

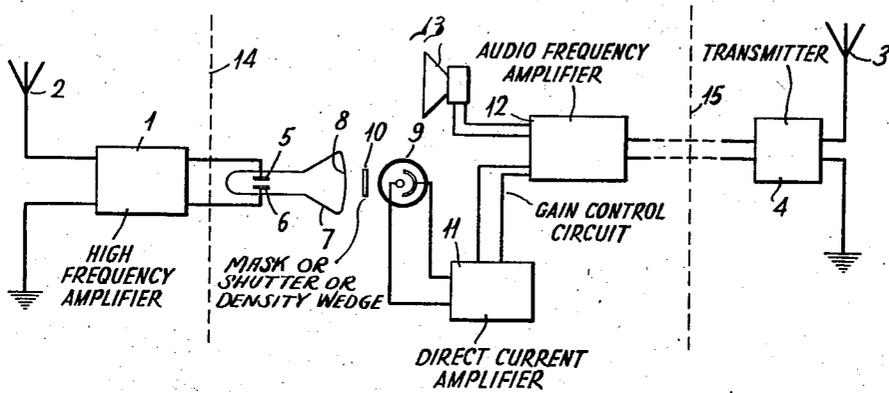
Dec. 19, 1939.

O. E. KEALL

2,183,717

MODULATION CONTROL SYSTEM

Filed Oct. 26, 1937



INVENTOR  
O. E. KEALL  
BY *H. S. Hoover*  
ATTORNEY

# UNITED STATES PATENT OFFICE

2,183,717

## MODULATION CONTROL SYSTEM

Oswald Edward Keall, Essex, England, assignor  
to Radio Corporation of America, a corporation  
of Delaware

Application October 26, 1937, Serial No. 171,053  
In Great Britain November 5, 1936

1 Claim. (Cl. 179—171.5)

This invention relates to modulated carrier wave transmitting apparatus and more particularly to automatic modulation monitoring systems for use in radio and like transmitters. By the term "automatic modulation monitoring systems" as employed in this specification is meant systems wherein modulating signals are automatically controlled in value so as to prevent overloading or under-loading (or both) of a transmitter.

Manually operated modulation monitoring systems are well known in connection with radio systems, but such systems offer the serious defect that in practice it is not possible to reduce an excessive degree of modulation until after over-modulation has in fact occurred, a time lag of two or three seconds being quite usual. Further, in the case of radio transmitters modulated with music signals, there is the difficulty that certain forms of over-modulation, for example over-modulation due to percussion effects in an orchestra, which last but a fraction of a second, and which may result in the tripping of a circuit breaker and thus interruption of the service, are almost impossible to control manually unless previous warning is given.

The object of the present invention is to overcome these difficulties and to provide a rapidly acting and reliable automatic modulation monitoring system.

According to this invention an automatic modulation monitoring system comprises an oscillograph which is subjected to signals corresponding to the modulated carrier wave in such manner that the length of "sweep" of said oscillograph is a function of the degree of modulation of said wave and means including a light sensitive device and associated light control device for automatically controlling the modulation input to the transmitter to be modulated in dependence upon the length of said "sweep". The light control device may, for example, be a mask or shutter or it may be a so-called "density wedge".

The invention is illustrated in the accompanying drawing which shows schematically one embodiment thereof as applied to an ordinary radio transmitter.

Referring to the drawing the automatic modulation monitoring system therein illustrated comprises a high frequency amplifier 1 which is fed with and amplifies modulated carrier wave derived from a suitable point in the transmitter. For example, as shown, the high frequency amplifier 1 may be fed from a receiving aerial 2 which is radiation coupled with the transmitting

aerial 3 of the transmitter 4 to be monitored. The output from the high frequency amplifier 1 is fed to a pair of deflector plates 5, 6 in a cathode ray oscillograph tube 7 having a fluorescent screen on its end wall 8. It will be appreciated that with this arrangement the high frequency output from the amplifier 1 will deflect the cathode ray in the cathode ray tube 7 and produce upon the screen at 8 a straight line whose length will depend on the degree of modulation in the carrier wave. Positioned to be activated by light from the screen of the cathode ray tube is a photo-electric cell 9 and between the said cell and the said fluorescent screen at 8 is a suitably dimensioned and shaped mask or shutter 10 which is constructed in accordance with the degree and nature of the monitoring control desired. In place of using a mask or shutter at 10 a so-called "density wedge" or combination of "density wedges" may be employed. One well known form of "density wedge" consists of a piece of plane glass coated with a light sensitive emulsion which has been exposed to light and suitably treated thereafter so that the density or transparency of the "wedge" varies over the length thereof in a desired predetermined manner. The output from the photo-electric cell 9 is amplified by a direct current photo-cell amplifier 11 the output from which is utilized to control the modulation input to the transmitter; for example, the said output may be utilized as gain controlling grid bias upon one or more tubes in an audio frequency amplifier 12 interposed between the sound pick-up microphone 13 or other modulation signal source of the transmitter and the rest of the transmitter at 4. The apparatus shown in the figure between the broken lines 14, 15 may and preferably is all located in the studio.

Suppose the arrangement is such that with an unmodulated carrier the length of line or "sweep" on the fluorescent screen at 8 is a quantity  $a$ . Then when the carrier is fully modulated the length of line will be a quantity  $2a$ . Suppose the apparatus is such that 80% modulation is regarded as the maximum permissible. Then the mask or other light control device 10 interposed between the fluorescent screen of the tube and the cell 9 will be of such length as to obscure (as respects the cell) a length of line up to  $1.8a$  so that it is only when the line exceeds  $1.8a$  in length that any light falls upon the cell and any control is exercised in the direction of decreasing the modulation signal input.

A system as above described is adapted automatically to prevent over-modulation, but ob-

5 viously if it be desired to prevent under-modulation this may be effected by suitably arranging a mask and gain controlling photo-cell unit so that the gain as respects modulation signals is automatically increased if the length of line or "sweep" on the fluorescent screen of the tube falls below a predetermined minimum. Obviously, by a suitable arrangement of cells and mask, it is possible automatically to prevent both over-modulation and under-modulation.

10 It will be appreciated that an advantage of the present invention is that there is considerable scope for variation as to adjustment to meet varying conditions likely to be encountered in practice especially if a "density wedge" or "wedges" are used at 10. The time constants of the various circuits may be made adjustable and the degrees of amplification of the amplifiers, e. g., the degree of amplification of the direct current amplifier for the cell, may also be made capable of adjustment.

20 By suitably disposing the light control device and photo-cell apparatus it is possible so to arrange matters that one end of the "sweep" on the fluorescent screen of the tube is conveniently visible to the eye of an observer, and if this be done the apparatus will also constitute a visual indicator of the degree of modulation.

I claim:

In a modulation control system to be used with signaling means wherein wave energy is modulated as to amplitude by signal wave energy, a transmitter, a source of modulating potentials, a modulating potential amplifier connecting said source of modulating potentials to said transmitter, a gain control circuit for said amplifier, amplifying means excited by modulated energy radiated from said transmitter, a cathode ray tube having deflecting plates connected with said amplifying means, said cathode ray tube producing a ray the extent of deflection of which is a function of the amplitude of the amplified wave energy radiated from the transmitter, a light sensitive device adjacent said cathode ray tube to be controlled by the ray produced thereby, a direct current amplifier connecting said light sensitive device to said gain control circuit of said modulating potential amplifier, and a light control device in the form of a density wedge interposed between said light sensitive device and said cathode ray tube for limiting the time during which said ray produced in said cathode ray device reaches said light sensitive device to thereby control the gain of said modulating potential amplifier.

OSWOLD EDWARD KEALL.