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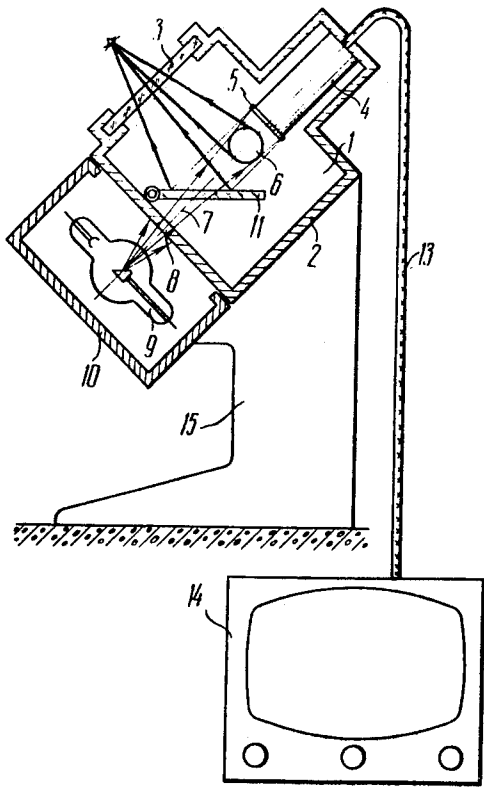
[54] X-RAY TELEVISION MICROSCOPE
3 Claims, 2 Drawing Figs.

[52] U.S. Cl. 250/77,
250/65, 250/78, 250/90
[51] Int. Cl. G01n 23/04

[50] Field of Search 250/77, 65,
78, 49.5, 88, 90

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ABSTRACT: An X-ray television microscope has a mirror disposed in a radiation protection chamber in the path of an X-ray beam between the object being irradiated and an X-ray source and at an angle of 45° relative to the X-ray beam axis. The mirror permits observation and recording through a window in the working chamber of the actual position of the object being irradiated in two projections, while the X-ray beam axis is inclined to the horizontal at an angle of 30° to 60° to reduce the dimensions of the instrument and to facilitate its operation.



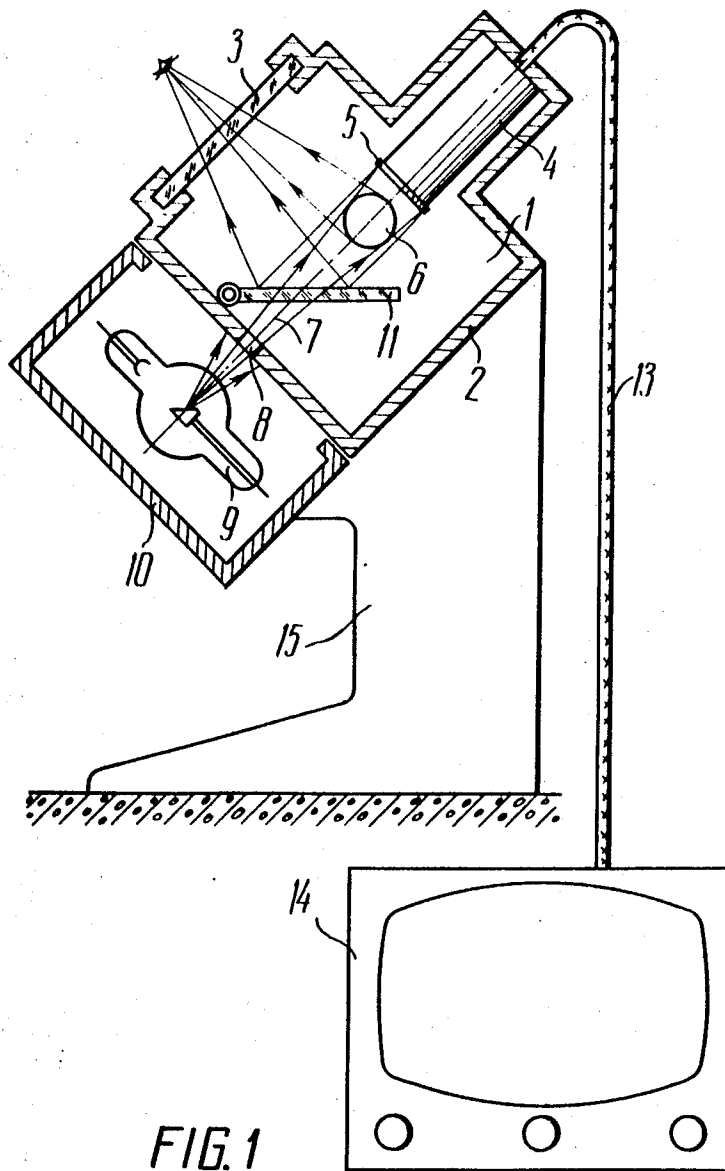


FIG. 1

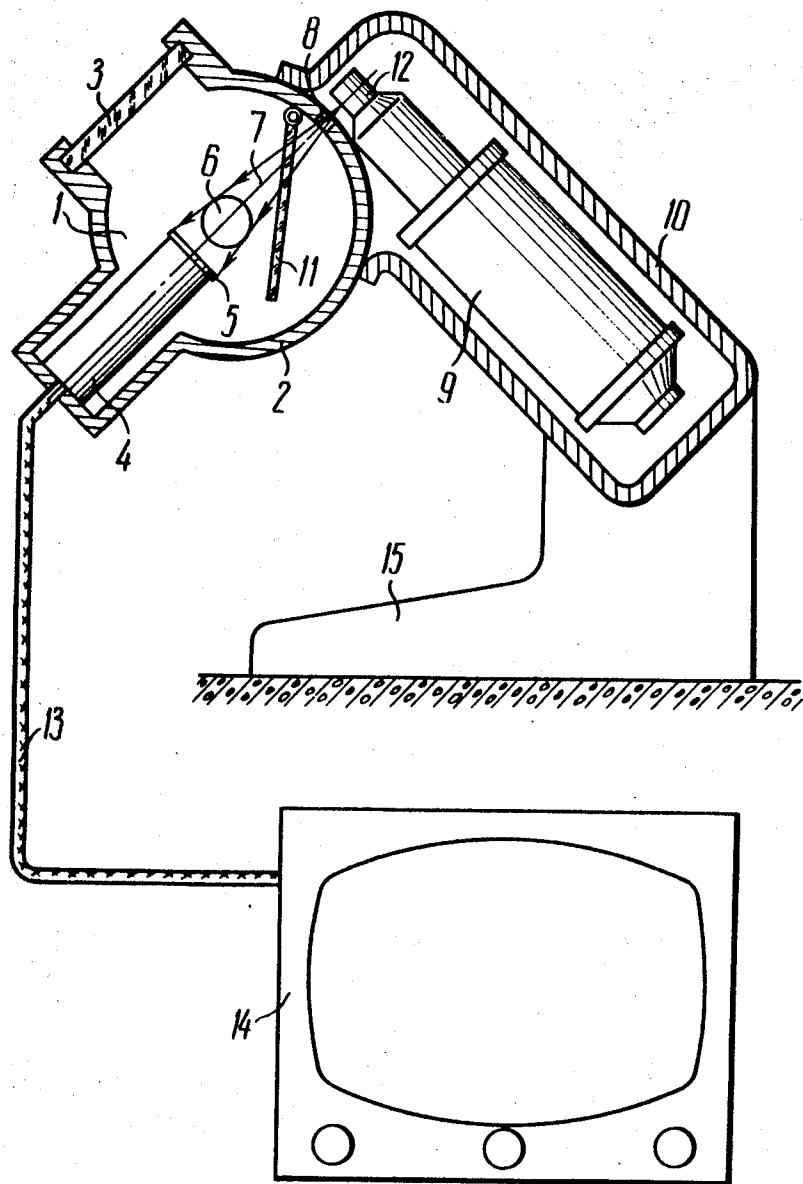


FIG. 2

X-RAY TELEVISION MICROSCOPE

This invention relates to the field of instrumentation and, more particularly, to X-ray television fluoroscope units of the image magnifying type, referred to hereinbelow as X-ray television microscopes and intended for observing visually on a screen an enlarged image of the internal structure of opaque objects and, primarily, for nondestructive testing of midjet electronic devices for internal micro- and macroflaws.

Known in the art are X-ray television microscopes comprising a protective sheath, which encloses an X-ray source, and a working chamber which houses an object under examination, provision being made in the chamber for a window through which the position of the test object can be checked. The object under examination will be disposed in the path of an X-ray beam ahead of the target of an X-ray image converter, so that the converter transforms shadow images obtained into video signals fed to a monitor. In said prior art microscopes, provision is made for an arrangement that makes it possible to displace the test object being irradiated relative to the target and X-ray source.

The efficiency of an X-ray television microscope as a means of production line inspection depends essentially on the extent to which a test object position lends itself to adjustment.

When handling known X-ray television microscopes, the operator is stationed at a considerable distance from the test object mounted in the working chamber and is, therefore, incapable of accurately determining or adjusting the distance from the target to the test object. This limitation of the known X-ray television microscopes becomes particularly pronounced where the objects to be tested are small in size, insofar as it is impracticable in this instance to attain a maximum sharpness of image contours on the screen by bringing the test object closer to the target.

Another disadvantage of the known X-ray television microscopes is that they provide no means of observing and recording the position of the test object being irradiated in relation to the target of the converter along the path of X-rays emerging from the X-ray tube, so that the image viewed on the television screen cannot be correlated to the actual position of the object being irradiated.

The aforementioned disadvantage make the known X-ray television microscopes inadequately efficient for mass-scale testing applications in the industry, where it is necessary to effect rapid and accurate adjustment and recording of test object position relative to the converter target.

It is an object of the present invention to provide a viewing system that will render it possible to adjust the distance between the test object and converter target and to observe the position of the object in the direction of an X-ray beam path and to observe two projections of the object.

This and other objects are accomplished by the provision of an X-ray television microscope incorporating an X-ray source and a shielded working chamber furnished with a window for viewing the test object disposed ahead of the target of an X-ray image converter and in the path of an X-ray beam between the X-ray source and the test object, wherein, according to the invention, the working chamber houses a mirror inclined relative to the converter target and intended for simultaneously viewing through the chamber window both the target and the test object in the direction of X-ray beam propagation.

It is expedient to dispose the mirror so that its reflecting surface will be inclined at an angle of 45° relative to the converter target and to direct the X-ray beam at an angle of 30° to 60° with respect to the horizontal.

The mirror should be interposed in the path of X-rays and be made from a material that exhibits low X-ray absorption characteristics, the surface of the mirror being coated with a visible-light reflecting film.

The X-ray television microscope, according to the present invention, has the following advantages. Thanks to the provision of a mirror, the operator is in a position to rapidly and conveniently adjust the object under investigation as required by the rest procedure. Mirror inclination at an angle of 45° in

conjunction with an appropriate inclination of the X-ray beam is conducive to substantially reduce the overall dimensions of the microscope as well as to facilitate observation of the position of the object being irradiated, and also renders it possible, upon recording the internal structure pattern of the test object as viewed on the monitor screen, to record simultaneously two projections of the true orientation of the test object in the working chamber. It is to be noted that the coordinates of an internal flaw detected by means of the present X-ray television microscope lend themselves to accurate determination by means of photographing in two directions thanks to the fact that the provision of the mirror for viewing the test object through the window results in obtaining a true position of the test object and in ascertaining the orientation of said object both in the direction of the X-ray beam axis and at right angles to said axis.

The present invention is illustrated hereinbelow by the description of an exemplary embodiment thereof with reference to the accompanying drawings, wherein:

FIG. 1 is a simplified sectional diagram of the X-ray television microscope, according to the invention, wherein a test object is disposed in the working chamber, and

FIG. 2 is simplified sectional diagram of the X-ray television microscope, according to the invention, wherein the X-ray source comprises a roentgen tube having an external anode.

Working chamber 1 (FIG. 1) is enclosed in casing 2 which affords complete radiation protection, provision being made in a casing wall for lead glass window 3. Disposed inside the working chamber is converter 4, which converts X-ray shadow images into video signals which are conveyed by a cable 13 to a television receiver 14. The surface of target 5 of converter 4 facing test object 6 has changed its center coincident with the axis of the X-ray beam that enters the working chamber via aperture 8 and serves as a diaphragm to confine the cross-sectional area of the beam in question. X-ray tube 9 is contained in separate protective casing 10 adjoining the working chamber. Mounted in working chamber 1 is mirror 11 tilted at an angle of 45°. In relation to the target surface, the angle of mirror inclination being adjustable within a narrow range. The mirror consists of a visible-light reflecting film deposited on a backing made from a material exhibiting low X-ray absorption characteristics. Working chamber 1 and X-ray source 9 is mounted on support 15.

This arrangement enables the operator to view the test object 6 directly through the working chamber window and to determine the distance from said object to converter target 5, while the mirror is instrumental in ascertaining the position of the test object and converter target in the direction of the X-ray beam axis.

FIG. 2 presents a simplified diagram of the X-ray television microscope in which recourse is had to an X-ray tube within an external anode 12. In this case, converter 4 is disposed under the X-ray source and mirror 11 is placed almost vertically, provided the angle of mirror inclination in relation to the target remains as specified hereinabove.

The present invention not only makes it possible, as stated hereinabove, to enhance the testing procedure efficiency, to provide for operation convenience and to reduce the overall dimensions of the X-ray television microscope, but also to determine accurately and objectively the true location of internal flaws in the object being irradiated, thereby extending significantly the range of uses to which the present X-ray television microscope can be put.

We claim:

1. An X-ray television microscope comprising an X-ray source: a protective casing accommodating said source; a shielded working chamber in which a test object being irradiated is disposed in the path of an X-ray beam, said chamber having a window; a converter for converting X-ray shadow images into video signals, said converter having a target and being disposed in said working chamber behind said test object in the path of the X-ray beam; a mirror housed inside said working chamber between said source and said test

object, said mirror being tilted relative to the target of said converter and positioned to enable simultaneous observation through said window of the test object and the converter target in the direction of the X-ray beam; and a monitor electrically coupled to the output of said converter.

2. An X-ray television microscope according to claim 1 wherein the reflecting surface of the mirror is tilted at an angle of 45° in relation to the longitudinal axis of the converter tar-

get, while the axis of the X-ray beam is inclined at an angle of 30° to 60° with respect to the horizontal.

3. An X-ray television microscope according to claim 1 wherein said mirror consists of a material exhibiting low X-ray absorption characteristics, and a visible-light reflecting film deposited on said material.

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