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(54) PROCUDURE FOR MEASURING FAULTS IN A PIPELINE

VERFAHREN ZUM MESSEN VON DEFEKTEN IN EINER PIPELINE

PROCEDE DE MESURE DES DEFAUTS D'UN PIPELINE

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Description

The present invention concern a procedure for measuring faults in a pipeline and for observing foreign objects occuring in a pipeline.

Problems in maintenance are at present caused in various installations in processing industry, in power plants and equivalent by the job of monitoring the condition of pipelines. Damage to the pipelines is usually only observed after leakage has already occured, when the losses thereby incurred may be appreciable indeed.

The object of the invention is to eliminate the drawbacks mentioned above. Specifically, the object of the invention is to create a measuring procedure, by the aid of which the condition of pipelines can be monitored whenever desired, without interfering with their use in various processes, and with the aid of which faults in the pipelines can be accurately located.

The procedure according to the invention for measuring and locating faults in a pipe, in which beams are directed at an angle relative to each other through the walls of the pipe, traversing the pipe, and in which the intensities of the beams that have passed through both walls of the pipe are measured, uses two collimated beams which are moved, one trailing the other, in the axial direction of the pipe, whereby the locations of the faults in the pipe walls are determined by comparing the distance in the measuring direction between the signals derived from the beams and the distance between the beams at both traversing points.

In JP-A-6122239, DE-A-26 08 841, US-A-3,158,744 and JP-A-62203049 procedures are known suitable for measuring faults in a pipe whereby through the walls of the pipe are directed a plurality of beams traversing the pipe and directed at an angle relative to each other.

The difference between the invention and JP-A-6122239 is that in the invention only two and collimated beams are used and they are moved, one trailing the other, in the axial direction of the pipe. In JP-A-6122239, three beams are used and the pipe is rotated while the irradiator and the detectors are immovable. The invention makes it possible to inspect in a simple and reliable way all kinds of tubes, straight and curved ones, and especially tubes that are already in use, e.g. in large power plants.

The measuring procedure of the invention is based on the fact that two collineated radiations which are moved one after the other pass through the pipe wall with a given spacing when entering the pipe, and when they come out through the mantle on the other side of the pipe their spacing is different, preferably greater. Therefore comparison of the result of measurement obtained from different beams enables inferences to be drawn as to on which side of the pipe and at what location is the measured point of observation, such as e.g. a thinned-down area.

The measuring procedure is based on the fact that the radiation which is being used is absorbed by the pipe mantle in greater proportions, the greater the thickness at the traversing point. It is therefore also possible with the procedure of the invention to measure obstructions in the pipe, in addition to various instances of corrosion damage and the like.

The pipes that are being measured may be made of reinforced plastic, steel, aluminium, copper, etc., and they may also be lagged with various lagging materials.

Although it is feasible to have one of the two radiations perpendicular to the pipe and the other at an angle, it is advantageous if the angle enclosed by the radiation observed by the detectors and the normal on the pipe is within 1 to 60°, suitably 1 to 15°, advantageously 1 to 5°, the radiations being at equal and opposite angles relative to the normal. Hereby the conditions of measurement will be exactly equal for both radiations, and any differences observed in the radiations will signify existing deviations in the structure of the pipe or obstructions present in the pipe.

The distance between detectors is advanteously on the order of 10 to 100 mm, suitably 10 to 60 mm, e.g. 10 to 20 mm.

The beams going to the detectors may be attenuated with filtering plates, to be appropriate for the detectors. Such filtering plates may be inserted in the path either after the radiation source or before the pipe or after the pipe and before the detectors. The material to be used for the filtering plates is a conventional material used to attenuate radiation.

The signals from the detectors may be electrically ampified to be appropriate for the plotter, each channel by itself, whereby the thickness can be read, once the apparatus has been calibrated.

The advantage of the invention over prior art is that it affords a rapid, accurate and simple way of measurement without any interference with the operation of the pipelines.

The invention is described in the following in detail with the aid of examples, referring to the attached drawings, wherein:

Fig.1 presents a schematic diagram of an arrangement according to the invention,

Fig.2 presents an arrangement according to the invention,

Fig.3 shows the example of Fig.2, seen from another viewing angle, and

Fig.4 illustrates the radiation intensities measured by the detectors.

As shown in Fig.1, a gamma or x-ray radiation source 1 and two detectors $3,3^1$ have been placed on opposite sides of the walls of the pipe 1 to be measured. The detectors have been placed one after the other in the axial direction of the pipe to be measured, and so aligned relative to each other that the beams striking the detectors form equal angles α with the normal on the pipe under observation. The radiation emitted by the radiation source 2 is collineated with the aid of collimators 5, 5^1, 5^2,5^3 before the pipe 1, and after the pipe, to form two sharp beams which are directed accurately into the detectors 3,3^1. The radiation may be attenuated with filtering plates 7 in order to adjust the radiation from the radiation source 2 to be appropriate for the detectors 3,3^1.

The measuring apparatus of Fig. 1 is operated as follows. The measuring apparatus is moved in the axial direction of the pipe 1, the radiations from the radiation source 2 traversing both walls of the pipe. If the pipes are of uniform thickness and faultless, the signals going to the output device 4 are similar and the output device gives out no signals in a null balance measurement.

In Fig. 4, the radiation intensity I has been plotted on the y axis and the pipe length 1 in the direction of movement, on the x axis. The curve 9 represents the signal from detector 3 and the curve 10 that from detector 3^1 when the pipe is moved relative to the measuring apparatus. When the pipe or the measuring apparatus is moved relative to the other, the intensity of the radiation changes if there are faults or other changes in the pipe walls. A rise or descent in intensity, i.e., increase or decrease of the radiation passing through the pipe, indicates the wall thickness of the pipe. The measuring range is linear in the measuring direction in the axial direction of the pipe. The measuring speed, when the measuring apparatus is being moved, depends on the detectors, and it may be such that the measurement can even be made at a walking pace.

Referring to Fig. 4, if one of the pipe walls presents, for instance, a thinned spot, the first sign of this fault is received from the first beam, which is absorbed in the pipe structure in a different manner at the fault from that experienced at a faultless point. The x axis representing the pipe length gives information as to the location of the fault in the pipe. As the measuring apparatus is moved on, a similar fault signal is obtained from the other beam, whereby it is seen from the spacing of the fault signals in the x direction, on which of the two pipe walls the fault is located. This observation is based on the circumstance that the beams pass through the pipe at an angle against each other, due to which they pass through the different pipe walls with a different mutual spacing.

In the embodiment of Fig. 2, the radiation source 2 and the detectors 3,3^1 have been mounted on a transport means 6 by the aid of which the apparatus can be moved relative to the pipe 1 in the axial direction of the pipe, when a measurement is in progress.

As shown in Fig. 3, around the pipe has been provided a transport means 6, consisting of an arc which is 3/4 of the pipe's circumference and which is centrally braced against the pipe with three supporting legs carrying wheels 8. The arc carries, on opposite sides of the pipe, one radiation source and two detectors, one after the other in the axial direction of the pipe. The detectors are aligned to be at an angle e.g. about 3° against the normal on the pipe, and spaced at 10 to 20 mm. The radiation is directed through the apertures of collimators located before the pipe, accurately into the apertures of two collimators on the other side in conjunction with the detectors, and further into the detectors, one specific beam into each. The radiation is attenuated in case of need with filtering plates for ascertaining the wall thickness and good functioning of the detectors. The detector signals are electrically amplified by methods known in the art, when needed to suit the plotter, each channel separately by itself, whereby the thickness will be readable once the apparatus has been calibrated.

The measuring apparatus of the invention can be employed in measuring the faults of various kinds of pipelines, such as faults in the pipe walls, foreign objects present in the pipes, and clogged pipes. The faults in the pipe walls can also be measured without removing the lagging, making the measurement through the lagging.

The invention is not confined to the foregoing examples: its embodiments may vary within the scope of the claims following below.

Claims

1. Procedure for measuring and locating faults in a pipe, in which beams are directed at an angle relative to each other through the walls of the pipe, traversing the pipe, and in which the intensities of the beams that have passed through both walls of the pipe are measured, **characterized** in that the method is using only two collimated beams which are moved, one trailing the other, in the axial direction of the pipe, whereby the locations of the faults in the pipe walls are determined by comparing the distance in the measuring direction between the signals derived from the beams and the distance between the beams at both traversing points.

Patentansprüche

1. Verfahren zum Messen und Lokalisieren von Defekten in einem Rohr, bei dem Strahlen in einem Winkel relativ zueinander durch die Wände des Rohres gerichtet werden und das Rohr durchqueren und bei dem die Intensitäten der Strahlen, die durch beide Wände des Rohres hindurchgedrungen sind, gemessen werden, dadurch gekennzeichnet, daß das Verfahren nur zwei kollimierte Strahlen verwendet, die, einer dem anderen folgend, in Axialrichtung des Rohres bewegt werden, wodurch die Defektstellen in den Rohrwänden bestimmt werden, indem der Abstand in der Meßrichtung zwischen den von den Strahlen abgeleiteten Signalen mit dem Abstand zwischen den Strahlen an beiden Durch-

trittspunkten verglichen wird.

Revendications

1. Procédé de mesure et de localisation de défauts dans une conduite, dans lequel des faisceaux sont dirigés en formant un angle entre eux à travers les parois de la conduite et traversent celle-ci, et dans lequel les intensités des faisceaux qui sont passés à travers les deux parois de la conduite sont mesurées, caractérisé en ce qu'il n'est utilisé que deux faisceaux collimatés qui sont déplacés, l'un à la suite de l'autre, dans la direction axiale de la conduite, les localisations des défauts dans les parois de la conduite étant déterminées par comparaison de la distance, dans la direction de mesure, entre les signaux issus des faisceaux et la distance entre les faisceaux aux deux points de traversée.

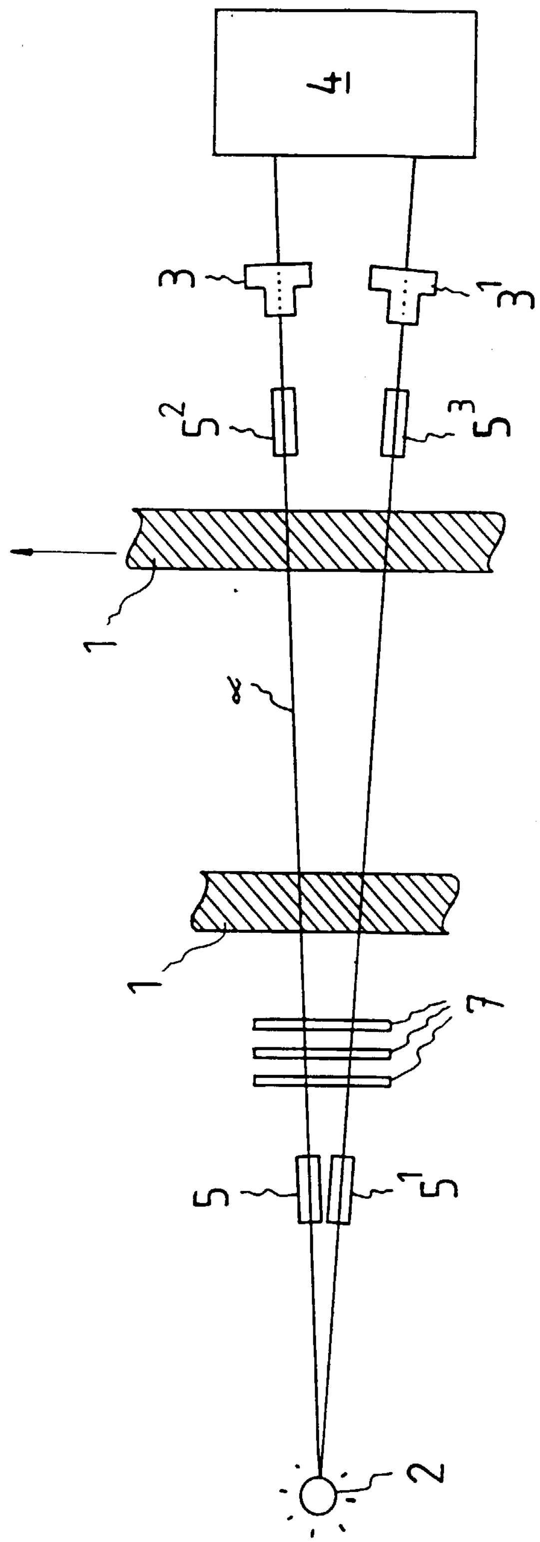

Fig.1

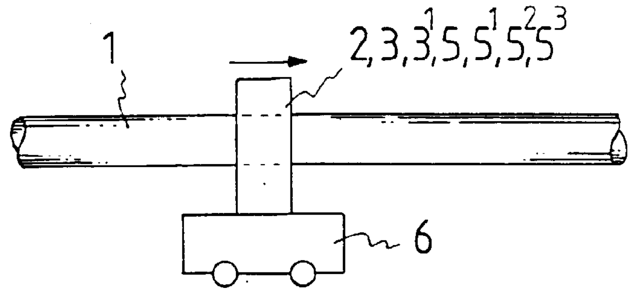

Fig.2

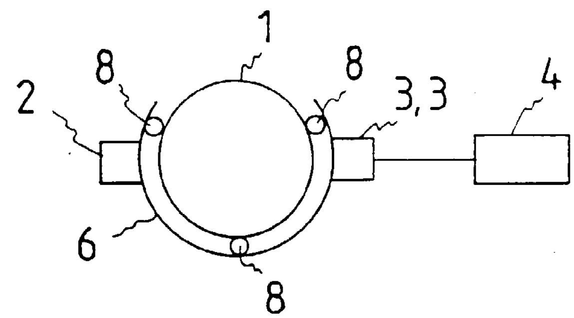

Fig. 3

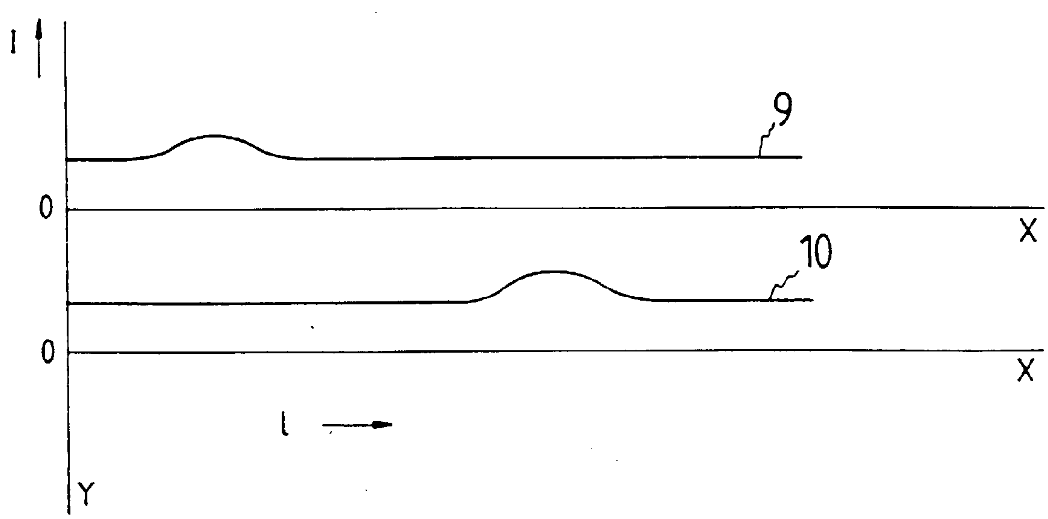

Fig.4