

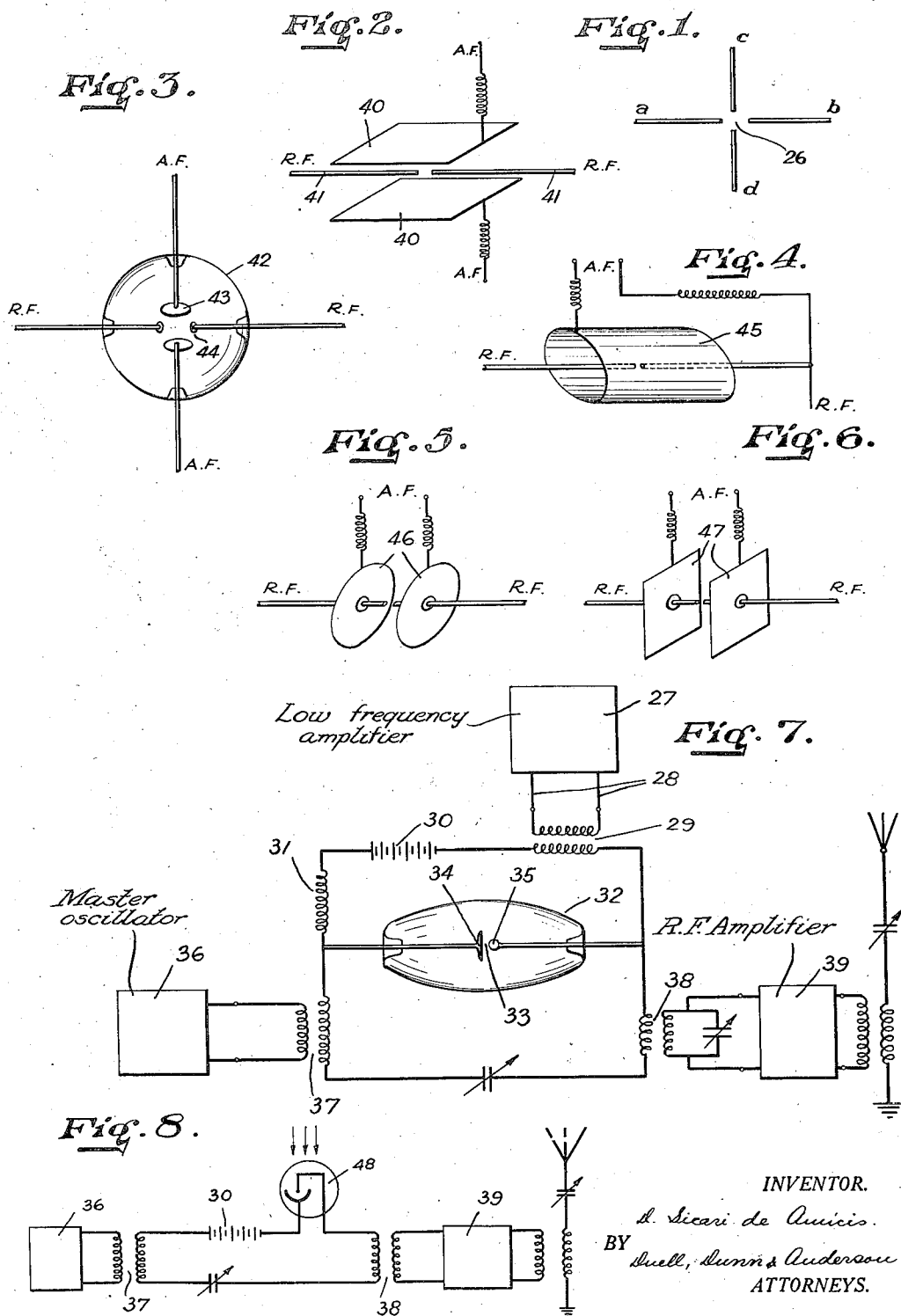
April 30, 1935.

D. SICARI DE AMICIS

1,999,686

HIGH FREQUENCY MODULATION SYSTEM

Original Filed June 27, 1929



INVENTOR.

D. Sicari de Amicis.

BY *Quell, Dunn & Anderson.*
ATTORNEYS.

UNITED STATES PATENT OFFICE

1,999,686

HIGH FREQUENCY MODULATION SYSTEM

Domenic Sicari de Amicis, Jersey City, N. J.

Application June 27, 1929, Serial No. 374,053

Renewed March 22, 1935

2 Claims. (Cl. 179—171)

This invention relates to television and more particularly to methods of and means for transmitting images and electrical phenomena with greater definiteness and efficiency.

5 The general object of the invention is to provide a system of radio communication, particularly television, in which a single wave of predetermined and constant frequency may be employed for each communication channel, the single wave being suitably controlled to carry out the objects heretofore intended to be accomplished by a band of waves.

10 In order to suitably analyze an image at a sending station, and effect concomitant composition at a receiving station, it is customary to use a plurality of waves of varying wave lengths, the different waves being utilized at different frequencies. Thus, it has heretofore been customary, for television purposes to use a carrier wave, in the radio frequency range, and a signal wave, generally in the audio frequency range, the combination necessitating a band of waves ranging to 100 kilocycles. This is due to the system of transmission and modulation employed, the modulation of the carrier wave by the signal and its subsequent amplification resulting in an output which is a function of the characteristic of the tube.

15 Applicant proposes to provide a new system of wave transmission and modulation by utilizing a single wave of desired frequency, whose modifications in form and character will be carried on by varying the resistance of a gap between electrodes in an ionization tube serving a circuit therefor.

20 A feature of the invention therefore resides in the provision of a tube employing one or more pairs of electrodes positioned with respect to a gap, whose resistance is varied responsive to change in the character of a circuit served by some of said electrodes. Thus, for example, an ionization tube may be employed in combination with an audio frequency amplifier, the resistance of a gap between electrodes in the tube being varied responsive to changes in wave form characteristics of the audio frequency signal. By utilizing a master oscillator, or the like, producing a constant frequency wave, changes in form of the wave may be effected by employing the resistance of said gap to vary the E. M. F. of the constant characteristic wave. A radio frequency amplifier has its output correspondingly varied and hence is enabled to transmit a single wave of constant frequency whose resultant form has the same effect as the sum of the audio frequency and

radio frequency sinusoidal component waves now have, except that applicant eliminates the side bands encountered in the present system.

Other objects and features, making for efficiency, economy and dispatch, in the art of television, will be apparent from the following description read in connection with the accompanying drawing, in which:

Fig. 1 is a diagrammatic illustration of a plurality of electrodes adapted to be used in an ionization tube designed to carry out applicant's method of wave transmission and control;

Figs. 2 to 6 illustrate different ensembles of electrodes constituting variations of the arrangement shown in Fig. 1, and

Figs. 7 and 8 are diagrammatic circuit arrangements illustrating two applications of applicant's system.

25 The beam of light employed in combination with scanning mechanism is usually arranged in combination with a sensitive photo-electric cell or tube, which is connected with a suitable electric circuit, the cell acting as a valve controlling a current depending upon the character of the light affecting the cell. The current accordingly varies responsive to the intensity of the light, which depends upon the degree of darkness of the particular point of the image reflected by the beam. For better transmitting this current, and in order to avoid using the wide band of waves usually employed in transmission of this character, applicant proposes to employ a new system of transmission and wave control, whereby this current, acting as a signal carrier, will be used to modulate a wave of constant frequency and certain character, which may be employed in the nature of a carrier wave. Thus, in Fig. 1, is shown diagrammatically an arrangement of electrodes in a tube designed to carry out such a system of transmission and modulation. 40 It may be assumed that electrodes A and B, within an ionization tube are arranged to serve the circuit whose E. M. F. varies responsive to the intensity of the light falling on the photo-electric cell. As may be noted, electrodes A and B are separated by a gap 26. As the current varies, the resistance of gap 26 between electrodes A and B will also vary. This variation corresponds to the variation in the character of the current. In other words, the resistance of the gap will vary in accordance with the variation of the composite curve representing the varying intensity of the light affecting the photo-electric cell. The electrodes C and D may be arranged within the tube, as shown in Fig. 1, and also be separated by a gap 26. 55

rated by gap 26. These electrodes may be used in a circuit of carrier current, suitably produced or impressed, and of constant curve characteristic. While this current may be represented by a constant curve in its primary character, it will necessarily be affected if subjected to the resistance of gap 26, which is a variable. The carrier current will, therefore, be modulated and in final form be represented by a single wave which is of constant frequency and whose amplitude curve reflects the variations in the signal. This is diagrammatically illustrated in the circuit drawing shown in Fig. 7. As shown, numeral 27 may represent an audio frequency amplification arrangement, and, in television, the circuit including leads 28 will carry the current, of audio frequency range, reflecting the variable current whose character is determined by the intensity of the successive beams of light falling on the photo-electric cell. Transformer 29, current source 30, coil 31, and ionization lamp 32, are included in a circuit carrying the audio frequency signal. Gap 33 between electrodes 34 and 35 provides a resistance which will vary responsive to variations in the signal. A master oscillator 36 is provided to supply a source of radio frequency current of a single frequency and constant wave character. As illustrated, this radio frequency current through transformer 37 and the circuit shown, will be modulated by the variation in resistance of gap 33, due to the variation in the character of the signalling current. Since the electrodes 34 and 35 also serve the radio frequency or carrier current circuit, the carrier wave will be varied responsive to changes in the resistance of the gap. This modulated carrier current will, in effect, be in the form of a wave of a single frequency whose amplitude varies responsive to the changes in resistance across the gap between electrodes 34, 35. Thus, the output at transformer 38 will be a variable equal to the modulated form of the constant carrier wave. By means of a suitable radio frequency amplifier 39, the modulated wave may be broadcast or transmitted by wired systems, in any desired manner.

In Figure 8, a circuit arrangement similar in operating effect to that of Fig. 7, is illustrated. The parts similar to those illustrated in Fig. 7 serve similar functions. In this embodiment, photo-electric cell 48 is shown provided with a pair of electrodes forming a gap. The resistance of the gap will vary responsive to variations in the image to which the lamp reacts. The signal will accordingly serve to vary the E. M. F. of the constant characteristic wave constituting the carrier or radio frequency current.

The system, therefore, employs a single wave of desired character whose modulation is carried on by a change in resistance between electrodes serving a variable source. Applicant thus limits himself to a single carrier wave and produces a system based on a valve essentially distinct in its modulating effect and in its formation of a

composite wave having all the characteristics of a band of waves of varying frequencies and curve characteristics.

In Figs. 2 to 6 are illustrated various arrangements of electrodes suitable for applicant's purpose. Thus, in Fig. 2 metallic elements 40 constitute electrodes connected to leads in the signal or audio frequency circuit, whereas electrodes 41 serve the carrier or radio frequency circuit. The enveloping tube is not illustrated, but it will be understood that the electrodes are suitably arranged within an ionization tube containing any desirable gas, such as neon or the like, or exhausted, if preferred. The electrodes are separated by a gap which serves both sets of terminals for the purposes hereinbefore outlined. In Fig. 3 the electrodes are illustrated with terminals variously formed and suitably positioned within an envelope 42. In this illustration the electrodes 43 may have terminals greater than those of electrodes 44. In Fig. 4 cylindrical terminal 45 is shown as a terminal on one side of the audio frequency circuit, the other side terminating in a common terminal serving the radio frequency arrangement as well. In Figs. 5 and 6 the terminals 46 and 47 constitute electrodes mounted on the electrodes serving the radio frequency side. It is patent that numerous arrangements may be improvised for carrying out applicant's objects. It may be noted that in all the various forms illustrated the terminals of larger area serve the audio frequency arrangement, and this is deemed preferable.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The method of transmitting low and variable frequency signal currents which comprises producing a constant high frequency carrier current, producing an ionizing discharge, by the application of a constant ionizing potential, varying the ionization current by the application of additional ionization potentials proportional to the low frequency signal currents to be transmitted, and varying the amplitude of said carrier current by means of the varying ionization currents.

2. A transmission system comprising an oscillator circuit containing a master oscillator for generating a constant frequency carrier current, a modulator circuit connected inductively to said oscillator circuit, a transmission circuit for transmitting a modulated carrier wave, connected inductively to said modulator circuit, an ionization device containing a pair of electrodes connected in series in said modulation circuit, an ionizing current source of fixed potential in series with the electrodes in said device, a low frequency signal current source, and means for applying additional and variable ionization potentials proportional to signal variations from said signal current source to said device to variably ionize the gas therein so as to vary the resistance between said electrodes and in said modulator circuit.

D. SICARI DE AMICIS.