(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 290 412**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **88850155.8**

(51) Int. Cl.4: **G 08 B 17/10**

(22) Date of filing: **06.05.88**

(30) Priority: **06.05.87 SE 8701873**

(43) Date of publication of application:
09.11.88 Bulletin 88/45

(84) Designated Contracting States:
CH DE FR GB LI NL

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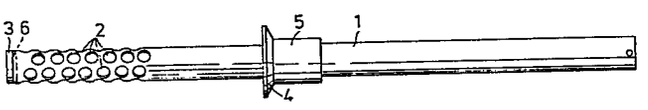
(54) **A measuring head for detection of particles.**

(57) A measuring head, e.g. for a smoke detector, includes a tubular holder (1) intended for being disposed in a ventilation duct for being passed through by the air which is to be monitored. The portion of the holder to be introduced in the ventilation duct is ended by an optical reflector (6) defining one end of a measuring path while the opposite defining surface of the measuring path includes a beam transmitting means and a detector means. The peripheral surface of the holder around the measuring path has a number, preferably six, of rows of holes (2) with at least six holes in each row. The holes in a row are staggered relative the holes in adjacent rows, the staggering amounting to between 1/4 and 1/3 of the hole width. At least 1/4 of the peripheral surface of the holder introduced in the ventilation duct and surrounding the measuring path is covered by the holes.

Fig. 1



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Description

A Measuring Head for Detection of Particles

Technical Field

The present invention relates to a measuring head for detection of particles in flowing gases. The measuring head includes a tubular holder one end portion of which being introduceable in the gas duct through which the flowing gas is carried. This end portion has rows of holes made in the peripheral surface for allowing gas to penetrate the inside of the holder and for forming a measuring path inside the rows of holes. An electronic measuring circuit is arranged in the rest of the holder mainly situated outside the gas duct.

Background Art

In known measuring heads of the kind in question, see e.g. British Patent No. 636 341, the opening intended for the flow-through by gas are arranged as diametrically opposed openings. The openings have been formed with a rather small area taking up less than a fourth of the holder cylindrical surface, with the intention of not preventing or disturbing the gas flow. Thus, the flow past the measuring path has been diametrical through the holder.

In the measuring head known from the British patent there is a one-way optical beam passing through the measuring path, i.e. a transmitter means (the bulb 3) is arranged at one defining surface of the measuring path and a detector means (the photo detector 4) is arranged at the opposite defining surface of the measuring path. A troublesome drawback is that minimum influence on the optical beam is obtained from particles eventually transported in the gas flow. To the minimum influence also the fact is added that due to the diametrically opposed openings the measuring head known from the British patent when mounted in a gas duct has to be carefully set so that the opposed openings are in line with the gas flow direction to avoid too strong flow resistance. There by a non-turbulent homogeneous flow is obtained. Another and equally as serious disadvantage has been found to be that particles from the gas have a tendency to deposit themselves on the measuring circuit elements inside the holder.

Disclosure of Invention

The present invention dispenses with the problems present in known measuring heads by an optical reflector carried at the end of the end portion introduced in the gas duct, said optical reflector being the one defining surface of the measuring path while a beam transmitting means and a detector means are arranged at the opposite defining surface of the measuring path, and by having the holes of the rows uniformally spaced around the peripheral surface of the holder, whereby the holes within a hole row are staggered in relation to the holes in the adjacent hole rows so that turbulence is obtained in the measuring path without having any appreciable flow resistance and whereby a maximum area is opened up for through-flowing of gas without any appreciable weakening of the solidity of the holder against radial, axial or shearing forces. Apart from the problems mentioned being taken care of, there is also gained an essential advantage in that the optical transmission of the measuring path is thus changed or amplified.

To advantage, the hole rows are six in number, with each row having at least six holes, the spacing of the holes being uniform around the peripheral wall of the holder.

With the measuring head in accordance with the invention there is also achieved simple fitting of the detector in the ventilation duct, since the person fitting it does not need to note any particular orientation of the holder relative the direction of the medium, i.e. the flow direction of the air. A still further simplification of fitting the holder to the air duct is by equipping the holder with an annular ring for sealed juxtaposition against the duct wall.

Preferred Embodiment

The present invention will now be described in more detail with reference to the accompanying drawing, where a preferred embodiment of the measuring head in accordance with the invention is illustrated, and where

Figure 1 is a side view of the measuring head in accordance with the present invention and

Figure 2 is a development of the measuring head holder portion with the rows of holes.

In the embodiment of the measuring head in accordance with the invention depicted in the drawing enclosed, there is a tubular holder 1. One end portion of the holder 1 has six rows of holes 2, this end being closed by a body 3 which forms a reflector. This end portion of the holder 1 is intended for insertion in a ventilation duct (not shown) where the air flowing in this duct is to have its possible particle or smoke content monitored or measured by the measuring head in accordance with the invention. The described end portion of the measuring head is inserted in an opening in the ventilation duct for this purpose, and the opening is sealed around the holder 1 with the aid of a collar means 4. Retaining the collar means 4 in its position on the holder 1 is carried out with the aid of a cylindrical sleeve 5, which can have a friction fit on the peripheral surface of the tubular holder 1 and/or the sleeve can be provided with a set screw (not shown) for gripping said surface.

The holder 1 accommodates an electronic measuring circuit, which has a transmitting means and a detecting means flush with a defining surface of the measurement path formed behind the holes 2 in the holder 1. The other defining surface of the measuring path consists of a reflector surface 6 formed by the body 3 inside the holder 1. Measurement is preferably carried out by optical radiation transmission along the measurement path, and thus in such a way that the radiation passes the

measuring path twice after being transmitted by the transmitting means and up to being received by the detecting means when reflected by the body 3. It should be noted, however, that the electronics associated to perform the measuring process are not part of the present invention, which relates to the measuring head, and this head can be used for purposes other than optical measurements, as well as for media other than particle mingled air where such as particle measurement is to be carried out.

For achieving an optimum measurement result it has been found advantageous to cause turbulence in the air passing the measuring path. At the same time there is a requirement for good through-flow of air past the measuring path. The desire to achieve turbulence and the requirement of good through-flow are two mutually conflicting conditions for the measuring head. An optimum solution has been found for the measuring head in accordance with the invention, however. Basic for this solution is on one hand the beam passing the measuring path twice as mentioned above and on the other hand the distribution of the holes 2 over the peripheral surface of the holder 1. As will be seen from Figure 2, which is a development of the tubular holder 1, there are six rows with holes 2. Each row has seven holes 2 which are staggered between one fourth and one third of the hole width relative the holes in adjacent rows. Accordingly, no direct diametric through-flow direction past the measuring path is formed, although good air flow-through is also obtained. The turbulence which is obtained contributes to a good measurement result, inter alia due to the measuring means being kept free from dust and particle deposits.

The size of the holes 2 in the preferred embodiment has been selected such that added together they take up more than 1/4 of the peripheral source of the holder 1 surrounding the measuring path. Advantageous measurement results have been achieved by this surface share and distribution of the holes in the holder, i.e. the measuring head allows good measurement accuracy for a long time. Though the total hole area is covering a substantial part of the peripheral surface of the holder 1 there is no appreciable weakening of the solidity of the holder against radial, axial or shearing forces. The selected hole distribution also provides the advantage that the orientation of the measuring head in a duct is not critical. Accordingly, since there are six hole rows the fitter does not have to place any holes in line with the flow direction of the air in the duct.

Although the measuring head in accordance with the invention is described in detail with reference to a preferred embodiment, the invention must not be regarded as restricted thereto. Thus, both the number of hole rows and the number of holes per row can be varied. However, the number of hole rows should be at least four, but preferably six or some other even number. The more hole rows which are used, the less staggered relationship is needed between holes in adjacent rows. The number of holes in each row should be at least six, but this should also be in proportion to the length of the measurement path, so that the latter is substantially in communication with holes along its entire length. The holes, which has been shown circular, can also have some other shape, both with corners or curves. In the description given hereinbefore, the detection of smoke has been stated as being the field of use. Of course, other closely related fields of use can be envisaged, such as particle detection in ventilation air orother gas transport. The scope of the present invention is therefore solely defined by the following claims.

Claims

1. A measuring head for detection of particles in flowing gases and including a tubular holder (1) one end portion of which being introduceable in the gas duct through which the flowing gas is carried, said end portion having rows of holes (2) made in the peripheral surface for allowing gas to penetrate the inside of the holder and for forming a measuring path inside the rows of holes, an electronic measuring circuit being arranged in the rest of the holder mainly situated outside the gas duct, said measuring head being characterized by an optical reflector (6) carried by the end of the end portion introduced in the gas duct, said optical reflector being the one defining surface of the measuring path while a beam transmitting means and a detector means are arranged at the opposite defining surface of the measuring path, and by having the holes (2) of the rows uniformally spaced around the peripheral surface of the holder (1) along the measuring path, whereby the holes (2) within a hole row are staggered in relation to the holes in the adjacent hole rows so that turbulence is obtained in the measuring path without having any appreciable flow resistance and whereby a maximum area is opened up for through-flowing of gas without any appreciable weakening of the solidity of the holder against radial, axial or shearing forces.

2. The measuring head according to claim 1, characterized in that said staggering of the holes (2) within the hole rows is attaining between one fourth and one third of the width of a hole, and in that the total area of the holes take up at least one fourth of the peripheral surface area of the holder (1) introduced in the gas duct.

3. The measuring head according to claim 2, characterized in that the number of hole rows is at least four, and preferable six with each row having at least six holes (2).

4. The measuring head according to claim 2, characterized in that the holes (2) are circular.

5. The measuring head according to claim 1, characterized in that the holder (1) carries a collar means (4) for sealing engagement of the measuring head in an opening made for measurements in the gas duct.

Fig. 1

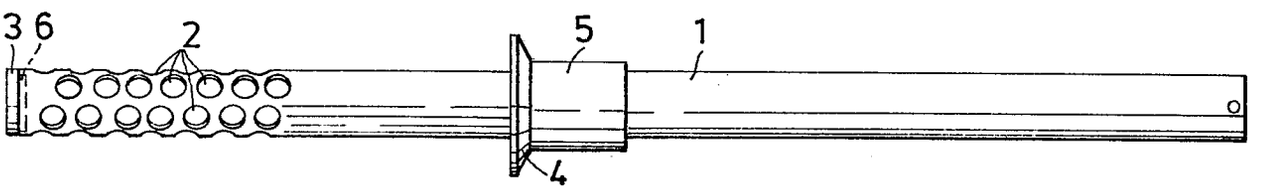

Fig. 2