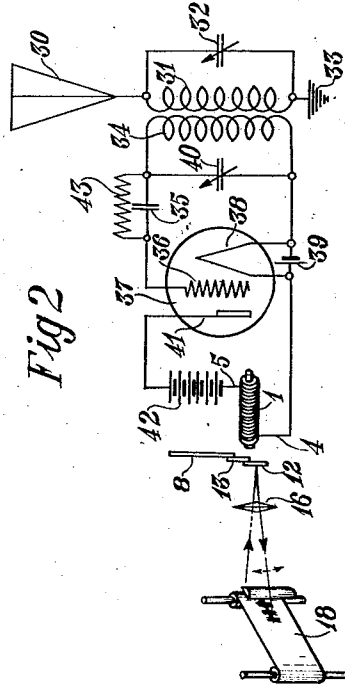
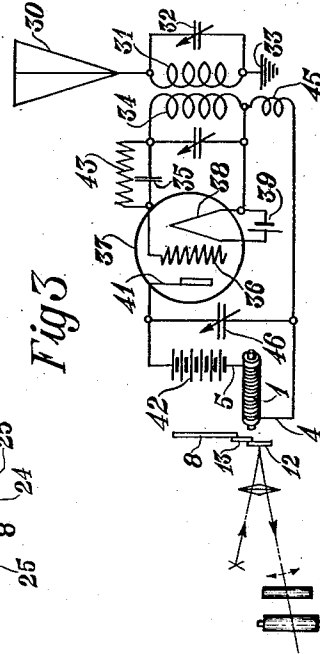
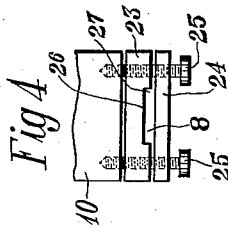
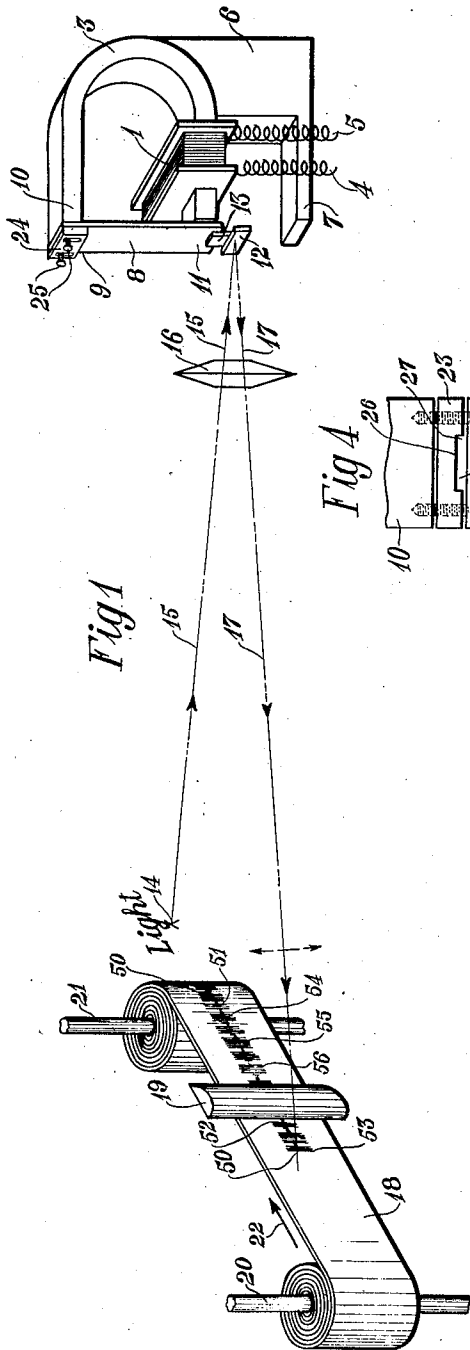


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 PHOTOGRAPHIC RECEIVING APPARATUS.
 APPLICATION FILED JUNE 19, 1919.

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To all whom it may concern:

Be it known that I, CHARLES A. CULVER, a citizen of the United States, residing at Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Photographic Receiving Apparatus, of which the following is a specification.

This invention relates to a new and improved means for recording signals.

The invention is particularly directed to means constructed in co-action with oscillation receiving systems, for recording indications corresponding to the received signals.

In the more preferred forms of my invention, the signals are recorded on a chemically-sensitive strip by the use of light waves controlled by oscillation-responsive means comprising an electrical coil in electromagnetic relation with a vibratable element and a mirror controlled by the vibratable element for controlling the character of light waves impinging on the sensitive strip. Means are provided for regulating the frequency of period of vibration of the vibratable element, in coaction with means for tuning the antenna circuit relative to the vibratable element, thereby weeding out the reception of any undesired waves. The recording mechanism is preferably arranged to automatically effect the recording of the signals, as by imparting uniform or other predetermined rate of travel to the sensitive strip under controlled shutter exposure, and automatically developing and fixing the successively subjected portions of the strip.

Further features and objects of the invention will be more fully understood from the following description and the accompanying drawing, in which

Fig. 1 is a diagrammatic view showing one form of the invention;

Fig. 2 is a diagram of a radio receiving system for receiving damped waves and embodying the form of my invention shown in Fig. 1;

Fig. 3 is a diagram showing the form of my invention of Fig. 1 embodied in a radio receiving system adapted to receive undamped waves; and

Fig. 4 is a detail top plan view of the clamp for adjusting the effective length of the reed.

Referring to Fig. 1, the coil 1 is disposed in suitable relation with the pole 2 of the

permanent magnet 3, the terminals 4 and 5 of the winding of the coil 1 being suitably connected with the receiving circuit, as more particularly described hereinafter.

The magnet 3 is suitably supported in fixed relation, as by means of the bracket 6 having base 7 adapted to be secured to any suitable fixed support. As shown, the magnet 3 may be mounted with its poles one vertically above the other.

In suitable vibratory relation with the magnet 3 is arranged the reed 8 which is preferably of a free-reed type, as by mounting its upper end 9 in determined, relatively fixed relation to provide its free end 11 to extend normally relatively closely adjacent to the pole 2 of the magnet 3.

The reed 8 controls the mirror 12, or other suitable light diverting means; as shown, such mirror 12 is preferably suspended from the reed 8 by means of a strip 13, of relatively highly flexible material. The mirror 12 is large in mass, i. e., of high inertia, relative to the force required to flex the flexible strip 13.

The reed 8 is preferably of very thin, highly resilient material to provide a very low damping factor and may be of magnetic material, or may have its portion 11 adjacent the pole 2 of the magnet 3 of magnetic material, or equivalent, as is understood; or the reed 8 may be of non-magnetic material and a suitable facing or insert of magnetic material provided in adjacent magnetic relation with the pole 2 of the magnet 3.

In co-action with the mirror 12 is provided a source of light 14, of any approved type, and arranged to direct the incident rays of light 15 on the mirror 12, and, if desired, the lens 16 arranged to concentrate such incident rays of light 15 on the mirror 12. The reflected rays 17 are refracted through the lens 16 onto the strip of sensitive paper 18. The lens 16 may be of the double convex form, and the cylindrical object lens 19 may be employed in co-action therewith to locate the focus of the reflected rays 17 substantially within the plane of the face of the sensitive paper 18.

Upon the reception of oscillations in the antenna circuit, and the consequent excitation of electrical impulses through the coil 1 the reed 8 is electro-mechanically vibrated in correspondence with the electrical excitations, and by reason of the low damping fac-

tor of the reed 8, the relatively high flexibility of the strip 13 and the high inertia of the mirror 12, the mirror 12 is deflected rotatively, thereby deflecting correspondingly the deflected rays 17. In the particular arrangement shown in the drawings, the extent of arcuate deflection of the reflected rays 17 is approximately twice the arc of oscillation of the mirror 12.

The sensitive strip 18 is suitably mounted on rolls 20, 21, suitably driven by clock-mechanism (not shown), or equivalent, to provide a substantially uniform travel of the strip 18, say, in the direction of the arrow 22, the whole being enclosed in a suitable light-proof container, having a suitable light receiving opening in which is disposed the lens 19.

I have discovered that the extent of deflection of the deflected rays is commensurate with the amount of energy of the transmitted waves, the duration of deflection corresponding to the duration of the waves of the particular frequency to which the reed is tuned.

Upon adjustment of the effective length of the reed 8, its period of vibration is correspondingly modified whereby the frequency of the impulse sensitive device comprising the coil 1, magnet 3, and reed 8 is accordingly regulated. As one form of adjusting the length of the reed 8, I have shown the inner clamping plate 23, the outer clamping plate 24, and clamping screws 25, 25, tapped into the pole 10 of the magnet 3, said inner clamping plate being cut away at 26 to receive the correspondingly thickened lip 27 of the reed 8, as indicated in Figs. 1 and 4.

In Fig. 2, I have indicated a suitable form of radio receiving system including a vacuum valve detector, embodying my photographic recording device, the same being arranged for receiving damped waves of a predetermined frequency. Such receiving system is adapted for the reception of signaling oscillations emitted by a spark transmitter. In the diagrammatic view of Fig. 2, the antenna is indicated at 30, and connected through the closed tuning circuit comprising the primary coil 31 and adjustable condenser 32 and with the ground 33. The secondary coil 34, in inductive relation with the primary coil 31, is connected through its one terminal through the condenser 35 and high resistance 43 with the grid electrode 36 of the vacuum valve detector 37. The filament cathode 38, heated by the battery 39, is connected through its one terminal with the other terminal of the secondary coil 34, adjustable condenser 40 bridging across the terminals of the secondary coil 34. The anode plate 41, of the vacuum valve detector 37, is connected through the battery 42 with the terminal 5 of the excitation coil 1, the

terminal 4 of the excitation coil 1 being connected with the remaining terminal of the cathode filament 38.

The reed of the photographic recording device indicated at 8, the lens at 16, and the sensitive photographic film 18 correspond to like parts referred to more particularly hereinabove.

In the receiving system shown in Fig. 3, I have indicated my photographic receiving device 1 suitably connected in suitable form of receiving system including a vacuum valve detector 37, arranged for the reception of undamped oscillations of a predetermined frequency, like elements of the receiving circuit of Fig. 3 being designated by like reference characters, as in Fig. 2, the connections being modified, however, to include the inductance 45 connected to one terminal of the secondary coil 34, the other terminal of the inductance 45 being connected with the terminal 4 of the oscillation responsive coil 1, and the variable condenser 46 bridging the battery 42 and the oscillation responsive coil 1.

In such receiving circuits, the vacuum valve is arranged to generate high frequency oscillations, the frequency of which is controlled by the variable elements of the circuit, as will be understood. The oscillations of the local circuit of the oscillation sensitive coil 1 react with the oscillations set up in the antenna 30 to produce in such local circuit the beat tone, which is rectified by the vacuum valve detector.

In receiving the signals from a spark transmitting station, the reed is adjusted to the spark tone frequency of the transmitting station and such adjustment of the reed is maintained while receiving from such particular transmitting station.

In receiving signals from a station emitting undamped waves, the reed adjusted approximately to respond to a beat tone frequency most agreeable to the particular operator in charge, at which adjustment the reed is clamped more or less permanently. The beat tone frequency is then adjusted to the reed frequency by adjusting the variable elements of the receiving circuit.

A dot and dash record is indicated in Fig. 1, on an enlarged scale, and in Figs. 2 and 3, on a reduced scale. During the intervals of quiescence the beams of reflected rays 17 effect the impression on the traveling sensitive strip 18 of a substantially rectilinear line indicated at 50-50, corresponding to an axis of abscissa and upon the reception of a dot, representing a relatively small interval of excitation, a relatively thin impression is developed on the sensitive strip 18, as indicated at 51, 52, 53, etc.; whereas upon the reception of a dash representing a relatively long period of excitation, a relatively thicker impression is developed on the trav-

eling sensitive strip 18, as is indicated at 54, 55, 56, etc.

The developed photographic record represents, accordingly, a sequence of relatively thin and relatively thick impressions extending in the direction of length of the strip, reversely to the direction of travel of the strip, thus enabling the operator to readily read or receive the message. The record is permanent in form and possesses the advantages of photographic records generally.

I have discovered that reeds of the free-reed type are particularly advantageous in eliminating excitations generated by undesirable oscillations, such as those which arise from static disturbances.

By reason of the relatively large angular movement of the mirror, induced upon relatively small movement of the reed, a high degree of sensitiveness is attained, thereby making possible photographic records of faint signals.

It will be understood that waves or vibrations of a form other than light may be similarly employed to indicate the received oscillations.

Whereas, I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the appended claims.

I claim.

1. The combination with electrical oscillation means, of an electro-mechanical vibratable element of the spring type controlled by said means, the natural stiffness of the spring being sufficiently low to give substantially simple harmonic vibration for small displacements when loaded, means for varying the frequency of said element, and loading means for recording the vibrations of said vibratable element.

2. The combination with a selective electrical oscillation receiving means, of a selective electro-mechanical vibratable element of the spring type controlled thereby, the natural stiffness of the spring being sufficiently low to give substantially simple harmonic vi-

brations for small displacements when loaded, means for varying the frequency of said element, and loading means for recording the vibrations of said vibratable element.

3. The combination with oscillation receiving means, of a reed electro-mechanically controlled by said receiving means, means for mounting said reed solely at one end, a relatively short, highly flexible element secured to the free end of said reed and a mirror of relatively high inertia carried by said flexible element.

4. The combination with oscillation receiving means, of vibratable means of the spring type responsive to the oscillations of the receiving means, and loading means to indicate the vibrations of the vibratable means and possessing greater inertia than the vibratable means.

5. The combination with oscillation receiving means, of vibratable means of the spring type responsive to the oscillations of the receiving means, means for varying the frequency of the vibratable means, and loading means to indicate the vibrations of the vibratable means, said vibratable means having less inertia than the loading means.

6. The combination with oscillation receiving means, of vibratable means responsive to the oscillations of the receiving means, a vibratable light-reflecting member connected with the said vibratable means for actuation thereby and possessing greater inertia than the vibratable means, and light-sensitive means adapted to record vibrations of the light-reflecting member.

7. In combination with an electrical oscillation receiving circuit, a leaf spring means of low inertia and high relative displacement for a given applied force, a recording means mounted on and having an inertia higher than the said leaf spring means, and further means to give a series of mechanical impulses to said spring means by virtue of the electrical oscillations in said receiving circuit.

In testimony whereof I affix my signature
CHARLES A. CULVER.