Oct. 25, 1949. J. BION 2,485,556

FACSIMILE COMMUNICATION SYSTEM

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Fig. 1.

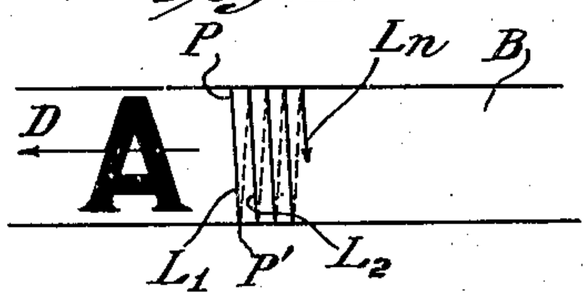


Fig. 2.

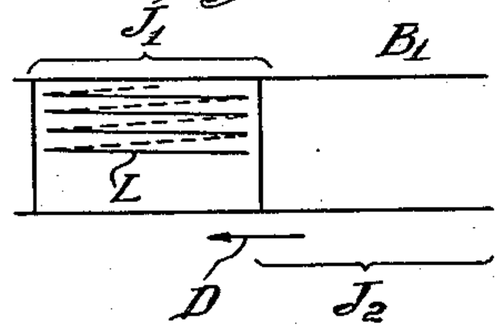


Fig. 3.

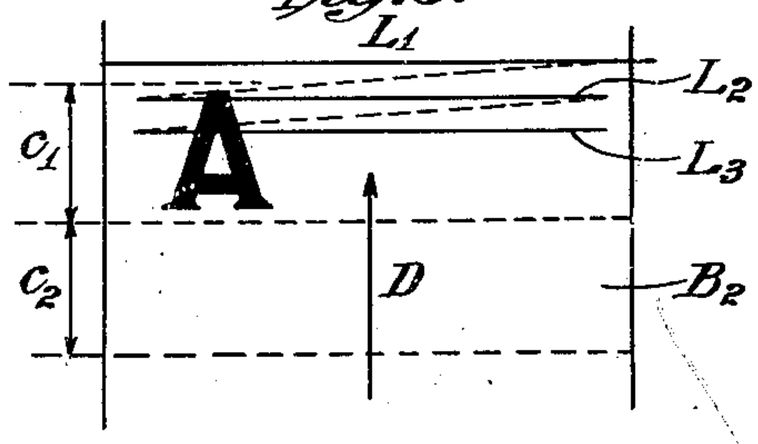


Fig. 4.

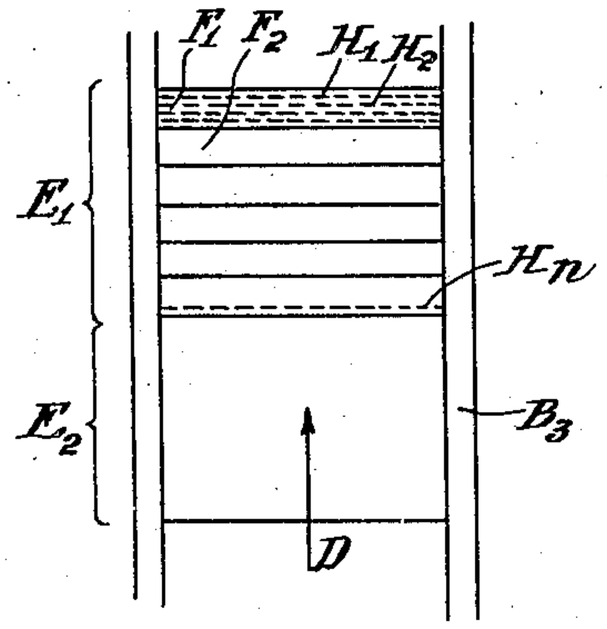
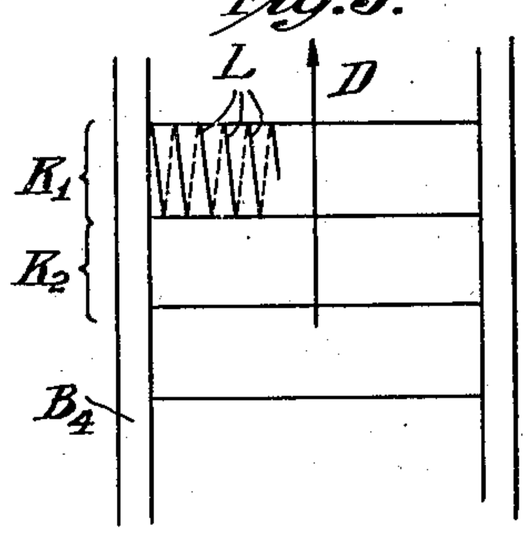


Fig. 5.



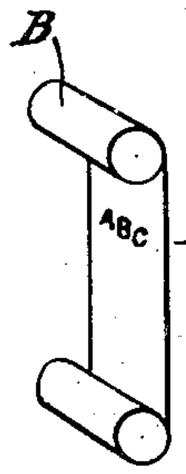
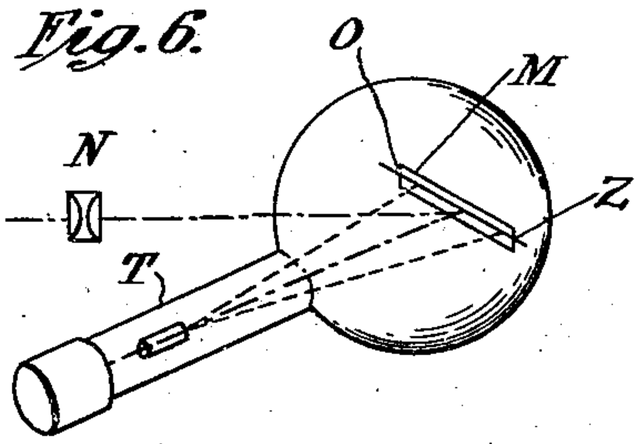


Fig. 6.



INVENTOR
JOSEPH BION
BY Robert J. Berry
AGENT

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Fig. 7.

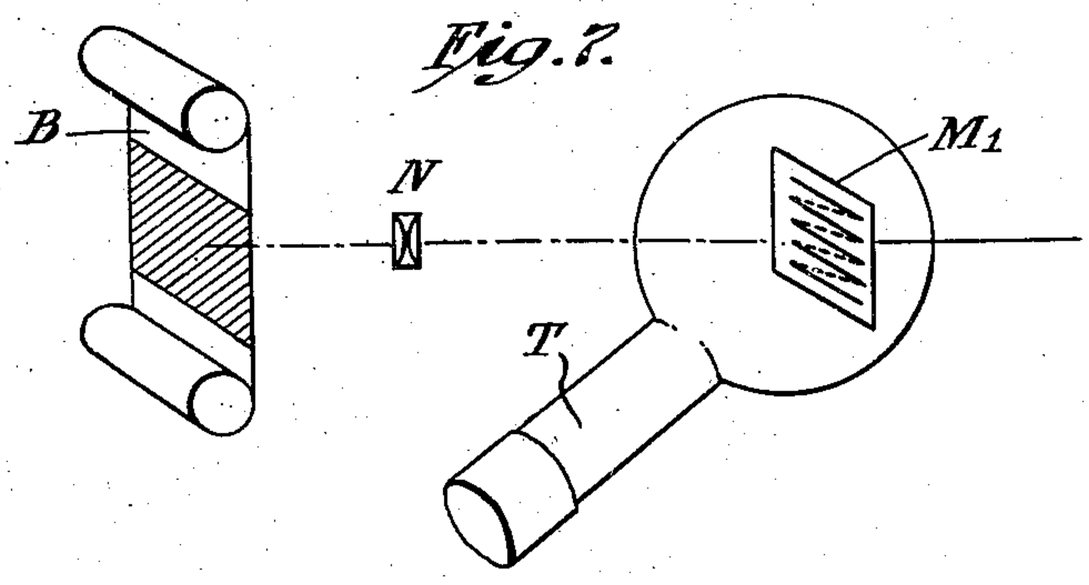


Fig. 8.

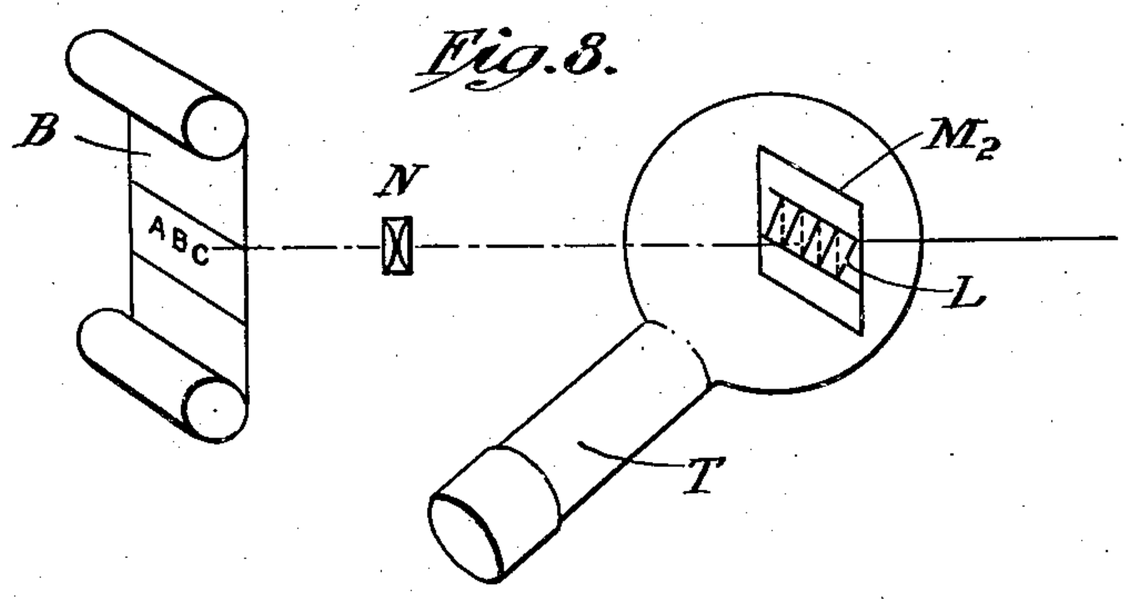


Fig. 9.

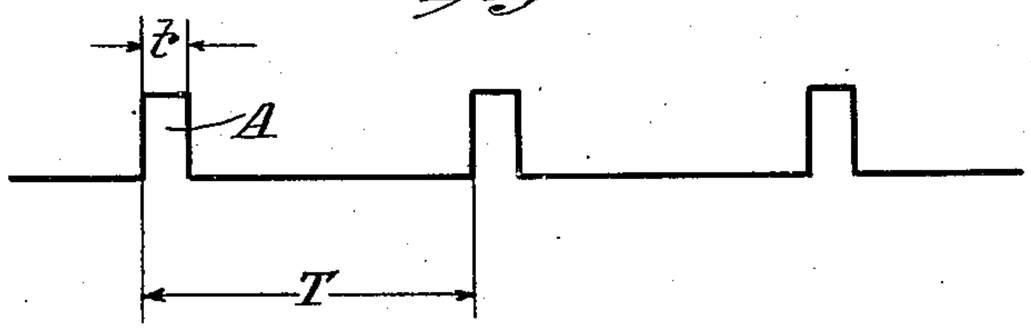


Fig. 10.

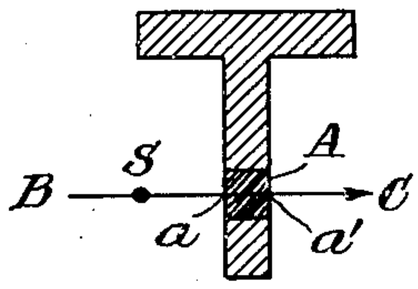
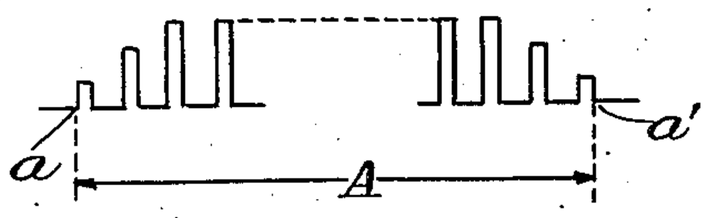


Fig. 11.



INVENTOR
JOSEPH BION
BY Robert J. Berry
AGENT

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Fig. 12.

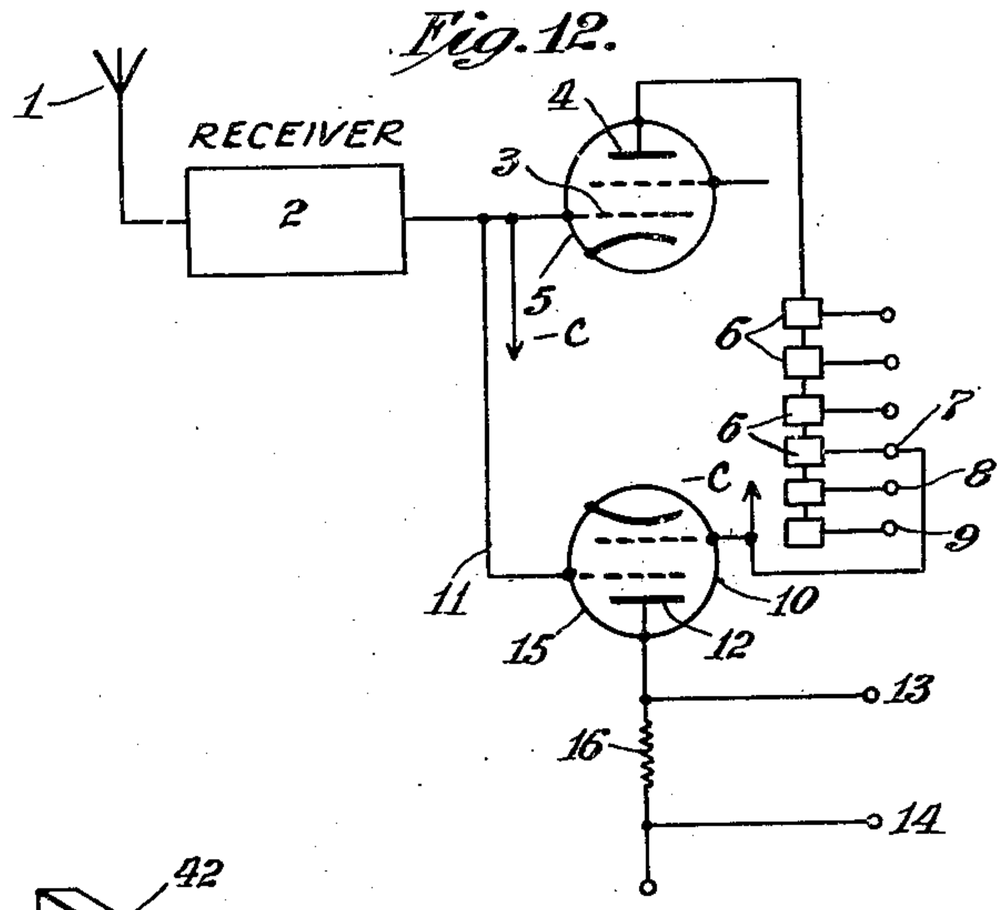
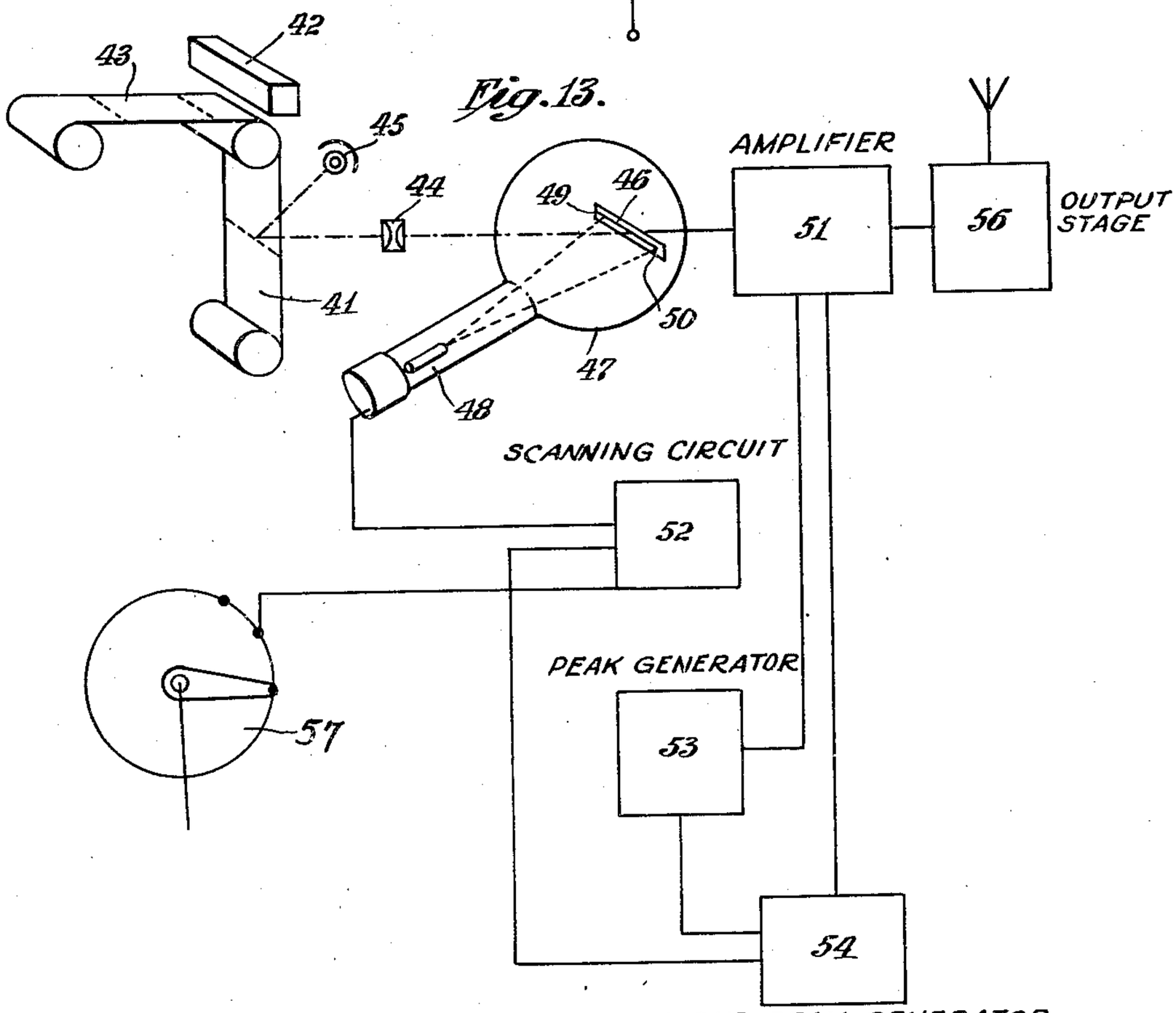


Fig. 13.



INVENTOR
JOSEPH BION
BY Robert J. Berry
AGENT

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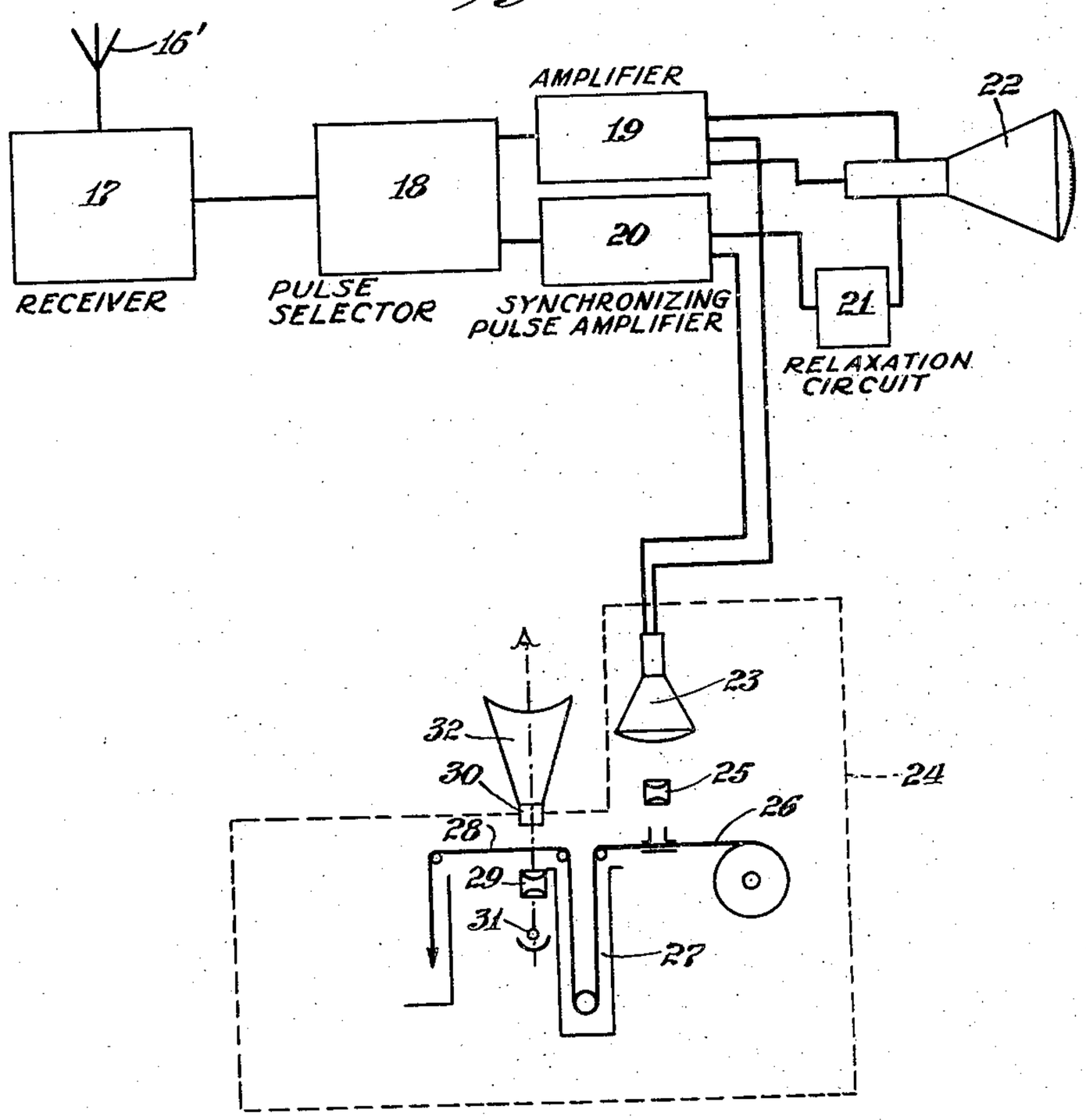
Fig. 14.



INVENTOR
JOSEPH BION
BY Robert J. Berry
AGENT

Patented Oct. 25, 1949 2,485,556

UNITED STATES PATENT OFFICE

2,485,556

FACSIMILE COMMUNICATION SYSTEM

Joseph Bion, Paris, France, assignor to International Standard Electric Corporation, New York, N. Y., a corporation of Delaware

Application May 15, 1943, Serial No. 487,193
In France December 2, 1941

Section 1, Public Law 690, August 8, 1946.
Patent expires December 2, 1961

5 Claims. (Cl. 178—6.8)

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The present invention refers to facsimile communications systems for televised communications or messages, and specifically has among its objects to provide means or systems for obtaining facsimile or television transmission, allowing a particularly high transmission speed, for example reaching the speed of a certain number of words, signs, or views in a fraction of a second.

According to certain features of the invention, a facsimile or television transmission system comprises, at the transmitting end, means for projecting the image to be transmitted (text, sketch, photographic view, or natural view) upon the screen of a television transmitting tube and means for performing a "single sweep scanning" of the projected image, i. e., said image is scanned only once, and, at the receiving end, means for controlling the electronic beam of a receiving tube, whose fluorescent or luminescent screen has luminous persistency, by the short signal obtained from the single sweep scanning of the transmitting tube screen, in order thereby to produce a record that can be read, copied, or photographed.

According to other features of the invention, a series of images to be transmitted are projected in succession, at the transmitter, upon the screen of a transmitting tube (or upon the screens of several transmitting tubes), each of these images being explored by means of a single sweep scanning. At the receiver, short signals corresponding to these explorations are transmitted in succession and directed, by any suitable process of discrimination and separation, towards different receiving tubes in order there to produce records that can be read, copied or photographed. Alternatively, the various images to be transmitted may be projected, at the transmitter, upon as many transmitting-tube screens as there are messages, the short signals resulting from each single sweep scanning of these screens being transmitted in succession.

The single scanning can be obtained, according to another arrangement of this invention, by providing a normally blocked sweep scanning circuit capable of acting upon the electronic beam only for the duration of one complete scanning or, in other words, during only one period of its voltage variation. According to another arrangement of this invention, this single scanning may be obtained by determining suitably the relative speeds of the electronic scanning of the screen located in the tube at the

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transmitter and of the movement of transition of the message in front of said screen.

A transmission system incorporating certain features of the invention may comprise, for example, means for modulating, at the transmitter, a pulse generator by means of the short variations of current or voltage obtained by the single scanning of each image. This modulation may be of any suitable type, of amplitude, of duration, or of displacement in time of the generator pulses, etc. At the receiver, means are provided for controlling the sweep scanning, preferably a single scanning, of one or more cathode-ray tubes by the received signals, an auxiliary sweep scanning being generated locally in order to obtain upon the fluorescent screen or screens facsimile reproductions of the transmitted images.

According to another feature of the invention, synchronizing signals are transmitted before each image transmission, these signals offering different characteristics from the image signals. At the receiver, a signal-selecting circuit may be provided to separate the synchronizing signals from the image signals and to route them over two different paths. According to a feature of the invention, this selecting circuit may use a filtering network comprising artificial lines.

These objects and features, as well as still others, will be explained in detail in the following description, given with reference to the accompanying drawings, in which:

Figs. 1 to 5 show schematically various methods of analyzing a film or a message tape that can be used in the systems of the present invention;

Figs. 6, 7, and 8 show schematically scanning devices of various types that can be used at the transmitting end in the systems provided by the present invention;

Figs. 9, 10 and 11 show graphs illustrating an example of application of pulses to the transmission systems covered by the present invention;

Fig. 12 shows schematically an example of a circuit arranged to be used in the receivers of systems incorporating features of the invention; and

Figs. 13 and 14 show schematically, according to certain features of the invention, transmitter and receiver circuits, respectively, of an example of a transmission system provided by the present invention.

There are already quite a few well-known communications systems whereby texts or messages of another nature can be transmitted at

a certain speed. These systems generally are based upon the use of currents of various frequencies, ordinarily low frequencies, which are selected by filters. In that case the transmissions are rated as to speed in words or signs per minute.

The problem particularly envisaged in the present invention consists, not in transmitting a certain number of words, sketches, conventional signs, or images per minute, but a certain number of words, sketches, conventional signs, or images in a fraction of a second. It is indeed particularly desirable to shorten the transmission time as much as possible, for instance in order to make possible quasi-simultaneous operation or the duplex and multiplex working of one or more links and the control of a large number of receivers ensuring the transmission of heavy traffic between two points or between numerous different points with reduced frequency congestion; likewise, in order not to occupy the air but for very short periods and hence make the transmissions less easy to decode and less easy to jam.

It becomes impossible to resort to low frequencies and receiving-filters in order to increase the transmission speed by such proportions, but the need appears of employing ultra-high frequency signals. Likewise, it becomes impossible to use, either for scanning or for the reproduction of the messages, any devices showing appreciable inertia. Therefore, the cathode-ray tube is particularly suitable for these purposes.

In order to transmit a message in a very short period of time, of the order of one twentieth of a second, for example, for a complete text, the present invention, according to certain of its features, envisages the use of message-reproducing and scanning systems of a particular type employing in a general way the scanning and image-reproducing methods used in television.

In order to transmit a message in systems incorporating features of the invention, the text or the sketch to be transmitted is arranged in front of the object glass of a television scanning device. The television transmitter will be arranged in such a way that it will scan the image presented in a very short time and by means of a single scanning of the mosaic. At the receiving end, the cathode-ray tube upon the screen of which the message is reproduced is provided with a luminous persistence screen so that the transmitted text or sketch will appear on this screen with sufficient luminosity and for a sufficient time for it to be read, copied, or recorded, by photography, for example.

However, owing to reasons that will be explained in greater detail later on, it is not possible to use ordinary television system arrangements for the desired message transmissions, and according to certain features of the invention, means are provided for ensuring such transmissions.

While the various transmission systems envisaged in the present invention will allow the transmission of half-tones, the description will be simplified by referring more particularly to black and white transmissions, i. e., the transmission of high-contrast messages with which the amplifiers used operate either at maximum or do not operate at all.

The transmitted image may be presented under different forms, on pages or on tapes, in letters or signs that are handwritten, printed, perforated, applied to a support (metallic letters on a magnetic support), traced electrically on a conductive support, etc. The particular examples that will be described concern the case of letters or signs carried by a tape that unwinds in front of the optical lens of the transmitting tube. Various methods of analyzing and of breaking down the image of the message to be transmitted will now be given with reference to Figs. 1 to 5.

In Fig. 1 is shown a supporting tape B, of paper, fabric, or other material, on which have been traced letters such as A, in black on a white background.

The tape unwinds continually in direction D and, while this tape is unwinding, the scanning is effected in the form of a crosswise sweep scanning PP′ repeated regularly, thus analyzing in lines L1, L2, etc., the letters to be transmitted, owing to the continuous passing along of tape B.

Instead of being continuous, the scanning could be accomplished intermittently, i. e., the spot would not describe a line P, P′, always at the same place, but scan a certain number of juxtaposed lines, by means of two sawtooth scanning voltages of different frequencies acting to ensure the shift. The displacement of tape B could then be continuous or proceed intermittently, the scanning being effected each time on a stationary surface.

Another embodiment alternative is shown in Fig. 2, wherein tape B1 is not scanned crosswise but lengthwise, according to lines L, each portion J1, J2, etc. representing a series of text or of letters or of sketch. Tape B1 may advance in direction D either continuously or intermittently.

These two embodiments presuppose, preferably, a single row of letters, but it is obvious that other embodiments may be envisaged, for example such as shown in Fig. 3, wherein tape B2 comprises text lines C1, C2, etc., one below the other, tape B2 being of a certain width corresponding to one line and unwinding continuously or intermittently, while the scanning by the spot is effected in the form of juxtaposed lines L1, L2, L3, etc.

Similarly, in Fig. 4, a tape B3 is unwound either continuously or intermittently and it comprises complete texts E1, E2, etc. similar to cinema film images, for example; each text corresponds to a complete transmission of a message and comprises lines F1, F2, etc., F*n*. Each of these lines can be scanned in the form of horizontal sweep scanning lines H1, H2, etc., H*n*, the final scanning ending with line H*n*.

In Fig. 5 a tape B4 comprises text lines or complete texts K1, K2, etc., that are scanned by vertical lines L juxtaposed latitudinally. The advance of the tape B4 is preferably accomplished intermittently.

Further, the various alternatives of the figures described may be carried out on a film or a large-surface tape, alone or in combination. It is also possible to use any other system already known in the scanning field, particularly for television motion pictures. It is obvious, likewise, that instead of linear scanning one may use any other desired method of scanning (circular, oblique, etc.).

The cathode-ray tube is particularly suitable for the scanning of the image, owing to its flexibility, the synchronism of its operation, its relatively small volume, and its light weight. Moreover, with a cathode-ray tube the "hunting" inherent in all mechanical systems is avoided. Inasmuch as the cathode-ray tube shows no appreciable inertia and the conditions of rapidity of scanning, of transmission during a very short period of time, and of sudden interruption of the

transmission are present in the highest degree in the systems considered by this invention, this allows taking into account only the time constants of the circuits for assuring effective synchronization, even for sudden putting into operation of the scanning circuits.

Scanning devices of two principal types may be considered. In the first, the scanning of the screen of a cathode-ray tube is projected by an optical system upon the image to be scanned. A photo-electric cell interprets this scanning either by reflected or by transmitted light. In the second, a cathode-ray tube is used provided with a mosaic or similar screen upon which the image to be transmitted is projected. This second type, being more simple, will be considered in greater detail.

In Fig. 6, the text to be transmitted is reproduced for example on a film or tape B that is unwound continuously in any suitable manner, and the photo-sensitive mosaic M of cathode-ray tube T, which may be reduced to a tape or a small surface that is narrow and very long, is scanned constantly along a line OZ by the cathodic spot that scans the image reproduced by object lens N upon the photo-electric mosaic.

In Fig. 7 a tube is used having a mosaic screen M1, this type being known under the name of "Iconoscope." Upon screen M1 is projected a substantial portion of the surface of the tape B to be scanned, and a scanning is obtained identical with that of television devices, i. e., the whole surface of mosaic screen M1 is scanned.

In Fig. 8 the device is arranged so that the scanning will be effected by vertical lines L juxtaposed latitudinally on a mosaic screen M2 upon which is projected the image of a portion of tape B.

In these various figures, different combinations may be considered for the unwinding of the film and for the scanning, it being possible for the unwinding to be continuous or intermittent. In general, it is possible to use all the analyzing systems shown in Figs. 1 to 5 or any other known analytic system for effecting the scanning at the transmitting end.

The scanning of the image having been effected in suitable fashion, the variations of intensity corresponding to the passage over the black or white portions of the message to be transmitted must be converted into current variations. In the usual television systems, the simple solution consists in modulating, through the medium of the scanning tube, an amplifier that controls the high frequency current amplitude of a transmitter. This method may be applied in systems incorporating features of the invention where the transmission speed must not be very high, but it is unsuitable for very short period high speed transmissions.

In the transmission of television images, the multiple repetition of a particular point of the white or black image upon the same spot of the screen predominates over any variation of screen luminosity due to static and disturbances of any kind. The static is not essentially of definite frequency but appears at any time, this differing from the modulating signal, which latter repeats a point of a given degree of illumination at each repetition of the scanning process. This fact, which is only of relative interest in the case of a slow transmission, assumes particular importance in the short period transmissions considered, because the difficulties are cumulative with the increase in the number of points transmitted, the causes of interference of the

image, or the widening of the band of the amplifier, each time that the frequencies are increased.

It seems, therefore, essential that each point of the image be characterized by a successive repetition of similar phenomena, but it is by no means essential that these similar phenomena be repeated for successive points according to a single repetitive law. Rather, on the contrary, according to a feature of this invention, a point may be constituted for example by the transmission of this point ten times in succession before doing similarly for the next point. Means are provided at the receiver for selecting or separating the signals, corresponding to each point, from the static or interference produced signals.

Thus a very high speed transmission system incorporating features of this invention may comprise, at the transmitter, means for transmitting an image or a text by means of short signals or ultra-high frequency peaks spaced at different intervals in time and, at the receiver, means for selecting these short signals, for example suitably arranged artificial transmission lines. These artificial transmission lines will behave for the high frequency signals as do the filters ordinarily employed in low frequency systems.

In considering Fig. 9, for example, a peak A whose duration is t and which is reproduced every T microseconds, it is possible, according to one feature of this invention, to provide the transmitter arrangement in a way to control the photoelectric amplifier in such manner that the amplifier output current shall consist of peaks and that these peaks shall have, for example, an amplitude dependent upon the luminous intensity of the point explored by the transmitter scanning.

It comes about in this fashion, for example, that a white surface may correspond to a succession of peaks of great amplitude and a black surface to a succession of peaks of low amplitude, or even extending as far as the suppression of the peaks. Stated otherwise, the white portions of the image may correspond to positive peaks and the black portions to negative peaks, in a symmetrical output circuit.

Fig. 10 shows a letter, a T, for example, which the scanning analyzes into successive points. One point of this letter, characterized by an image element A, is explored by the scanning system along line BC by means of spot S. This spot will remain a relatively short time at point A of the image, and this point may be characterized by a minimum a, a' during which a certain number of pulses control the operation of the amplifier of the scanning tube. The peaks A shown in Fig. 11 are thus obtained. A transmitter operating on waves of the order of magnitude of decimeters, for example, may then be modulated by the trains of pulses whose amplitude is controlled by the luminosity of the image at the points successively scanned, in such a way that a minimum number of pulses, ten for example, will form an elementary point of the image.

The receiver may comprise then, according to one embodiment of this invention, the circuit shown schematically in Fig. 12. Antenna circuit 1 supplies receiver 2, which, after detection of the signals, operates the grids 3 and 11 of two amplifier tubes 5 and 15. These tubes are biased so that in the absence of received pulses both of them will be grid blocked and tube 15 will conduct only when pulses are present at the same

time at both grids 10 and 11. By connecting plate 4 of tube 5 to an artificial transmission line 6 having for example taps 7, 8, 9, etc. for different transmission time delays, when a pulse unblocks grid 3 of tube 5 the peak is amplified by this latter tube and transmitted to retardation line 6, which in turn transmits it at the end of a definite time equal to the time between pulses in a train to the control grid, 10, for example, of tube 15. This grid 10 unblocks tube 15 when it receives a pulse coming from the retardation line, and when a pulse is also received at grid 11. Due to the unblocking of tube 15, pulses are transmitted to terminals 13—14 of load resistance 16, connected to plate 12, only. It will be seen therefore that the first pulse of a train of pulses does not appear at load resistance 16 because no delayed pulse is present at grid 10 at the same time that the first pulse arrives at grid 11. However, all pulses in the train subsequent to the first do appear at load resistance 16 because each pulse in the train acts as a "gate" for each succeeding pulse.

The circuit of Fig. 12 therefore ensures the selection of the pulses as distinguished from the static, because of the use of retardation transmission line 6. Moreover, while such an artificial line may be considered up to a certain point as a filtering network, it offers a substantial advantage over a filter. Every electrical disturbance finding its way into a filter is converted into a pulse of shape sine ωt. The same is not true with a retardation line, as here shown, and hence grid 10 of the tube 15 will be unblocked only at the precise instant when the initial pulse received by antenna 1 reaches this grid. It is at this identical instant that another pulse of the train arriving at grid 3, at the same time as at grid 11, can possibly appear at terminals 13, 14 of the output circuit, because when this second pulse arrives at grid 11, the first pulse, having suffered a suitable retardation in line 6, will be just on the point of unblocking grid 10. Tube 15 can operate as an amplifier or a relay only when it receives on the grid 10 thereof the pulses coming from retardation line 6.

A receiver incorporating features of the invention may further comprise a certain number of circuits similar to that of Fig. 12 or derived from that circuit. In particular, it may comprise a certain number of successively released cascade stages of triode or pentode type of electronic tubes, not unblocking an amplifier or not operating an amplifier except at the conclusion of a certain number of peaks. The selectivity of the relay circuit will then be higher or lower depending upon the arrangement and the number of releasing or unblocking occurrences.

Likewise, according to another feature of this invention, a series of different relay circuits may be controlled at the receiver by peaks of different characteristics, e. g., widths, spacings, etc., characterizing different signals. Each relay may have a different degree of retardation in its coupling circuit. This arrangement may further be simplified by combining an unblocking circuit with different taps for different retardations for unblocking different circuits, which thus ensures selections of transmission paths leading to a certain number of receiving tubes, when multiplex working is involved in the set-up.

If a message has not been properly received at a receiving point, the latter sends back to the transmitter a particular signal requesting a new scanning of the message. This scanning may be

controlled automatically or manually upon receipt of the signal requesting repetition.

In addition to the modulation of peaks as to width or duration, relative spacing, etc., such a system is applicable to the case of amplitude modulation of peaks. In fact, a large number of systems may be based upon the circuit of Fig. 12, both for radio-telephone communications and for telegraph or multiplex television transmission, especially the text transmission more particularly described in the herein described embodiment of this present invention.

According to another feature of this invention, differently spaced peaks are provided for the signals, bringing about the release of the scanning at the receiving station and the synchronization of the scannings at the transmitting and receiving ends while effecting the modulation corresponding to the black and white elements, respectively, of the image.

At the receiving terminal, the device is always in circuit and ready to operate, the scanning of the receiver being continuous but the illumination of the spot occurring only each time that the scanning spot at the transmitter passes over the black elemental points of an image that is to be transmitted. Otherwise, the scanning of the receiver need not take place except upon a special transmission signal or yet according to a given repetition frequency.

Inasmuch as the receiver is non-responsive to the transmitter when there is no modulation, hence no transmission taking place, the synchronization, according to one feature of this invention, is provided by sending at the end of each scanning line of the analyzer or scanner, a train of pulses, ten for example, whose spacing is not identical with that of the modulation pulses. This sending of pulses is controlled by the relaxation oscillator used for the exploration or scanning, and this synchronization emission takes place only during the periods when there is no modulation to be transmitted, by utilization, for example, of circuits having suitable time constants.

Any other known arrangement may also be used for controlling the sending of the synchronization pulses. Particularly, black dashes of a given duration may be caused to appear, which will determine the sending of the synchronization pulses before the beginning of each text or message.

Fig. 13 shows schematically an example of a transmitting installation incorporating certain features of this invention. In this figure, a tape 41 carries recorded thereon in any suitable manner, as above described, the matter to be transmitted. This tape, which is not necessarily to be unrolled continuously, advances in a continuous movement during the periods of transmission. In fact, inasmuch as the emission is stopped automatically during the periods when there is nothing recorded on the tape, the latter may be allowed to remain stationary when at a blank portion, even if the rest of the system is in operating condition, because there is no high frequency current at the transmitter. The recording system 42 may be of the automatic telegraph relay type or of any other type allowing a message to be recorded on tape 41. It is possible also to provide at 43 a space sufficient for writing by hand or for drawing a sketch upon tape 41.

Lens 44 projects the luminous image of the tape determined or illuminated by light source 45, by reflection, for example, upon mosaic screen

46 of scanning cathode-ray tube 47. The beam of this cathode-ray tube, generated by electron gun 48, as well known in the art, describes a line 49, 50 in continuous fashion, while tape 41 is unrolling. There follows an analysis or scanning, in the form of very closely spaced lines, of the message recorded on tape 41. The photoelectric current, thus produced, is amplified by amplifier 51. However, while scanning circuit 52 brings about the displacement of the beam on mosaic screen 46 by means of a sawtooth scanning voltage, peak generator 53 converts the modulated current of amplifier 51 into pulse trains.

The train of pulses produced by peak generator 53 have a well-defined repetition frequency or spacing. A second peak generator 54 is operated at the end of each scanning line, when the spot arrives at 50, for example, during a very short period of time corresponding to ten pulses, for example, but these ten pulses are generated at a repetition frequency different from that of generator 53.

At the receiving terminal, as at the transmitting end, the rapidity of the transmission makes desirable the use of a cathode-ray tube. Two alternative methods of reconstructing a transmitted image may be employed, either separately or in combination, viz., the direct reading or observation and the recording of the transmitting signals.

An illustrative but not limiting embodiment of one form of a receiver incorporating features of the invention is shown schematically in Fig. 14. The receiver shown in this figure may be constantly ready to function, i. e., ready to receive a message.

The scanning of the cathode-ray tube of the receiver may be performed in synchronism with the scanning selected at the transmitter. In the case where the scanning at the transmitter is such as shown in Fig. 13, receiver cathode-ray tube 22 will be scanned constantly by a lateral sawtooth voltage, at high speed, corresponding to the transmitter scanning of line 49, 50.

A second scanning is provided for cathode-ray tube 22, because the system of constant scanning in the form of a simple line could not produce an image of the transmission upon the receiving tube without the additional element of a second vertical scanning.

The receiver of Fig. 14 may comprise a collecting antenna circuit 16' and a receiver 17, supplying a pulse selector 18, is arranged according to the method indicated with reference to Fig. 12, this selector comprising the various artificial line elements making it possible to separate the synchronization peaks and the modulation signals proper.

Amplifier 19 will receive the modulation peaks and control the actuation of cathode-ray tube 22 only when signal modulation is being transmitted. The scanning also may be made continuous, nothing however, appearing on the screen while no message is being transmitted.

Amplifier 20, which receives the selected synchronization pulses, serves to control the relaxation oscillator (not shown) which latter produces the horizontal rapid scanning of lines, and relaxation circuit 21, which is intended for the relatively slow vertical scanning, may preferably be synchronized with rapid scanning amplifier 20.

The message may be read at the same rate at which it is transmitted, on the screen of cathode-

ray tube 22, which is chosen so as to have suitable persistence of luminescence.

The message may be very short or of a predetermined length, but it may not be absolutely assured that a copy can be made of the whole of this message, at the exact instant it is received. Furthermore, it may be desired to keep a record of such reception.

The receiving system shown in Fig. 14 therefore comprises means, illustrated as one embodiment only, for recording the messages while directly observing them on the screen of tube 22. This recording is rapid, in order to be able to observe very quickly a large surface of the transmitted images, either to have an idea of the whole or to search for some detail and make a sketch thereof.

For this purpose, a second indicating or receiving cathode-ray tube 23 is supplied by modulation amplifier 19 and rapid scanning amplifier 20, in order that the spot of this last mentioned cathode-ray tube shall continuously describe a line similar to that of the scanning tube at the transmitting terminal.

The fluorescent substance of the screen of cathode-ray tube 23 is chosen such that it shall be suitable for a photographic recording, i. e. have a rapid factor of decay of luminosity, while that of the screen of tube 22 has much greater luminous persistency and is of a luminous color value facilitating visual observation. Cathode-ray tube 23 is enclosed in the recording device proper, 24, and lens 25 reproduces the image of the scanning displacement of the spot upon photographic film 26, which, for example, may consist of a motion picture film insensitive to red light.

It should be noted that, since the signal is transmitted at a very high speed, further account should here be taken of the low degree luminosity of the reproduced image appearing on the screen of tube 23. One result thereof is that the dimensions of the photographed image will have to be reduced. This however does not offer any very great difficulty, because the high degree of definition of such reproductions is well known in the art. Moreover, the fact that the photographic recording is reduced in order to take better advantage of the low degree of luminosity of the screen of the cathode-ray tube for rapid scanning, makes it possible to use a very slow speed of advance of film 26, a speed that therefore may be retained without excessive wastage during the intervals between transmissions. It is clear, however, that any suitable arrangement may be provided for completely stopping the film during these intervals, if so desired.

Once exposed, film 26 may pass immediately into a continuous developing bath 27. The luminous intensity of the cathode-ray tube being always constant, on the one hand, and the unrolling or passage of the film occurring always at the same speed, on the other, the continuous development offers no difficulty and furthermore may allow the film to pass, when it comes out of bath 28, before an optical system 29, 30 comprising a hooded red-light source 31, for example, and an optical observation system 32. This latter allows an observer to see an enlarged image of the film and to observe a relatively large area of the latter. The film may then be washed and fixed according to the usual methods, as well known in the photographic art.

The embodiment just described as an example therefore allows the transmission and reception

of messages or images whose duration is of the order of one twentieth of a second. It is clear, however, that numerous modifications and adaptations may be made thereof, as also of the other arrangements described, without departing from the scope of the invention.

What is claimed is:

1. A television system in which each picture point is represented by a plurality of pulses comprising means for generating electrical signals corresponding to an image to be transmitted, means for generating pulses having a predetermined time spacing, means coupled to said first two means for combining said signals and said pulses, means coupled to said combining means for transmitting the output signals of said combining means and means for receiving said signals comprising a first electronic tube comprising control and output electrodes, a second electronic tube comprising control, output and ancillary controlling electrodes, means for coupling said received signals to said control electrodes, a delay network connected between the output electrode of said first tube and the ancillary electrode of said second tube for delaying the output of said first tube for a time equal to the interval between said pulses, an output circuit connected to the output electrode of said second tube and means for biasing said control electrodes, the bias applied to said second tube being sufficient to prevent operation of said second tube in the absence of signals at both said control and ancillary electrode of said second tube.

2. In a television system in which each picture point is represented by a plurality of pulses a receiver for receiving trains of spaced pulses, including signal receiving and amplifying means, means for selective discrimination of pulses according to the spacing of said pulses, a cathode-ray tube having a fluorescent screen, means for controlling the cathode ray of said tube by said selected pulses, and means for scanning the screen of said tube in two dimensions by the cathode ray thereof, said screen having a luminous persistence sufficient to allow reading of the reproduced image appearing thereupon.

3. Television receiver according to claim 2, and further including second means for selective discrimination of pulses according to the spacing of said pulses, said means being selective of pulses having a spacing different from said first-mentioned selected pulses, a separate amplifier responsive to said pulses selected by said last-mentioned selected pulse signals and means connecting the output of said amplifier to at least one of said means for scanning said tube screen.

4. A television system in which each picture point is represented by a plurality of pulses comprising means to scan an image in a predetermined manner and to produce electrical signals dependent upon the characteristics of said image, means to break up the signal produced by said scanning into repetitive peaks, there being a plurality of said peaks for each elemental area of said image and said peaks having a predetermined constant repetitive rate, means for transmitting the signals thus produced, means for receiving the signals so transmitted, means for separating the signals thus received from undesired interference signals, said means comprising a pair of circuit channels, means to feed the signals into said channels, a retardation line in one of said channels for delaying the signals in said channel for a time equal to the interval between said peaks, a common output circuit for said channels, means for causing said output circuit to respond only when signals appear simultaneously at the ends of said channels, and means to reconstitute the signals appearing in said output circuit into a visible image.

5. A television system according to claim 4, in which additional repetitive peaks are provided at spaced intervals of said scanning for synchronizing purposes, said peaks having a different repetition rate from that of said repetitive peaks constituting said signal, and means for separating said synchronizing peaks from said signal peaks comprising a pair of circuit channels, a retardation line in one of said channels for delaying signals in said channel for a time equal to the interval between the peaks of said synchronizing peaks, means to feed the received signal into said channels, a common output circuit for said channels, and means to cause said output circuit to respond only when signals reach the ends of said channels simultaneously.

JOSEPH BION.

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