

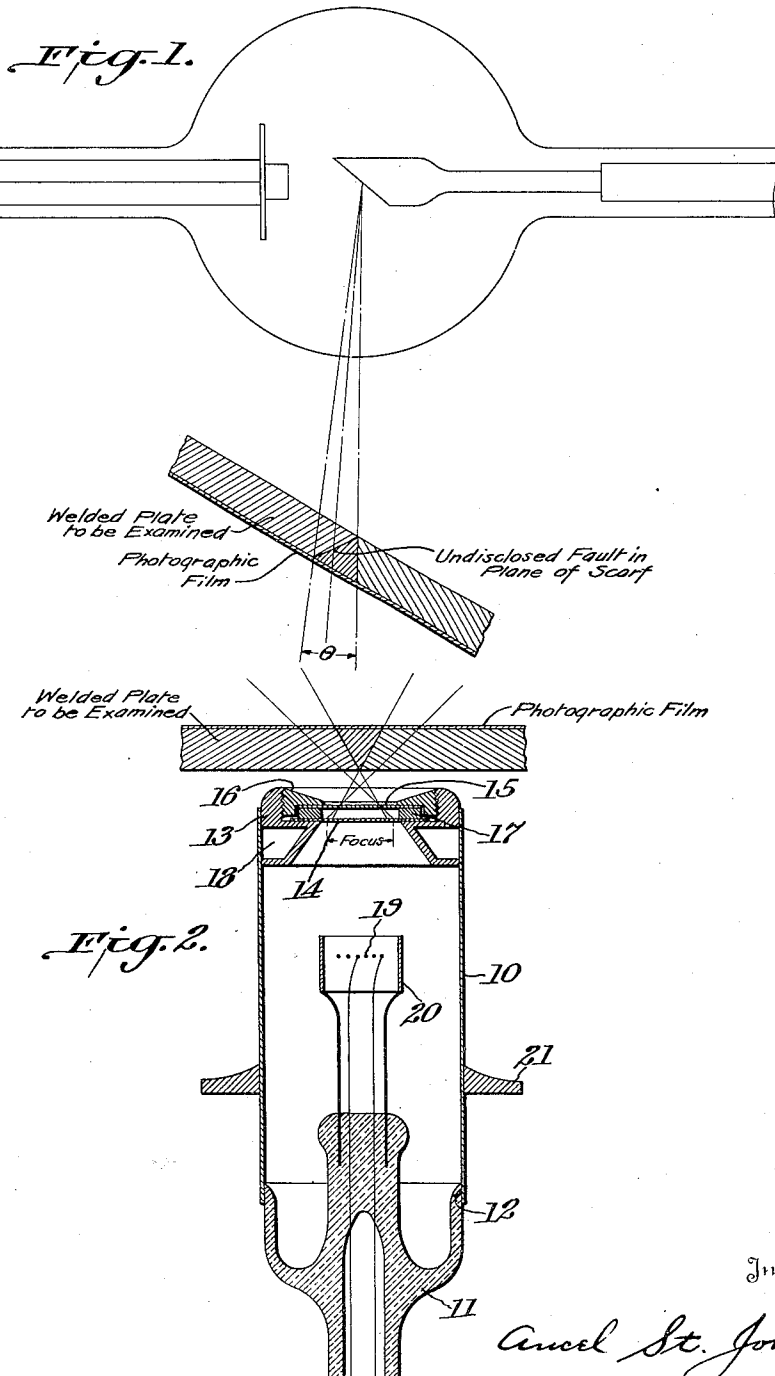
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METHOD OF AND APPARATUS FOR RADIOGRAPHIC EXAMINATION

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METHOD OF AND APPARATUS FOR RADIOGRAPHIC EXAMINATION.

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This invention is a method of radiographic examination, and includes a novel X-ray tube adapted for use in the method.

X-ray tubes are usually of glass, and the source of X-rays, the target or anticathode, is centrally arranged, and as far from the glass wall of the tube as the size of the tube will permit. This gives a symmetrical arrangement and protects the glass from the heat generated at the anticathode.

With the central arrangement of anticathode, a material to be examined cannot be brought close to the source of X-rays, and as a result the rays striking any small portion of the material travel in lines which are nearly parallel, as will appear from Fig. 1 of the accompanying drawing, in which

Fig. 1 illustrates the examination of a V-weld with the usual type of X-ray tube, and Fig. 2 shows an X-ray tube embodying my invention, and illustrates my novel method.

The V-weld shown in section in Fig. 1 has two scarfs disposed at an angle of say 75° . The extreme divergence of X-rays falling on the weld is the angle θ , hence much less than the angle between the two scarfs. Imperfections are more apt to occur in the scarfs than elsewhere in the weld, and in imperfect welds there is often a fissure along one or both scarfs where the added metal is not in contact or in welded relation with the base metal, though the weld may be perfect at both surfaces of the plate. Therefore no radiographic examination of the weld which does not critically test the scarfs can prove the soundness of the weld.

It will be understood, of course, that the width of any fissures present is almost always very small in comparison with the thickness of the plate. As a result, the increase in transparency to X-rays brought about by the presence of a fissure will be negligible when the rays pass transversely of the fissure, and if the examination is limited to a test in which the radiation travels only in this direction, the fissure will escape detection. A complete radiographic examination of a weld with equipment now available involves placing the weld in several different positions with respect to the tube and locating any regions of abnormally high transparency by the use of a fluorescent screen, photographic plate or other instrumentality visibly affected by X-rays. It is only when a fissure is turned substantially parallel to

the direction of propagation of the rays that its presence will be readily detected.

In Fig. 2 I have shown an arrangement, including an X-ray tube of novel design, whereby it becomes unnecessary to bring a fissure into a particular plane in order to detect it. In fact, all the fissures which can occur in a weld, whether parallel or not, can usually be detected with a single exposure.

The X-ray tube shown in Fig. 2 comprises a metal cylinder 10 closed at both ends. The end-closure 11 is of glass, hermetically sealed to the metal at 12. The other end of tube 10 is provided with a threaded collar 13 likewise hermetically joined to the tube.

The anticathode comprises the thin disc 14 of tungsten or other metal. The interior of the tube is of course evacuated, and the anticathode 14 should be very thin so as to cut down absorption, since the X-rays to be used are emitted from the inner surface bombarded by electrons, I therefore provide a protective cover 15 of a strong material relatively transparent to X-rays, such as aluminum, which serves to protect the anticathode from atmospheric pressure, from oxidation, and from accidental mechanical impacts. The anticathode and its cover may be assembled with a threaded ring 16 and one or more gaskets 17 to insure a gas-tight seal. The anticathode may be provided with a pin-hole (not shown) to permit the space between 14 and 15 to be evacuated, thereby better protecting the anticathode from oxidation and from atmospheric pressure.

A passage 18 in collar 13 permits water-cooling of the anticathode assembly. The member 15 will remain sufficiently cool to prevent its destruction.

The cathode filament 19 and focusing tube 20 are of well-known construction and so arranged as to give a broad focal spot, for example one-half inch in diameter, on the anticathode 14.

The anticathode is electrically connected with the metal tube 10, and the latter may be provided with a flange 21 for connecting it to the high-tension circuit. Otherwise, the construction and operation of the tube follows usual practice.

In Fig. 2 I have shown in section a V-welded plate placed before my novel tube for examination of the weld. With the weld in the position shown, X-rays will pass

along both scarfs and also through the weld in many other directions. Any imperfection which seriously diminishes the strength of the weld will have a relatively large dimension along some plane not parallel with the surface of the plate, and such an imperfection will be readily apparent from the abnormal intensity of the radiation transmitted through it along this plane. It will be seen that no exact orientation of the weld with respect to the tube is required. In Fig. 2, the weld could be rotated through a considerable angle in the plane of the paper and the results would still be equally good. Upon merely bringing the weld before and close to the anticathode, a complete examination can be effected with a single exposure.

Having now described my invention, I claim:

1. Method of detecting defects in objects wherein the tendency toward defects is localized along diverging lines, which comprises simultaneously propagating X-rays through the object along a plurality of said diverging lines.

2. Method of radiographically examining welds having strongly divergent scarfs which comprises simultaneously propagating X-rays through the weld in directions parallel to a plurality of scarfs.

In testimony whereof, I affix my signature.

ANCEL ST. JOHN.