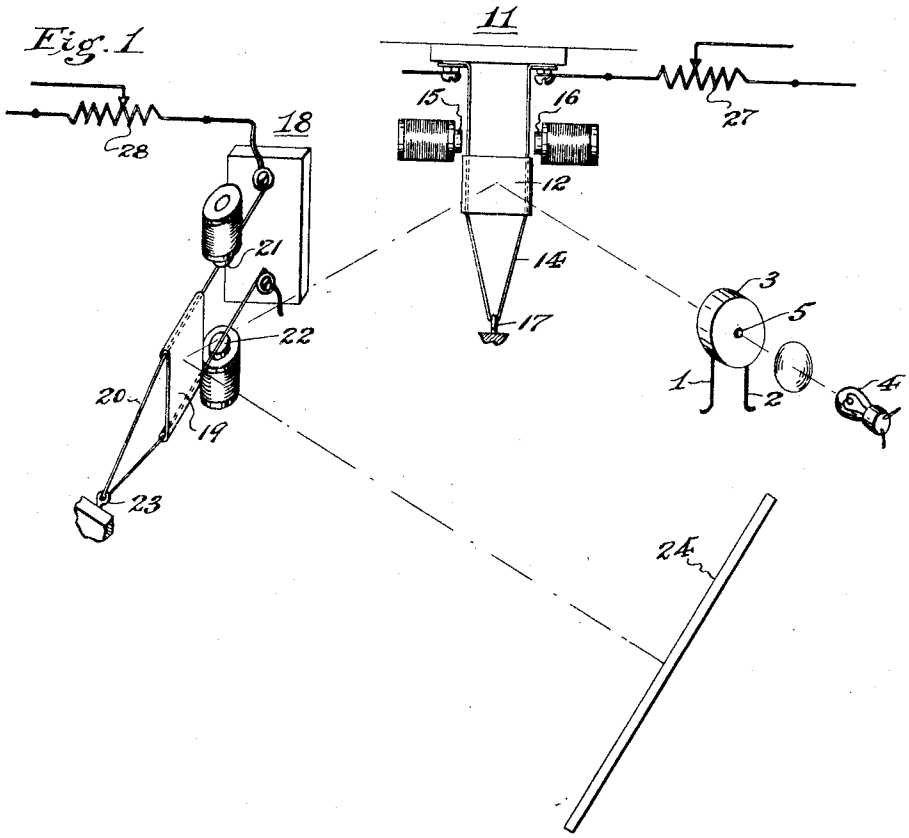
Jan. 5, 1932. L. SILBERSTEIN 1,839,777

TELEVISION APPARATUS

Filed May 24, 1929

Fig. 1



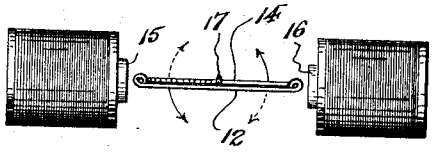


Fig. 2

INVENTOR.
Ludwik Silberstein,
BY
George D. Richards
ATTORNEY

Patented Jan. 5, 1932 1,839,777

UNITED STATES PATENT OFFICE

LUDWIK SILBERSTEIN, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO UNITED RESEARCH CORPORATION, OF LONG ISLAND CITY, NEW YORK

TELEVISION APPARATUS

Application filed May 24, 1929. Serial No. 365,679.

This invention relates to the electrical transmission of pictures or images over wire conductors or other channels sometimes termed electro-telescopy, and commonly known in the art as picture transmission or television.

In the electric transmission of pictures, as is commonly practiced, it is necessary to employ scanning discs, each of which discs is provided with a series of holes spirally spaced around its periphery. At least one of these discs is located at the receiving end and another at the transmitting end of the apparatus. These discs are necessarily rotated at great speed and must operate in close synchronism without fluctuation of the driving motor speed. Such equipment is not only highly complicated in structure but is also extremely difficult to maintain in efficient operating condition.

It is the principal object of the present invention to provide a novel television apparatus wherein the motor driven scanning discs and their elaborate synchronizing means are eliminated and are replaced by a plurality of suitably constructed and arranged oscillographs which collectively may be termed a compound oscillograph and which are especially applicable to the receiving end of the television circuit and are so designed as to have different periods of oscillation, the ratios of such periods being expressed by rather large co-prime numbers differing from each other by a small number.

Another object of the invention lies in the provision of a television receiving circuit apparatus which is simple and readily maintained in synchronizing relation with the transmitter apparatus and in which the inertia of the moving parts is reduced to a minimum.

Still another object of the invention is to provide a television receiving circuit apparatus which is especially adapted to be employed in conjunction with a transmitter circuit wherein the scanning element is adapted to sweep the area of the projected picture or image to be transmitted in a path corresponding to a Lissajous curve, such as is employed in the transmitter apparatus disclosed in my copending application for improvements in electro-telescopy, Ser. No. 340,198, filed Feb. 15, 1929, of which this application is a continuation in part.

Other objects of this invention not at this time more particularly enumerated will be clearly understood from the following detailed description of the same.

As disclosed in my above mentioned copending application, if an elastic rod, of rectangular section, clamped at one end is set in oscillation, it will have different vibration properties in different directions, depending upon its cross-sectional dimensions. If the rectangular cross-section of such a rod has two periods of vibration, such as T_1 and T_2 of component oscillation along the two sides of the rectangular section, which periods of vibration bear to one another the ratio of two large co-prime numbers differing from each other by a small number, such as represented by the ratio 49 to 50, then a photoelectric cell carried by the free end of such a rod, if vibrated in the plane of the image of the object to be pictorially transmitted, will traverse a Lissajous curve which is extremely complicated so that the path of the cell will in course of time come very close to every point in the area of the image during the period of this vibration, that is, it will practically sweep the entire area contained by the image. The variation in current produced by the photoelectric cell is adapted to be amplified by a suitable vacuum tube amplifier and transmitted to the receiving station. At the receiving station, a light valve operating in conjunction with a vibrating rod carrying a mirror or reflector, said rod being similar to the rod at the sending station, is used to project a beam of varied light adapted to develop a sweeping Lissajous curve synchronous with that described by the photoelectric cell at the sending station, which beam of varied light traverses the receiving screen effecting the desired picture production.

In the present invention, the novel receiving apparatus utilizes a compound oscillograph in conjunction with the light valve for converting the current delivered by the vac-

uum tube amplifier to the desired reproduced picture or image without the use of a vibrating rod.

The invention is clearly illustrated in the accompanying drawings, in which:—

Fig. 1 is a schematic representation of a receiving circuit apparatus embodying the principles of the present invention; and

Fig. 2 is a transverse sectional view of one of the oscillograph members employed in conjunction with the invention.

Similar characters of reference are employed in all of the hereinabove described views to indicate corresponding parts.

Referring now to the said drawings, the reference numerals 1 and 2 designate conductors leading from the amplifier of the transmitting circuit. The conductors 1 and 2 are connected to a suitable light valve 3 or string galvanometer which may be of the character disclosed in my above mentioned application which shows a ribbon extending between the pole pieces of an electro-magnet and normally blocking a light aperture 5 extending through the light valve. The fluctuations in current passing through conductors 1 and 2 cause a shifting of the light valve ribbon so as to permit light from lamp 4 to pass through the light aperture in the light valve and upon a mirror 12 of one member 11 of the novel compound oscillograph of this invention. The U-shaped conductor or loop 14 of the oscillograph member 11 extends between the poles 15 and 16 of a suitable permanent or electro-magnet and preferably has its closed end extending tightly around a fixed support 17 which may be suitably tensioned as by a spring, if desired. Mirror 12 is adapted to vibrate on an axis extending at right angles to the longitudinal axes of poles 15 and 16. The second oscillograph member 18 is arranged with respect to oscillograph member 11 so that its mirror 19 lies in a plane which extends at right angles to the plane of mirror 12 and vibrates on an axis that extends at right angles to the vibrating axis of mirror 12. Mirror 19 receives the light rays reflected from mirror 12. The U-shaped conductor 20 of oscillograph member 18 extends between the poles 21 and 22 of a magnet and is suitably connected with a fixed support 23. A suitable receiving screen 24 is arranged in a plane substantially parallel to that of the mirror 19 for receiving the light rays reflected from this mirror.

In operation, electric currents are passed through conductors 14 and 20 of the oscillograph members 16 and 18, respectively, of such frequencies as to cause the beam of light projected upon the receiving screen 24 to have exactly the same path as that of the photoelectric cell at the sending station, in other words is caused to describe on the screen a Lissajous curve corresponding to and synchronizing with that described by the photoelectric cell at the sending station. Thus, with the photoelectric cell at the sending station tracing a Lissajous curve, it is necessary to employ currents of such frequencies in the oscillograph members as to cause the beam of light projected on screen 24 to have a path and periodicity that is similar to that of the photoelectric cell at the sending station. If it be assumed, that the vibrating rod at the sending station has component oscillation along its two sides in the ratio of 49 to 50, then the conductor of one of the oscillograph members, such as conductor 14, will be supplied with current having a frequency of 49 cycles and the conductor of the other oscillograph member, namely conductor 20, will be supplied with a current of 50 cycles, so that the combined action of the compound oscillograph produces a projected Lissajous curve on the screen 24. Suitable variable reactances 27 and 28 comprising inductive reactance or condensive reactance or both, may be included in the circuits of the conductors 14 and 20 to enable the ready synchronization of the compound oscillograph of the receiving station with the vibrating rod at the sending station. To synchonize the two stations; it is merely necessary to transmit a trial figure from the sending station and to adjust the reactances in the circuits of conductors 14 and 20 so as to receive a distinct image of such figure at the receiving station. It will be apparent that the intensity of light projected upon the mirror 12 corresponds with that projected upon the photoelectric cell at the sending station, so that the image traced upon the receiving screen 24 will correspond exactly with that projected upon the photoelectric cell at the sending station.

Owing to the flexibility of the rate of vibration of the photoelectric cell supporting rod at the sending station, the number of vibrations of this rod may be conveniently varied from a few hundreds to several thousands per second, so that it will be apparent that pictures may be rapidly transmitted by this system.

Although the present invention has been disclosed as peculiarly adapted for use at the receiving station, it is to be understood that the principles thereof may be applied, if desired, at the sending station to thereby eliminate the vibrating rod at such station.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:—

1. In a system for the reception of pictures transmitted electrically, a pair of vibrating

mirrors and means for vibrating said mirrors so that their periods of vibration may be expressed by two large co-prime numbers, differing from each other by a small number, said mirrors acting jointly to project a beam of light so as to produce a transmitted picture.

2. In a system for the reception of pictures transmitted electrically, a pair of vibrating mirrors and means for vibrating said mirrors so that their periods of vibration may be expressed by two large co-prime numbers, differing from each other by a small number, said mirrors acting jointly to project a beam of light which will trace a Lissajous curve.

3. In a television system, a compound oscillograph, the mirrors of said oscillograph being arranged substantially at right angles to one another and adapted to vibrate about axes also extending substantially at right angles to one another, and means for supplying the conductors of said compound oscillograph with currents having frequencies which may be expressed by two large co-prime numbers, differing from each other by a small number.

4. In a television system, a compound oscillograph, the mirrors of said oscillograph being arranged substantially at right angles to one another and adapted to vibrate about axes also extending substantially at right angles to one another, the conductors of said compound oscillograph being adapted to be supplied with currents having frequencies which may be expressed by two large co-prime numbers, differing from each other by a small number, and means for independently varying the impedance of the circuits of said oscillograph conductors.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 18th day of May, 1929.

LUDWIK SILBERSTEIN.