The invention will be described in greater detail with reference to the accompanying drawing the sole FIGURE of which is a somewhat diagrammatic illustration of a representative embodiment shown in longitudinal section.

As shown in the drawing, a Farnsworth-type tube 35 having the usual evacuated envelope is provided with a composite receiving, image-intensifying and electron-emissive structure disposed near a radiation-transparent entrance end of the tube. This structure includes a multiplicity of layers transparent to X-rays, namely a base plate 2, a light reflector 36 deposited thereon, another base plate 3, a conductive layer 4, a photoconductive layer 5 and a high-resistance barrier layer 39 opaque to visible light. Layer 39 carries a photoelectroluminescent phosphor layer 6 adjoining another conductive layer 7 which is transparent to luminous radiation emitted by layer 6. A further base plate 8 serves together with plate 3 as a support for the multilayer stack sandwiched therebetween. Electrodes 4 and 7 may comprise an easily volatilizing metal, such as aluminum, silver or gold, deposited in vacuo with a thickness on the order of 0.1 mm; the same applies to reflecting layer 36. A pattern of incident X-rays has been diagrammatically indicated at 1.

A photocathode 9, disposed forwardly of base plate 8, comprises an electron-emissive layer generating an electron beam 40 in response to light emitted by phosphor layer 6; this electron-emissive layer may consist of a material also responsive to incident X-rays, e.g. bismuth, in which case the rate of electron emission is further increased.

The fluorescent mass 37 in the depressions of crenelated layer 36 may consist of one or more phosphors, with or without an activator, designed to emit high-actinic light when struck by X-rays; calcium tungstate with a lead activator may be mentioned by way of example. The indentations should, of course, be spaced closely enough along the surface of base 2 to provide a mosaic of light bundles with the desired degree of resolution.

The electron beam 40 is focused by several accelerating anodes 10, connected to respective taps of a potentiometer 41, and by an electromagnetic coil 11 upon a target electrode 34 emitting secondary electrons after a certain delay whereby the generated electron image is stored for a predetermined period. Electrode 34 is preceded by a field-equalizing grid 12 and is followed by a further accelerating anode 16. The secondary electron beam 18 travels within a conductive shield constituted by a graphite coating 17 (known as Agugadag) on the inner surface of tube 35; this section of the tube is surrounded by a focusing coil 19 and by a deflecting yoke 21 connected to a sweep circuit not shown. A conventional beam-scanning assembly at the far end of tube 35 includes an electron-multiplier structure 23 with an entrance orifice in a shield plate 20 and an output lead 24, together with a source of biasing potential represented by potential 25. Though an image-dissector type of scanner is shown by way of example, other conventional scanning means (e.g., of the Vidicon or image-orthicon types) may be employed with the same receiving and intensifier assembly.

A generator 31 of alternating current is connected across the two layer electrodes 4, 7 in series with a switch 38 and in parallel with a D-C source of biasing voltage 33, the latter lying in series with another switch 32. The polarity of battery 33 is so chosen that electrode 7, and therefore also the adjoining phosphor layer 6, is more highly positive than electrode 4 and adjoining photoconductive layer 5 upon closure of circuit breaker 32. Battery 33 and switch 32 are bridged by a condenser 30.

The general mode of operation of the system herein disclosed, apart from the intervening storage of the elec-
3,543,034 3tron image on target 34, is the same as in the device of
my prior application Ser. No. 306,897 (now Pat. No.
3,636,550), to which reference may also be made for
suitable operating voltages and for preferred compositions
of electroluminescent layer 6. The present system, how-
ever, sharpens the contrasts between lighter and darker
areas of the incident X-ray image 1 by virtue of its array
of closely spaced luminous pencils emitted by the
crenelated layer 36 with intensities depending upon the
impinging mosaic of ultraviolet radiation.
1 claim:
1. An image transducer responsive to X-rays, com-
prising:
an evacuated envelope having an entrance end trans-
parent to incident X-rays;
a receiving unit in said envelope disposed adjacent said
entrance end for irradiation by said X-rays, said unit
having a radiation-permeable base with a crenelated
light-reflecting surface remote from said entrance
end forming a multiplicity of depressions of substanc-
tially paraboloidal shape, and a fluorescent mass ex-
citable by said X-rays filling said depressions to pro-
duce concentrated bundles of light rays generally
paralleling the exciting X-rays;
an image-intensifier structure in said envelope con-
fronting said crenelated surface for receiving said
light rays therefrom together with X-rays trans-
luminating said unit, said structure including an emis-
sive layer for producing, in response to said X-rays
and light rays, an electron beam conforming to the
intensity pattern of the incident X-rays; and
output means in said envelope for converting said elec-
tron beam into a visible picture.
2. An image transducer as defined in claim 1 wherein
said base is provided with a metallic deposit of light-
reflecting character lining said depressions.
3. An image transducer as defined in claim 1 wherein
said output means comprises beam-scanning means and
a target ahead of said beam-scanning means for storing
energy of said electron beam and generating a pattern
of secondary electrons directed toward said beam-scann-
ing means.
4. An image transducer as defined in claim 3 wherein
said structure comprises a photoconductive layer proximal
to said unit, and an electroluminescent layer interposed
between said emissive layer and said photoconductive
layer for joint excitation by an electric field emanating
from the latter and by penetrating X-rays from said
entrance end.
5. An image transducer as defined in claim 4 wherein
said structure further comprises a barrier layer opaque to
said light rays but transparent to said X-rays between said
photoconductive and electroluminescent layers.
6. An image transducer as defined in claim 4 wherein
said structure further comprises a pair of conductive lay-
ers bracketing said photoconductive and electrolumines-
cent layers, and a source of alternating voltage connected
across said conductive layers.

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