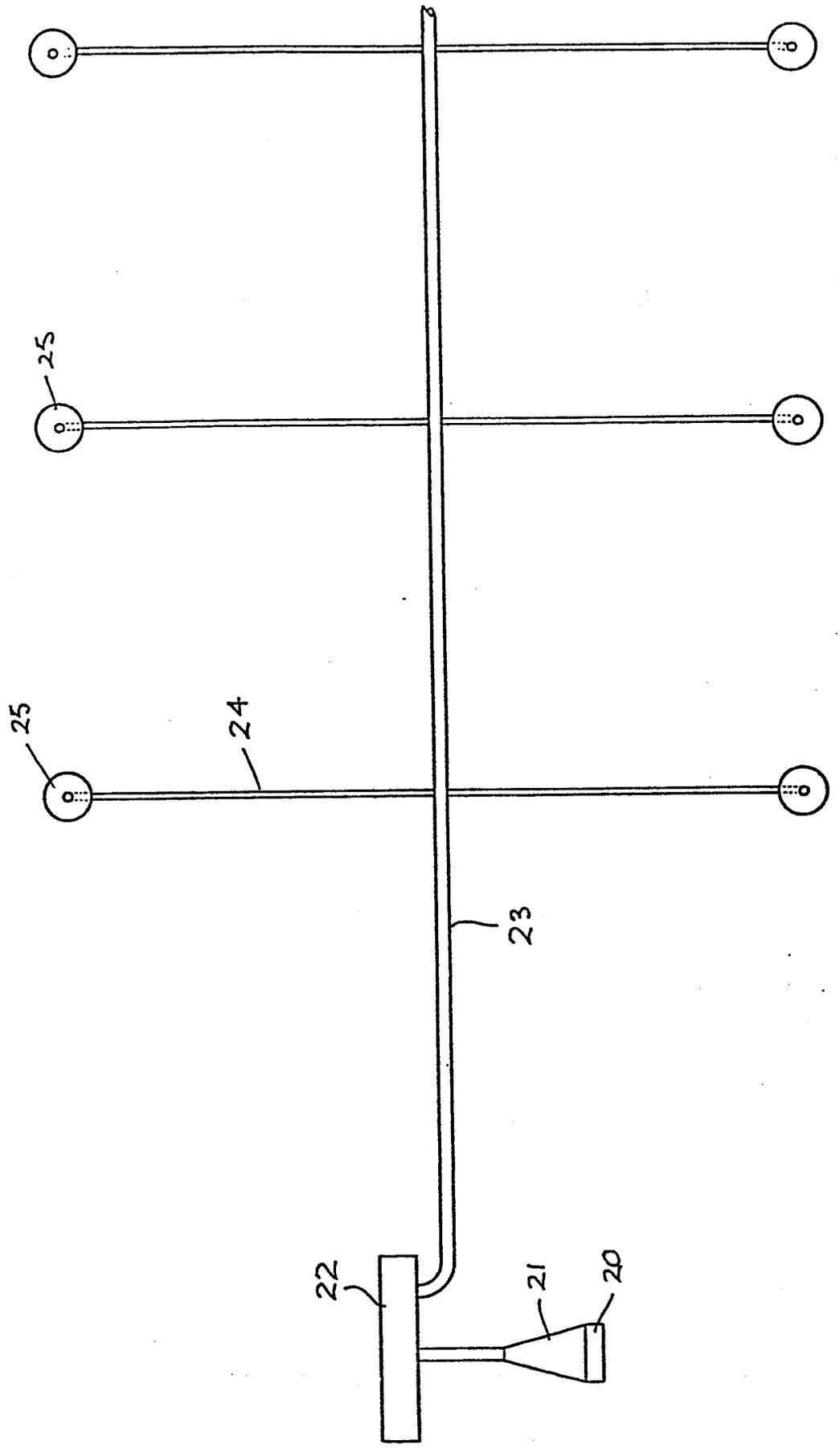


FIG. 7.

European Patent Office

EUROPEAN SEARCH REPORT

0132969
Application number

EP 84 30 4549

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl.4)
A	US-A-3 765 842 (PURT) * Abstract *	1	G 08 B 17/06
A	US-A-4 241 282 (TRESCH) * Abstract *	1,9	
A	US-A-4 170 189 (PAPPAS) * Abstract *	1	
A	EP-A-0 040 342 (CERBERUS) * Abstract *	1	
A	DE-A-3 237 021 (WESTINGHOUSE) * Abstract *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

G 08 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17-10-1984	SGURA S.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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