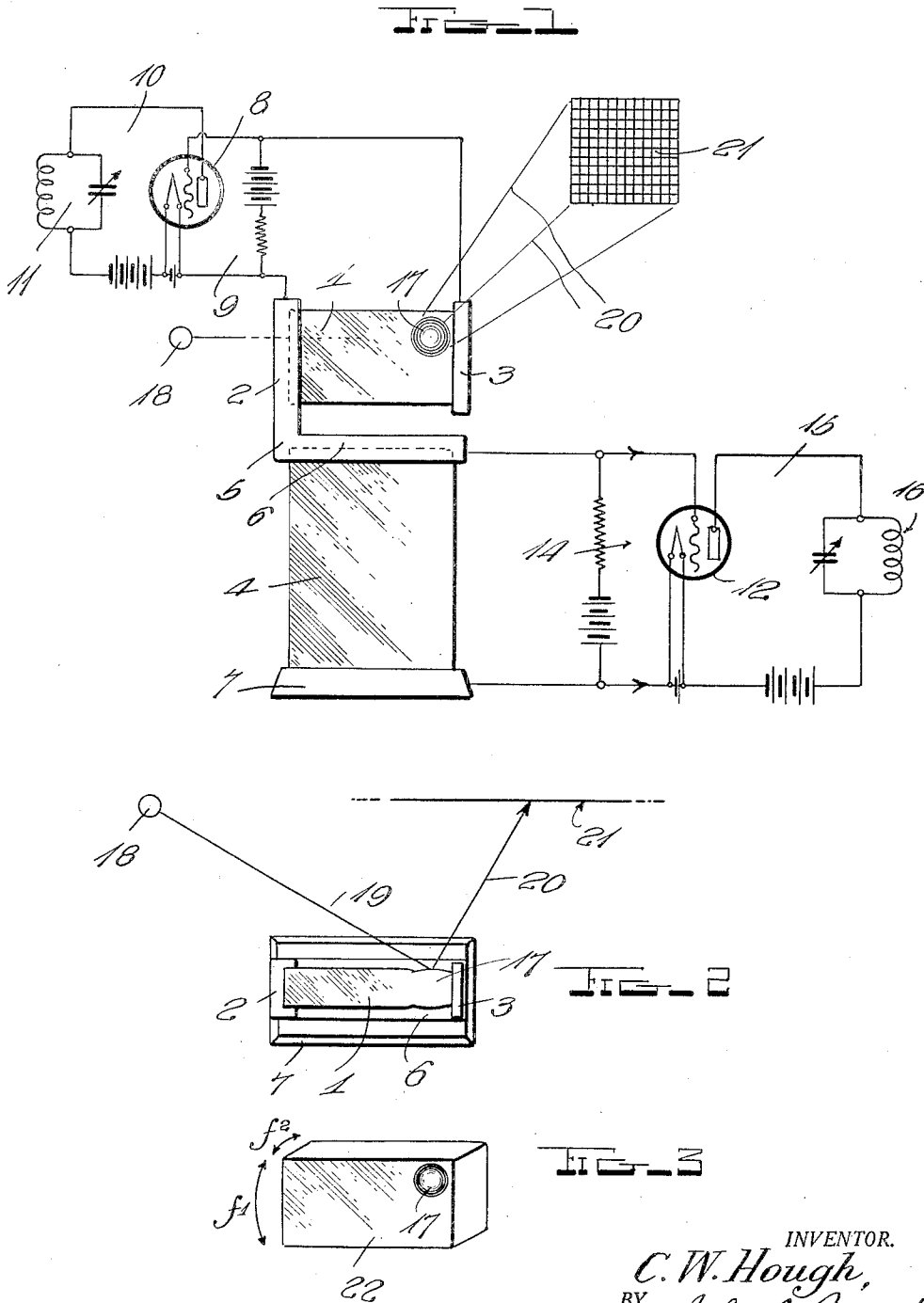


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C. W. HOUGH
TELEVISION APPARATUS
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UNITED STATES PATENT OFFICE

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TELEVISION APPARATUS

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My invention relates broadly to television and more particularly to a system for scanning the use in connection with television, still and motion pictures in wire and wireless telephone and telegraph systems and in wired radio systems.

One of the objects of my invention is to provide a high speed system of scanning for utilizing the mechanical vibrations of piezo electric crystal elements and combining the vibratory effects thereof in such manner that scanning of a predetermined area may be assured at high speed.

Another object of my invention is to provide a system of mounting piezo electric crystal elements for securing the combined vibratory effects of the piezo electric crystal elements along both horizontal and vertical lines for effecting a rapid scanning of a given area in the transmission and reception of pictures.

Other and further objects of my invention will be understood from the specification hereinafter following by reference to the accompanying drawings, wherein:

Figure 1 shows diagrammatically the mounting of the piezo electric crystal elements in accordance with the principles of my invention and the electrical circuits employed in connection with the piezo electric crystal elements; Fig. 2 is a plan view showing the arrangement of the piezo electric crystal elements embodying my invention; and Fig. 3 shows a single piezo electric crystal element ground in such manner that the crystal oscillates along two axes for effecting the scanning in accordance with the principles set forth in the structure illustrated in 1.

In transmitting vision, still or motion pictures by electrical means, it is necessary to break up the picture to be transmitted into small units which are transmitted successively. Various plans involving the use of revolving mirrors, revolving shutters and revolving lens systems have been suggested. The present invention makes use of the vibration of piezo electric elements, and I utilize two piezo electric elements, one of which operates at a comparatively low frequency and the other at comparatively high frequency. The movements of these two ele-

ments are mechanically interrelated so that one piezo electric element will act to move a beam of light over the image to be transmitted or received in one direction, for example horizontally, while a second piezo electric element simultaneously moves the beam of light at right angles to the first movement, for example in a vertical direction. The first element then in effect draws horizontal lines of light across the image and the second element in effect moves successive horizontal lines of light vertically over the plane of the image so that the entire surface of the image to be transmitted or received is covered by the beam of light once for each alternation of the slow moving piezo electric element.

In order to obtain these results, the two piezo electric elements are fastened together at right angles to each other and the movement of this double piezo electric unit is utilized mechanically to change the direction of a beam of light, by transmission as through a lens mounted upon or shifted in position by the movement of the piezo electric element, or by a refracting prism operated in the same manner, or a reflecting mirror mounted upon or moved by the piezo electric element. In the case of piezo electric material such as quartz, which is transparent, a portion of the piezo electric element itself may be fashioned to serve as a mirror, lens or prism for the purpose of shifting the direction of the transmitted, reflected or refracted light ray.

Referring to the drawings in more detail, reference character 1 designates a piezo electric crystal element mounted for vibration along a horizontal axis. The piezo electric crystal element 1 has an electrode 2 secured on one end thereof and an electrode 3 attached to the opposite end thereof. These electrodes serve to connect the crystal in an oscillatory circuit and at least one of the electrodes also serves to support the crystal in connection with the second piezo electric crystal element 4. The electrode 2 is substantially right angular in form as designated at 5 and is secured at 6 to the upper extremity of the piezo electric crystal 4. The piezo electric crystal 4 is arranged to vibrate along a vertical axis from the support 7. The piezo electric crystal ele-

ment 1 is connected in an electron tube oscillator circuit including electron tube 8 having an input circuit 9 and an output circuit 10. By adjustment of the tuning circuit 11 oscillations of the frequency of piezo electric element 1 are sustained. The piezo electric crystal element 4 is connected in an independent electron tube circuit which includes the tube 12 having an input circuit 14 and an output circuit 15. A tuned circuit 16 is provided for adjusting the speed of oscillation of the electron tube oscillator circuit. For example, the piezo electric crystal element 4 may be operated at a frequency f_1 while piezo electric crystal element 1 is operated at a frequency of f_2 which is higher than the frequency f_1 . The piezo electric crystal element 1 carries a mirror or lens designated at 17 arranged in such manner that a light source 18 may be provided for directing light rays upon the lens or mirror along a line designated generally at 19 for reflection along the line designated at 20 for scanning the area designated generally at 21.

In Fig. 3 I have shown a single piezo electric crystal element 22 which vibrates along different axes at a frequency of both f_1 and f_2 . The mirror or lens 17 may be ground integral with the crystal. The piezo electric crystal elements are characterized by the constancy in the frequency to which they operate and accordingly, a definite predetermined path for the light rays may be assured.

I have described the more preferred embodiments of my invention, but I desire it to be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A scanning system comprising a plurality of piezo electric crystal elements, one of said piezo electric crystal elements being arranged for vibration along a vertical axis and the other of said piezo electric crystal elements being arranged for vibration along a horizontal axis, means intermediate said piezo electric crystal elements, and means controlled by said last mentioned piezo electric crystal element for directing a beam of light over a predetermined area.

2. Piezo electric crystal apparatus comprising a piezo electric crystal system arranged to vibrate simultaneously along a vertical axis and along a horizontal axis, means for sustaining the vibrations of said piezo electric crystal system along both axes, and means controlled by said piezo electric crystal system for directing rays of light over a predetermined area.

3. A piezo electric crystal system comprising a piezo electric crystal element arranged to vibrate along a vertical axis, a piezo elec-

tric crystal element positioned over said aforementioned piezo electric crystal element and arranged to vibrate along a substantially horizontal axis, an angular member connecting an electrode of one of said piezo electric crystal elements with an electrode of the other of said piezo electric crystal elements, and means carried by one of said piezo electric crystal elements for controlling the movement of a light ray over a predetermined area.

4. A scanning system comprising a pair of piezo electric crystal elements, one of said piezo electric crystal elements being mounted for vibration along a vertical axis, the other of said piezo electric crystal elements being supported from said aforementioned piezo electric crystal element and arranged for vibration along a horizontal axis, means for sustaining the vibrations of each of said piezo electric crystal elements, and means carried by said last mentioned piezo electric crystal element for controlling the movement of a light ray over a predetermined area.

5. A piezo electric crystal system comprising a pair of independent piezo electric crystal elements, one of said elements being mounted for vibration along a vertical axis and the other of said elements being mounted for vibration along a horizontal axis, means for sustaining the vibrations of said first mentioned piezo electric crystal element, independent means for sustaining the vibrations of said last mentioned piezo electric crystal element at a frequency greater than the frequency of said first mentioned piezo electric crystal element, and means carried by said last mentioned piezo electric crystal element for controlling the movement of a light ray over a predetermined area.

In testimony where I affix my signature.
CLINTON W. HOUGH.