

April 14, 1931.

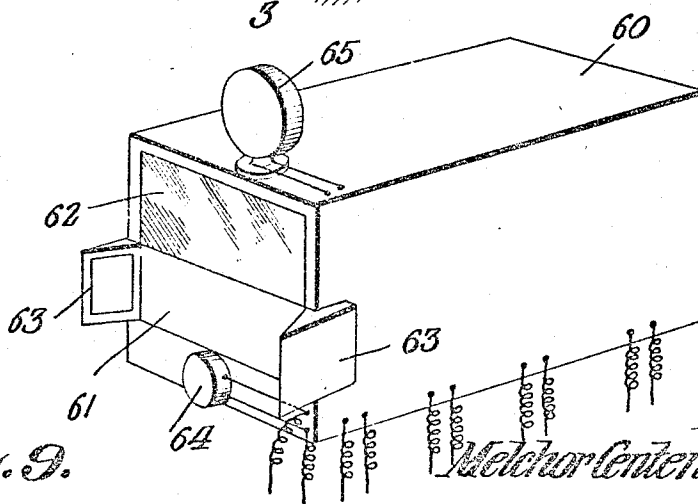
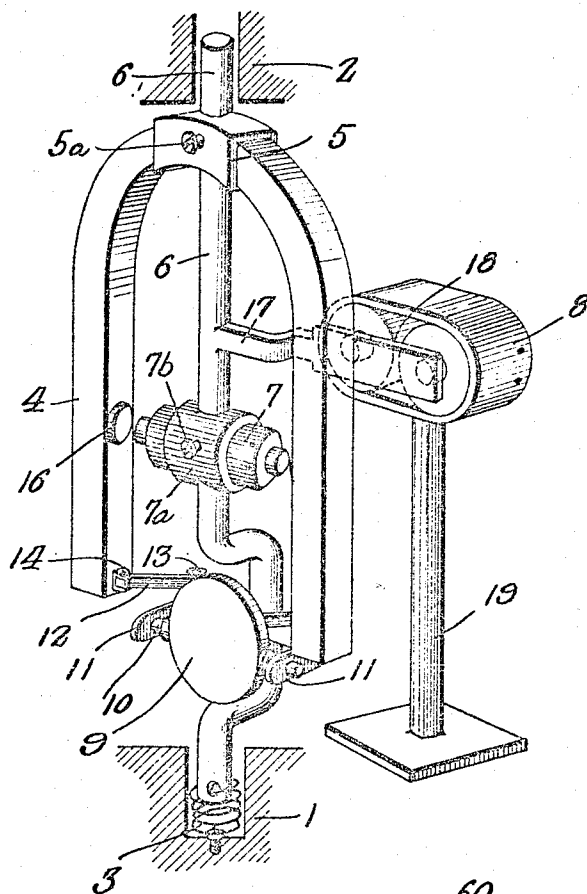
SUBSTITUTE FOR MISSING XR
MELCHOR CENTENO, V.

1,800,601

TELEVISION APPARATUS

Filed Jan. 7, 1929

4 Sheets-Sheet 1

Fig. 1.*Fig. 9.*

334

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Fig. 2.

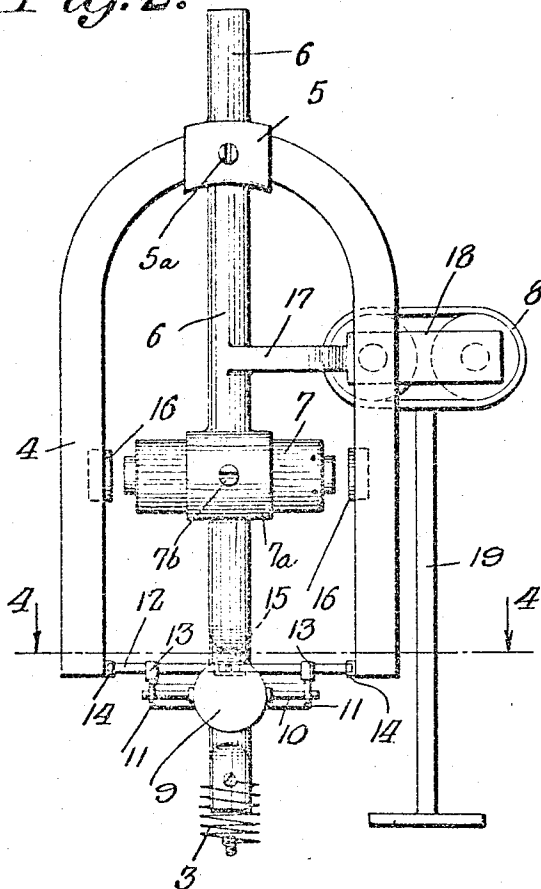


Fig. 3.

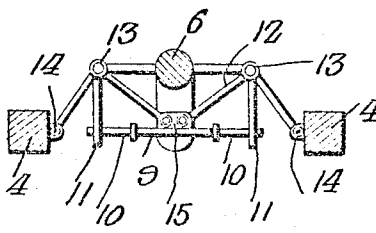
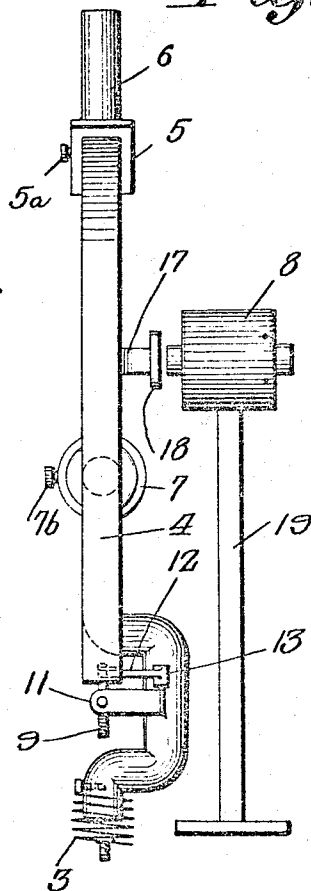


Fig. 4.

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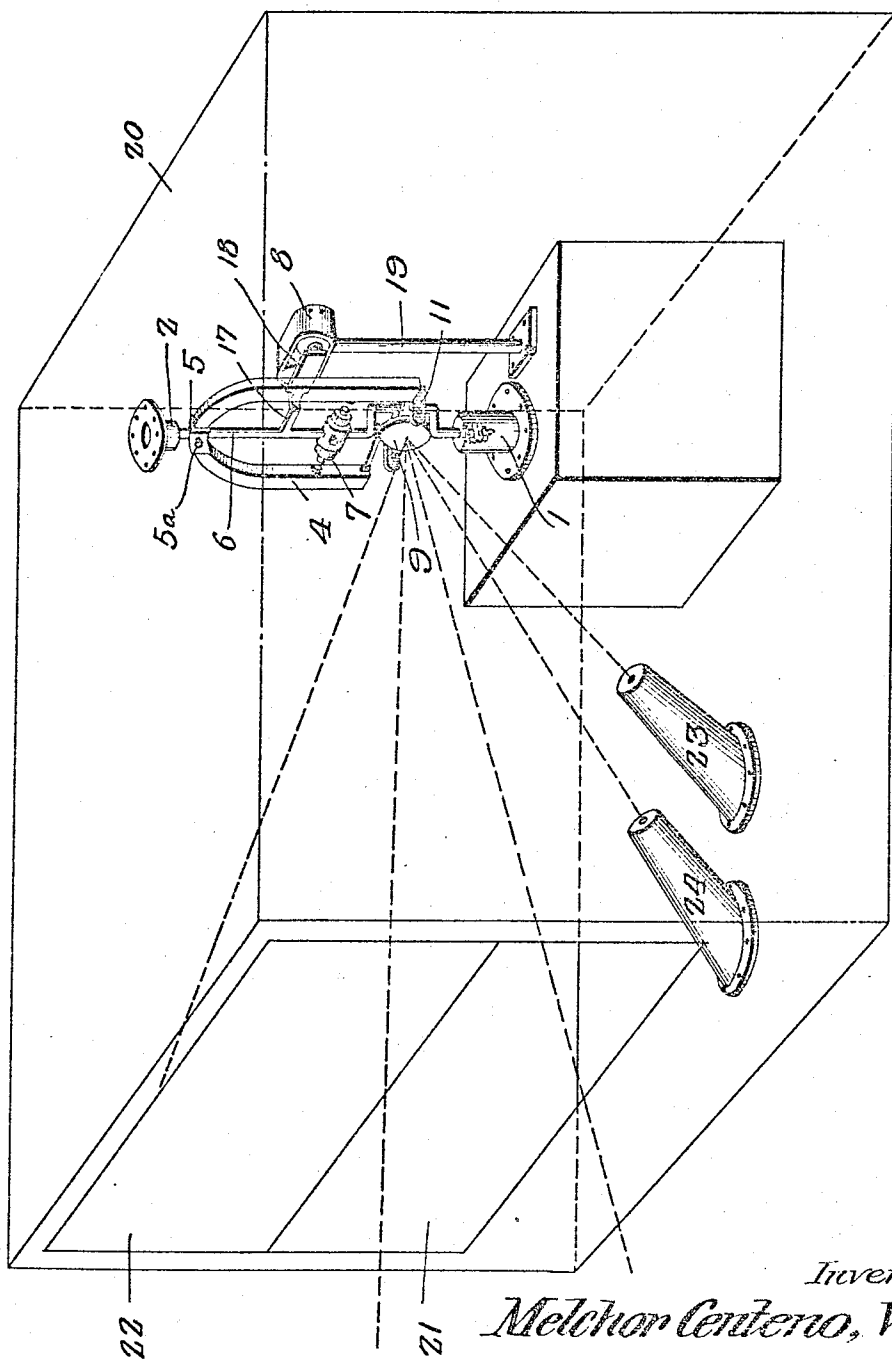
MELCHOR CENTENO, V.

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Fig. 7.

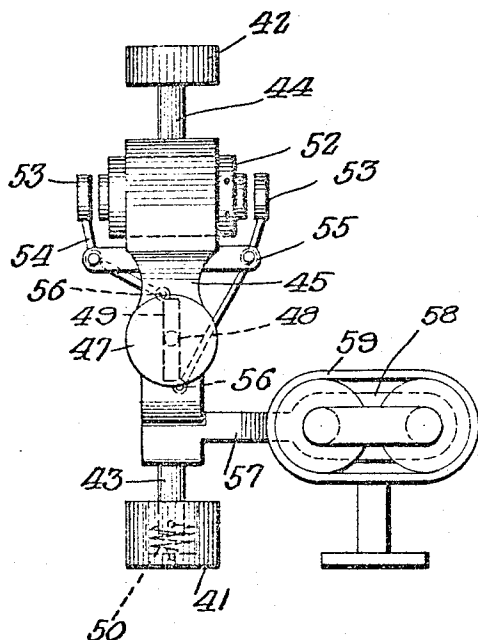


Fig. 6.

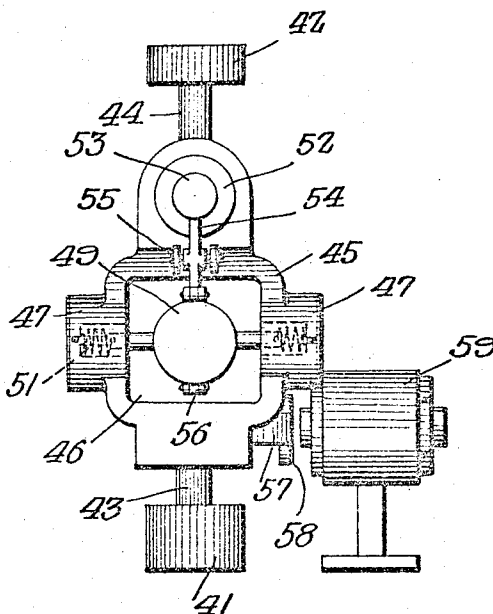
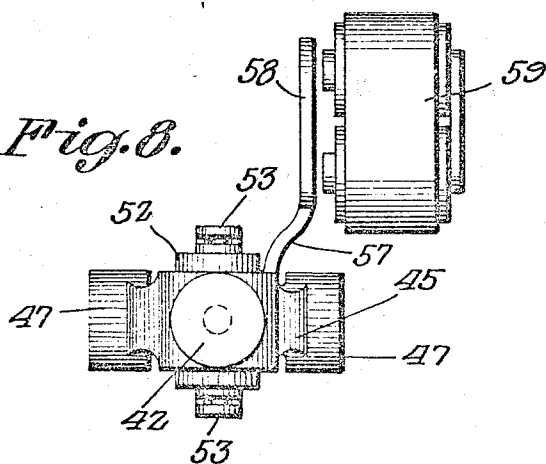


Fig. 8.



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TELEVISION APPARATUS

Application filed January 7, 1929. Serial No. 330,917.

This invention relates to the electrical transmission either by wire or by radio, of images, this art being ordinarily and popularly known by the name of television.

5 The principal object of the invention, generally stated, is to provide an improved apparatus by means of which television may be more readily accomplished and in a manner more satisfactory than has heretofore
10 been possible.

The underlying feature upon which the invention is based is the rapid tracing of the image to be sent by means of a tiny spot of light which is intended to traverse the image
15 in a plurality of directions within that small interval of time during which light impressions persist in the normal human retina, the light being reflected onto a system of photoelectric cells so as to vary the current supplied thereby to a correspondingly responsive illuminating means which will reproduce the tracing of or by the moving spot of light and consequently effect reproduction of the image at the receiving station.

25 It is of course, unnecessary to state that various types of photo-electric cells are known, the current output of which or the resistance of which is dependent upon the intensity of the light falling upon them. It
30 is unnecessary to enumerate the exact types of such cells. It is also known that a neon tube or lamp is extremely sensitive and emits a light which fluctuates accurately in accordance with any variations in the supply
35 current. It is also known that various means have been resorted to in the past for effecting a tracing or rapid covering of the image by a spot of light. One known method is to use a revolving disc provided with spiral
40 perforations, and another is to make use of a diagonally perforated ribbon or ribbons. In addition to these methods use has been made of prismatic revolving levers or a mirror mounted upon a universal joint and
45 adapted to be vibrated. In regard to the

whole question of television, it is of course, apparent that if this is capable of accomplishment through a wired or metallic circuit it can be just as readily carried out by means of space currents or radio. Furthermore, it is apparent that television is capable, when perfected, of being carried out in conjunction with the radio transmission of sound, and the present invention contemplates the uniting of the two features in a
55 common apparatus, the parts of which do not necessarily depend one upon another.

In accordance with the reference made in the above paragraph to the employment of a mirror mounted upon a universal joint, I wish to state that it has been found that this is unsatisfactory for the reason that the necessary vibration or oscillation of the mirror upon two axes which intersect, preferably at right angles, is seriously interfered with by the universal joint arrangement and the result is that there is an inaccurate tracing or covering of the image by means of the spot of light. Accordingly, it is a very important object of the present invention to provide a
70 novel arrangement of an oscillatory or vibratory mirror for moving a pencil of light across the image along many lines which are more or less or at least substantially parallel in each of two directions at substantially
75 right angles to each other, the pencil of light received upon the mirror being reflected onto the photoelectric cells for effecting corresponding actuation at a receiving station.

A more specific object of the invention is to provide a novel mounting and mirror arrangement whereby there will be no interference between the vibration of the mirror at a certain frequency in one direction with its vibration in a direction at right angles to the first mentioned and at a different frequency.

Another important object of the invention is to provide a television apparatus which will permit two-way transmission, that is, 90

that an operator with one machine can see another with a similar machine, and the latter can see the first, all of this preferably in actual practice taking place in conjunction with audition, so that in the eventual development of the invention two persons equipped with or stationed at the proper apparatus may see and hear each other at the same time.

Another specific object of the invention is to provide electrical means for effecting continuous vibration of the mirror at selected frequencies and in different directions.

An additional object is to provide an apparatus of this character which will be comparatively simple, easy to control or adjust, positive in action, efficient in service and a general improvement in the art.

With the above and other objects and advantages in view, the invention preferably consists in the combination, arrangement and detailed construction to be hereinafter more fully described and claimed, and illustrated in the accompanying drawings, in which:—

Figure 1 is a perspective view showing one form of the mirror mounting.

Figure 2 is a front elevation thereof.

Figure 3 is a side elevation thereof.

Figure 4 is a horizontal section.

Figure 5 is a somewhat diagrammatic perspective view showing the mirror mounting or device enclosed within a suitable cabinet with the necessary sources of light.

Figure 6 is a front elevation of a modified form of the mirror mounting.

Figure 7 is a side elevation thereof.

Figure 8 is a top plan view thereof, and

Figure 9 is a perspective view of a cabinet within which the apparatus may be enclosed, this cabinet also suggesting the association of the present mechanism with a radio apparatus.

Generally considered, the invention comprises a mirror so mounted and so moved that a thin pencil of light is made to cover the image in the time of visual persistence, the image being covered in zigzagging lines or traces substantially parallel. The number of traces for a given image may of course be varied but I have discovered that from fifty to sixty traces for an image two inches square is sufficient for normal details. Naturally, the number would depend necessarily upon the desired degree of clearness and the sensitivity of the photo cells and reproducing lamps used. The mirror is given a rapid horizontal oscillatory or vibratory movement upon an axis passing through its center and at a frequency of several hundred cycles. In actual practice five or six hundred vibrations per second may be sufficient. In the preferred form of the invention this is obtained by mounting the mirror upon the prongs of a tuning-fork having that same frequency specified, the fork itself being so mounted that it can oscillate about a vertical axis pass-

ing longitudinally of and between the forks or arms, means being additionally provided whereby the fork itself will be oscillated at a given frequency which may, however, be as low as in the neighborhood of ten per second. The invention further contemplates the provision of electro-magnetic means for vibrating the tuning-fork and for oscillating the same, the electro-magnetic means being energized by currents having frequencies corresponding to the desired frequency of oscillation of the fork. However, the invention is not necessarily limited to the employment of a tuning-fork as will be explained hereinafter. As a transmitter the mirror reflects the trace of the image upon photo-electric cells which control the energization of a reproducing lamp, such as the neon, it being known that a lamp of this type will respond practically instantaneously to a change in the current supply.

As a receiver, the mirror acts to reflect onto a suitable screen the light emitted from a neon tube which responds to pulsations of currents from photo-electric cells influenced by the light reflected thereonto from the vibrating mirror at the transmitting station. The above is a clear explanation of the general features of the invention so that the particular description will be more readily comprehensible.

Referring in detail to the drawings, and especially Figures 1 to 5, the numerals 1 and 2 designate lower and upper bearings within the former of which is a spring 3 provided for the purpose of supporting the fork-mirror-magnet system in a yieldable manner and to maintain this system normally in a certain position, this latter mentioned function being accomplished owing to the fact that the spring 3 is a torsion spring in view of the fact that one end thereof is anchored within the bearing 1 and the other end thereof is anchored within the main element of the fork-mirror system. The numeral 4 designates the tuning-fork which is mounted in some suitable manner, as for example as shown at 5, upon what may be called a shaft or spindle 6. It is to the lower end of this spindle 6 that the upper end of the spring 3 is secured. The mounting or connection 5 is herein disclosed as comprising simply a sort of rectangular sleeve within which the tuning-fork is received, this sleeve being equipped with some securing means, such as the set screw 5a for the purpose of holding the parts firmly.

The numeral 7 designates an electro-magnet carried by the spindle 6 in any suitable manner, as for example by extending through a sleeve 7a on the member 6, this sleeve carrying a set screw 7b engaging the electro-magnet for holding the parts together. The magnet is so arranged that the ends of its core are spaced somewhat from the inner sides

of the arms of the tuning-fork as clearly indicated in Figure 2. The purpose of this magnet is to effect vibration of the tuning-fork. The numeral 8 designates an electro-magnet provided for oscillating the fork system and its cooperation with the rest of the mechanism will be described hereinafter. The two electro-magnets 7 and 8 are the sole means necessary for imparting motion to the device owing to their periodically varying attractive force under the influence of oscillating energizing currents. It is intended that the electro-magnet 7 oscillate or vibrate the fork per se, or maintain it in a vibratory state, preferably at the rate of a few hundred times per second, in actual practice probably between five or six hundred oscillations, while the electro-magnet 8 oscillates the assembly of the fork upon the spindle 6 some five to ten vibrations per second, this action being aided by the spring 3 as pointed out above. The numeral 9 designates the mirror which in actual practice is very small or which at least may be very small, and this mirror is carried by a shaft or spindle 10 mounted in the laterally extended arms of a bracket 11 which is suitably rigidly secured upon the member 6, the latter being offset as clearly indicated in Figure 3 so as to permit the mirror to lie in a plane passing through the longitudinal center or axis of the member 6. This is an important point as the center point of the mirror must lie along the axis of the member 6 in order to obtain the best results.

To effect vibration of the mirror 9, I provide angular levers 12 pivoted at 13 upon the top of the bracket 11 and pivotally connected at one end, as shown at 14 to the tuning-fork arm and pivotally connected at their other ends, as shown at 15, to the rear side of the mirror. It is very probable that the connection of the levers 12 with the arms of the tuning-fork must be slotted and the same be true of the connection with the mirror in order to avoid binding of the parts.

It is preferable to provide armatures 16 which may be recessed into the confronting sides of the arms of the fork opposite the ends of the core of the electro-magnet 7. Secured or formed upon the member 6 is an arm 17 which extends laterally and which carries an armature 18 opposite the end of the core of the electro-magnet 8 which is mounted upon a standard 19 or the like for supporting purposes.

In actual practice, the above described fork-magnet-mirror assembly is intended to be mounted within a cabinet such as that indicated at 20 in Figure 5, which cabinet is provided at one end with an opening 21 above which is a translucent screen 22. The object whose image is to be transmitted is intended to be disposed at the end of the cabinet in front of the opening 21 whereas the

screen 22 is provided for the purpose of receiving the image transmitted from the other station.

Within the cabinet is a source of light such as some convenient lamp 23 which projects a ray or beam onto the mirror 9 in such manner that the beam will pass out through the opening 21 so as to play over and trace the object whose image is to be transmitted. It is of course, necessary to provide photo-electric cells, not shown, located in such position that the light will be thrown upon them after being modified by its tracing action upon the object. These cells are not shown for the reason that they are so old and well known and for the additional reason that they may be located in any desired specific point, this being immaterial. Also located within the cabinet 20 is a neon lamp 24 positioned to project a beam upon the mirror 9 in such a way that the reflection of this beam will be cast upon the screen 22. Of course, the neon lamp 24 responds to variations in current which is varied in accordance with the action of the tracing effected by the mirror throwing light upon the photo-electric cells at the other station. It will therefore be apparent that the device operates in two ways at the same time, both as a transmitter and as a receiver.

Referring more particularly to Figures 6, 7 and 8 which disclose a modification, the numerals 41 and 42 designate upper and lower bearings apertured for the reception of the trunnions 43 and 44 at the ends of a frame 45 having an open central portion 46 at the opposite sides of which are ears or enlargements 47 within which is rotatably mounted a shaft 48 carrying the mirror 49 which has its center point in registration or alignment with the axis of the trunnions 43 and 44. Rotary movement of the frame 45 in either direction is opposed by a spring 50 located within the bearing 41 and having one end secured thereto and its other end secured to the trunnion 43. Movement of the shaft 48, and consequently the mirror 49, in either direction is opposed by a spring 51 located within each ear or enlargement 47 with one end secured thereto and the other end secured to the shaft 48.

The operating means in this form comprises an electromagnet 52 carried by the frame 45 and adapted to act upon armatures 53 mounted on levers 54 pivoted at 55 and pivotally connected at 56 with the mirror 49. This is the high frequency magnet and is intended to be energized by an alternating current having a frequency of say from five hundred to six hundred cycles per second so that the mirror 49 will be given a very rapid vibratory movement upon its horizontal axis 48. The lower frequency means for oscillating the entire mirror and magnet assembly is shown as comprising a laterally extending

arm 57 carried by the frame 45 and equipped with an armature 58 positioned to be attracted by an electro-magnet 59 which is suitably mounted and which is intended to be actuated or energized by an alternating current of comparatively low frequency, say from five to ten cycles per second so that the necessary oscillation of the magnet and mirror assembly upon its vertical axis will be accomplished. In all essential features this form of the invention is identically the same as that above described, the only difference being that the tuning-fork is replaced by the frame 45, the vibration being imparted directly to the mirror instead of through the tuning-fork. This form of the invention is adapted to be mounted within the cabinet 20 in exactly the same manner as the first described form, there being absolutely no difference in this respect.

In the operation of the invention, regardless of which specific form of mirror mounting is used, it is to be understood that the person whose image is to be sent, or in fact any other object whose image is to be sent or transmitted takes a position or is given a position in front of the cabinet opposite the opening 21. The lamp 23, which may be energized by a local or any other circuit, is then brought into play and throws a beam of light upon the mirror 9 or 49 as the case may be. This small pencil of light is thrown out through the opening 21 and traces or plays back and forth over the object whose image is to be transmitted. In actual practice I have discovered that owing to the peculiar compound movements of the mirror, that is to say its rapid vibration upon a horizontal axis and its comparatively slow oscillation about a vertical axis, there results the production of a series of substantially parallel zigzag or more or less serpentine lines which traverse the image about the area thereof. The beam of light modified by its passage or tracing of course is reflected onto the photoelectric cells and their action is correspondingly modified. In view of the fact that these cells are in circuit with the neon tube at the other station and as a neon tube is extraordinarily susceptible to slight variations in the current supplied thereto, the result is that the light emitted from the neon tube at the other station will be correspondingly modified. Assuming that there are two of such devices, one at each station it is apparent that the neon tube 24 affected by the action of the tracing at the other station will throw its beam upon the mirror 9 or 49, as the case may be, and as this beam is modified in direct accordance with the variations in the current output from the photo-electric cells at the other station, the beam reflected upon and in fact traced upon the screen 22 will produce thereon an image corresponding exactly to that at the other station. In view

of the fact that the small pencil of light traverses the screen with such rapidity as to complete its action within the period of the duration of persistence of vision, there will be the effect upon the eye of the observer of an image corresponding exactly to that at the other station. In view of the fact that the two lamps 23 and 24 are placed at different positions with respect to the vibratory mirror it is clear that the beams of light issuing from both will not interfere with each other in any way whatsoever so that the device will operate perfectly as a transmitter and receiver at the same time.

Attention might be directed to the fact that it is possible to vary the frequency of the current energizing the electro-magnet which vibrates the mirror 9 or 49 as the case may be but this is a matter of adjustment. However, it is of course, of great importance and in fact essential that the mirrors at the two stations vibrate in unison or synchronism. Accurate adjustment in this respect can be obtained by means of suitable resistances, capacitances or other devices analogous to what is employed in conjunction with the tuning of radio sets and it is thought that any further amplification of the description in this respect is unnecessary.

While the invention can be worked out in its commercial developments in any particular manner specified, I have, in Figure 9, illustrated a single self-contained apparatus by means of which television, carried out as above indicated, together with radio reception or audition may be accomplished simultaneously. In this figure, the cabinet 60 disclosed therein corresponds exactly to the above described cabinet 20. This cabinet has its front provided with an opening 61 corresponding to the opening 21 above which is a screen 62 corresponding to the screen 22. At the opposite sides of the opening 61 are casings 63 within which are located the photoelectric cells for varying the current to the neon tube at the other station, not indicated. This self same cabinet 60 may also carry a microphone 64 and a loud-speaker 65 and may enclose a radio transmitting or receiving set, or both, so that by means of the entire device vision and audition may be accomplished simultaneously. The wiring details and the diagrams of any apparatus enclosed within the cabinet are not given as such are not necessary to a proper understanding of the present invention which has to do with the mounting and vibration of the mirror for throwing the pencil of light and tracing it upon the image or object to be transmitted.

From the foregoing description and a study of the drawings it is readily apparent that I have provided an extremely simple mechanism for the purpose specified and one which

should efficiently perform all the functions for which it is intended and effect a material advance in the art of television. It is believed that the construction, operation and advantages will be readily apparent to one skilled in the art without further explanation.

While I have shown and described a preferred embodiment of the invention, it is to be understood that I reserve the right to make all such changes not only in the details of construction but also in the arrangement and combination of parts as will not depart from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, I claim:—

1. In a device of the character described, a support mounted for turning movement about a vertical axis, a mirror mounted upon said support for vibratory movement about a horizontal axis, means carried by said support for vibrating the mirror, and separate means located exteriorly of said support for oscillating the same.

2. In a device of the character described, a support mounted for movement about a vertical axis, a mirror mounted upon the support for movement upon a horizontal axis, means mounted within said support for vibrating the mirror at a given frequency, and separate means exterior to the support for oscillating the same at a different frequency.

3. In a device of the character described, a support mounted for movement about a vertical axis, a mirror mounted upon the support for movement about a horizontal axis, electro-magnetic means carried entirely by the support for vibrating the mirror at relatively high frequency, and separate electro-magnetic means exterior to the support for oscillating the same at a lower frequency.

4. In a device of the character described, a support mounted for movement about a vertical axis, a mirror mounted on the support for movement about a horizontal axis, electromagnetic means on the support having a link and lever connection with the mirror for vibrating the mirror at a given frequency, and separate electro-magnetic means exterior to the support for oscillating the support at a different frequency.

5. In a device of the character described, a support mounted for movement about a vertical axis, a mirror mounted on the support for movement about a horizontal axis, electro-magnetic means on the support for vibrating the mirror at a given frequency, separate electro-magnetic means exterior to the support for oscillating the support at a different frequency, and alternating current energizing means for the respective electro-magnetic means, the frequency of the alternating currents corresponding respectively to the frequency of vibration of the mirror

and the desired frequency of oscillation of the support.

6. In a device of the character described, a vibratable member mounted for movement about a vertical axis, a mirror mounted on said vibratable member within the confines thereof for movement about a horizontal axis, an operative connection between the vibratable member and the mirror, means carried by and located within the confines of said vibratable member for maintaining the same in a state of vibration at a given frequency, and separate means for oscillating the vibratable member located exterior thereto.

7. In a device of the character described, a vibratable member mounted for movement about a vertical axis, a mirror mounted on said vibratable member for movement about a horizontal axis, an operative connection between the vibratable member and the mirror, electro-magnetic means mounted on and within the confines of the vibratable member for maintaining it constantly in a state of vibration at its natural frequency, and separate means exterior to the vibratable member for maintaining the same in a state of oscillation at a period differing from that of the period of vibration of the mirror.

8. In a device of the character described, a vibratable member mounted for movement about a vertical axis, a mirror mounted on said vibratable member for movement about a horizontal axis, a direct operative connection between the vibratable member and the mirror, electro-magnetic means mounted directly on the member for vibrating the vibratable member constantly at its natural frequency, and separate means exterior to the member for maintaining it in a constant state of oscillation at a period differing from that of the period of vibration of the mirror, both of said means being electro-magnetic.

9. In a device of the character described, a vibratable member mounted for movement about a vertical axis, a mirror mounted on said vibratable member for movement about a horizontal axis, an operative connection between the vibratable member and the mirror, electro-magnetic means on said member for vibrating the same and the mirror and maintaining them constantly in the same state of vibration at the natural frequency, and separate means exterior to the vibratable member for maintaining it in a state of oscillation at a period less than that of the period of vibration of the mirror, both of said means being electro-magnetic, and being energized by current impulses having respective frequencies corresponding to the natural frequency of vibration of the member and the desired frequency of oscillation thereof.

10. In a television apparatus, a frame member mounted for movement about an axis, a mirror mounted on said frame member for movement about an axis at substantially right

angles to the first named axis, an operative connection between said member and the mirror for imparting vibrations of the former to the latter about the axis thereof, electro-magnetic means carried directly by said member and energizable by current impulses for vibrating the same at a given frequency, and electro-magnetic means energizable by other current impulses of different frequency and located exterior to said member for oscillating the same and the mirror as a unit about the first named axis.

In testimony whereof I affix my signature.

MELCHOR CENTENO, V.

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