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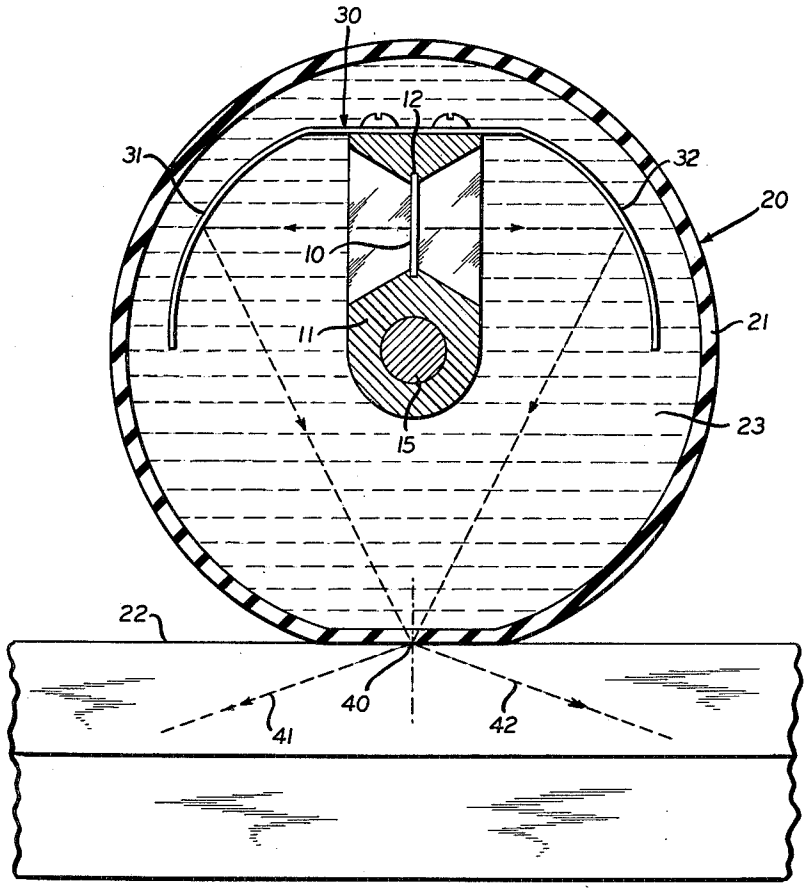
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ULTRASONIC TRANSDUCER

Filed March 5, 1958

(4)



X wave reflector

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ULTRASONIC TRANSDUCER

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3 Claims. (Cl. 73—67.8)

This invention relates to a method and means for utilizing an ultrasonic transducer of the piezoelectric crystal type. Such crystals usually are provided with a transmitting face, while an opposite face is usually provided with a backing for damping the undesired reflections from the back face.

It is the principal object of this invention to provide a piezoelectric crystal which is capable of performing the work done at present by a plurality of crystals. Thus, for example, in the patent to H. C. Drake, No. 2,628,335 granted February 10, 1953 for Ultrasonic Rail Flaw Detector Search Unit there is disclosed a plurality of crystals energized from a single pulse generator, certain of said crystals being utilized for transmitting ultrasonic vibrations in a forward direction while other of said crystals are utilized for transmitting vibrations in a rearward direction. The present invention has for its object the elimination of the dual sets of crystals by providing means whereby each single crystal may transmit vibrations in a plurality of directions.

It is a further object of this invention to provide a crystal capable of performing the function of a plurality of crystals, but which will yield maximum energy output for a given power input to the crystal since such power is not divided among a plurality of crystals.

It is a further object of this invention to provide crystals which require no backing for damping vibrations reflected from the back surface, thus avoiding the loss of power absorbed by such damping material.

Further objects and advantages of this invention will become apparent in the following detailed description thereof.

The accompanying drawing is a front elevation, partly sectioned vertically, showing one form of this invention.

The invention is illustrated herein as applied to the detection of fissures and other defects within a rail surface, but it will be apparent that it has general application. In the illustrated application a crystal **10** is mounted within a frame **11** which supports the crystal around its outer edges **12**. This leaves the crystal faces free of any obstruction. The frame **11** is fixed to an axle **15** which is supported on its outer ends in a conventional manner (not shown) and a wheel **20** rotates around said fixed axle. The wheel may be in the form of a rubber tire **21** which rides upon the rail surface **22**, and said wheel may be filled with a sound conductive fluid **23** so that vibrations from the crystal may be transmitted through the fluid to the rail.

By the above construction both faces of the crystal **10** may be utilized for transmitting ultrasonic energy into the test specimen. For this purpose a reflector support **30** fixed to frame **11** and having reflector elements **31** and **32** may be provided, said reflector elements **31** and **32** cooperating with the respective opposite faces of crystal **10** to reflect the energy from said

faces to a common point **40** on the test specimen (in this case the rail). From point **40** the energy transmitted from the respective faces will be refracted in opposite directions as indicated at **41** and **42**, and thus will perform the function which heretofore required two crystals, as shown in the aforesaid Drake patent.

Still another advantage of the foregoing arrangement over the Drake patent arrangement lies in the longer path from each face of the crystal to its respective reflector, to point **40** on the specimen, to the opposite reflector, and thence to the opposite face of the crystal.

The crystal is energized by a pulse generator as disclosed in the Drake patent, and since the energy from the pulse generator is not divided among a plurality of crystals, the full power from the pulse generator is applied to the crystal. Also since both faces of the crystal are utilized for transmission, no damping is employed and no energy is lost by reason of such damping. Furthermore the two faces of the crystal are always inherently in balance, whereas in the case of two separate crystals variations in balance due to aging, heating and cementing frequently arose.

If desired the reflectors **31**, **32** can be shaped either as flat reflectors, concave planes or spherical reflectors to concentrate the beam either in a plane or at a point.

Having described my invention what I claim and deside to secure by Letters Patent is:

1. Ultrasonic inspection apparatus comprising: a unitary mechano-electric transducer including a plurality of energy-emitting faces adapted to emit ultrasonic wave energy when said transducer is energized by electrical signal energy of ultrasonic frequency; and reflector means including portions disposed on opposite sides of said transducer and positioned so as to reflect ultrasonic wave energy emitted from said faces toward a test specimen in directions so as to intersect at the test specimen and be refracted at an entering surface thereof in opposite directions whereby ultrasonic wave energy may be transmitted into the test specimen in different directions.

2. Ultrasonic inspection apparatus comprising: a unitary mechano-electric transducer including a plurality of energy-emitting faces adapted to emit ultrasonic wave energy when said transducer is energized by electrical signal energy of ultrasonic frequency; reflector means including portions disposed on opposite sides of said transducer and positioned so as to reflect ultrasonic wave energy emitted from said faces toward a test specimen in directions so as to intersect at the test specimen and be refracted at an entering surface thereof in opposite directions whereby ultrasonic wave energy may be transmitted into the test specimen in different directions; and means for maintaining an ultrasonic wave energy coupling fluid in energy-coupled relation with said energy-emitting faces of said transducer, said portions of said reflector means and a portion of the test specimen.

3. Ultrasonic inspection apparatus comprising: a unitary mechano-electric transducer including a plurality of energy-emitting faces adapted to emit ultrasonic wave energy when said transducer is energized by electrical signal energy of ultrasonic frequency; reflector means including portions disposed on opposite sides of said transducer and positioned so as to reflect ultrasonic wave energy emitted from said faces toward a test specimen in directions so as to intersect at the test specimen and

be refracted at an entering surface thereof in opposite directions whereby ultrasonic wave energy may be transmitted into the test specimen in different directions; a support for said transducer and for said reflector means including an axle; and a wheel-like container rotatably supported on said axle and including a peripheral portion through which ultrasonic wave energy may pass, said container being adapted to maintain an ultrasonic wave energy coupling fluid in energy-coupled relation with said energy-emitting faces of said transducer, said portions of said reflector means and a portion of the test specimen.

References Cited in the file of this patent

UNITED STATES PATENTS

1,980,171	Amy	Nov. 13, 1934
2,086,891	Bachmann et al.	July 13, 1937
2,532,507	Meunier	Dec. 5, 1950
2,628,335	Drake	Feb. 10, 1953
2,855,526	Jones	Oct. 7, 1958

FOREIGN PATENTS

766,981	Great Britain	Jan. 30, 1957