

Dec. 5, 1950

M. MEUNIER

2,532,507

FEELER FOR ELASTIC WAVES

Filed July 18, 1946

2 Sheets-Sheet 1

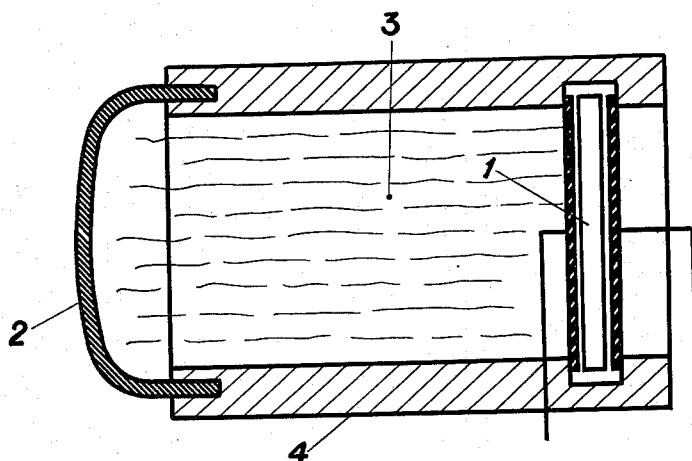


FIG. 1.

INVENTOR
MARCEL MEUNIER
by: *John Graham*
HIS AGENT.

Dec. 5, 1950

M. MEUNIER
FEELER FOR ELASTIC WAVES

2,532,507

Filed July 18, 1946

2 Sheets-Sheet 2

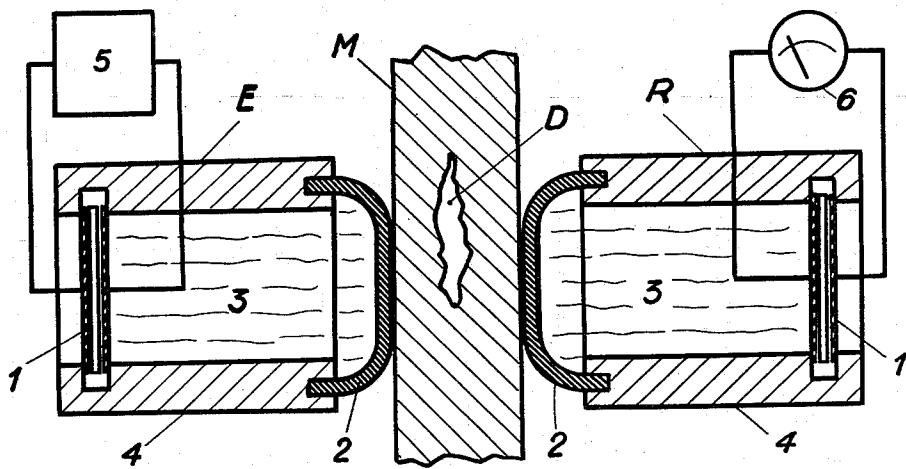


FIG. 2

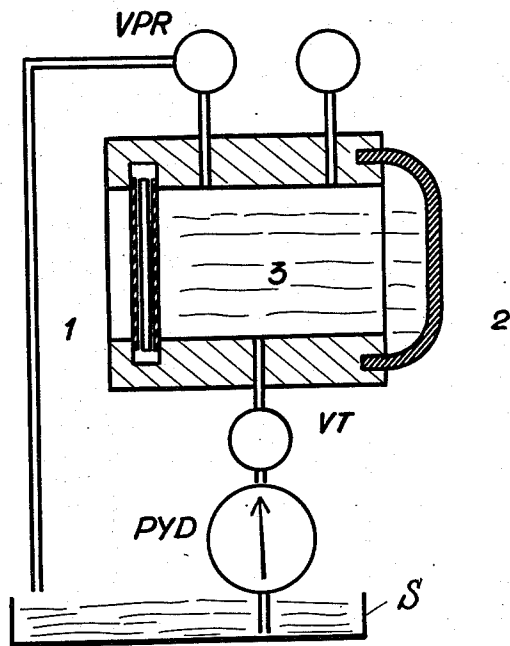


FIG. 3.

INVENTOR
MARCEL MEUNIER
by *John G. Gahan*
HIS AGENT.

UNITED STATES PATENT OFFICE

2,532,507

FEELER FOR ELASTIC WAVES

Marcel Meunier, Cuesmes, Belgium, assignor to
Ateliers de Constructions Electriques de Charle-
roi, Brussels, Belgium, a Belgian societe ano-
nyme

Application July 18, 1946, Serial No. 684,614
In France August 13, 1945

2 Claims. (Cl. 171-327)

1

This invention relates to the examination or treatment of solid bodies by elastic waves.

It is known that the transmission of certain elastic waves through gaseous media such as air is effected only with a great diminution of the intensity of the transmitted waves. More especially in the case of air, the diminution of intensity is so great, particularly for waves of high frequency, that it is possible to consider, in practice, that these elastic waves are not transmitted from one body to another by the intermediary of air.

Certain elastic waves, for example sonorous or ultra-sonorous waves, can be utilized for the examination of various bodies in order to predetermine the possible defects, without destroying the shape or the material of these bodies. Similarly, certain of these waves can be employed for the treatment of materials or bodies, particularly during the elaboration of a material with a view to a well defined use in a future utilization.

The examination or treatment of these bodies is effected by placing the body to be subjected to the elastic waves between an emitter device and a receiver device of these elastic waves, or simply in front of a device emitting such waves. For example, in the case of ultra-sonorous elastic waves, the emitter and receiver devices can be constituted by piezo-electric quartz crystals.

The passage of the elastic waves from the emitter device to the receiver device, through the body to be examined or treated, is greatly limited, or even in practice prevented, by any film of gas which may exist between the body and the emitter and receiver devices, by reason of the bad contact between these elements. Apart from the exceptional case where the emitter and receiver devices can be cemented against the body to be subjected to the elastic waves, it may be considered that the transmission of these waves is practically stopped by any solid-gas surface of separation.

The same applies for any liquid-gas surface of separation.

Many liquids possess properties such that they transmit the elastic waves without too much damping and that the intensity of these waves at reception remains within a region accessible in practice.

It has already been proposed, in order to improve the transmission of these elastic waves, to plunge the emitter device, the body to be examined or treated, and the receiver device, these three elements constituting an assembly, into a bath of suitable liquid. It is evident that this

2

solution is admissible in practice only for a small number of applications. In particular, this manner of procedure is not to be contemplated when it is a question of industrial control by elastic waves of metallic constructional parts, such as boilers and roofing or bridging elements.

There have likewise been recommended sprinkling devices ensuring a liquid continuity between the body to be treated or examined and the emitter and receiver devices. This solution presents the drawback of wasting the liquid use and soiling the sites where the operation takes place, without speaking of the necessary cleaning required by the emitter and receiver devices after each operation.

All these arrangements, therefore, do not present a practical character and cannot be contemplated for a routine industrial use of the examination or treatment by elastic waves.

The present invention has for its object a method allowing of transmitting elastic waves, for example sonorous or ultra-sonorous waves, from a device emitting these elastic waves to a body destined to be examined or treated by these elastic waves, or from that body to a device receiving these same waves, without the transmission of the waves undergoing too great a coefficient of damping.

The invention consists in principle of interposing between the device emitting or receiving the elastic waves and the body to be examined or treated, a liquid transmitting these waves well, in immediate contact with the emitter or receiver device, and limited on the side of the body by a flexible and distended wall which can conveniently adapt itself to the surface of this body without there existing an irregular or substantial layer of gas or vacuum in the path of the waves, this flexible wall being swollen to protuberant shape by the internal pressure of the liquid.

This flexible, liquid-backed wall is thus distended to bulging or protuberant shape and solves the important problem of how to obtain effective contact between the flexible wall and the surface of the material or body to be examined or treated, because any layer of air between the emitter or receiver and the said material or body is thereby obviated or greatly reduced.

The flexible and distensible wall may be composed of any suitable material, such as indiarubber, capable of bulging under the pressure of the liquid and of transmitting the waves utilized, without absorbing them or damping them down in their passage.

The contact between the wall and the body to

be examined or treated can be further improved by slightly moistening this body with a liquid, particularly water. It is even possible to carry out this moistening of the body interposed between the devices emitting and receiving the elastic waves by providing a slightly permeable flexible wall, thus moistening the body to be examined with an oozing film of the liquid transmitting well the elastic waves.

The assembly of the device emitting or receiving the elastic waves, the liquid under pressure transmitting these waves, and the flexible, distended and preferably slightly permeable wall, can be mounted in a turgescence feeler apparatus intended to be applied against the surface of the body to be examined or treated.

The invention is hereinafter described with reference to the accompanying diagrammatic drawings, in which:

Fig. 1 represents in its simplest form an embodiment of the improved feeler apparatus; all detail not necessary to the comprehension of the spirit of the invention has been deliberately neglected.

Fig. 2 represents an example of the application of the improved apparatus.

Fig. 3 represents a feeler provided with regulating means.

Referring to Fig. 1 of the drawings, 1 designates the device emitting or receiving the elastic waves, for example a piezo-electric quartz crystal; 2 designates the flexible and distended wall intended to be applied against the body to be examined or treated; 3 designates the liquid for transmitting elastic waves between the device 1 emitting or receiving these same waves and the wall 2; 4 designates the connecting member between 1 and 2, this member forming a container for the liquid 3.

Fig. 2 of the drawings represents the application to the examination of a piece of material including a possible flaw, of two turgescence feelers according to the invention. In this figure, E and R designate respectively the elastic wave emitting and receiving devices; M designates the material under examination, with the possible flaw indicated at D; and 1, 2, 3 and 4 designate the same elements as in Fig. 1. 5 designates a suitable device for producing electrical oscillations to cause resonance of the piezo-electric crystal 1 of the emitting device E; whilst 6 designates a suitable measuring device for registering the reception of the elastic waves by the receiving device R.

The flexible walls 2 of the emitting and receiving devices E and R are such that they fit perfectly against the surface of the material M, preferably with the interposition of a film of liquid which is a good conductor of the elastic waves, such film being obtained by permeation or sweating through the walls 2.

The turgescence feeler apparatus according to the invention can also be provided with any means suited for taking up automatically any loss

of liquid transmitting the elastic waves, whether by leakage between surfaces in imperfect contact, or through the permeable flexible wall.

It can also be provided with any suitable device intended to vary the pressure of the liquid transmitting the elastic waves, in order to regulate at will the distended and flexible wall and thus the degree of turgescence of the feeler apparatus intended to press against the body to be examined or treated by the elastic waves.

Fig. 3 of the drawings represents one of the feeler devices provided with such regulating means. In this figure, 1, 2, 3 and 4 designate the same elements as in the preceding figures; G is a manometer gauge for measuring the pressure of the liquid transmitting the elastic waves; VT is a regulating valve, the setting of which can be altered in order to vary the degree of protuberance of the flexible wall 2; PYD is a pump drawing liquid from a reservoir and forcing it into the container 4 for transmitting the elastic waves, the delivery of the pump being regulated by the valve VT; VPR is a discharge valve allowing the release of liquid 3 from the container 4 back to the reservoir.

What I claim is:

1. In the art of applying elastic waves to a material object, a feeler comprising a container, a flexible wall and a wave emitter forming component parts of said container, a liquid filling said container between said wall and said emitter, said wall being slightly permeable by said liquid and adapted to make close and liquid-moistened contact with said object, and said liquid being a good transmitter of elastic waves.

2. In the art of applying elastic waves to a material object, a turgescence feeler comprising a container, a protuberant flexible wall and a wave-emitter forming component parts of said container, and a liquid under pressure filling said container between said wall and said emitter, said wall being swollen to protuberant shape by the internal pressure of said liquid and being also slightly permeable by said liquid in order to make close and liquid-moistened contact with said object, and said liquid being a good conductor of elastic waves.

MARCEL MEUNIER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,463,507	Hahnemann	July 31, 1923
1,900,286	Huber et al.	Mar. 7, 1933
2,280,226	Firestone	Apr. 21, 1942
2,283,285	Pohlman	May 19, 1942
2,398,815	Turner	Apr. 23, 1946
2,415,832	Mason	Feb. 18, 1947