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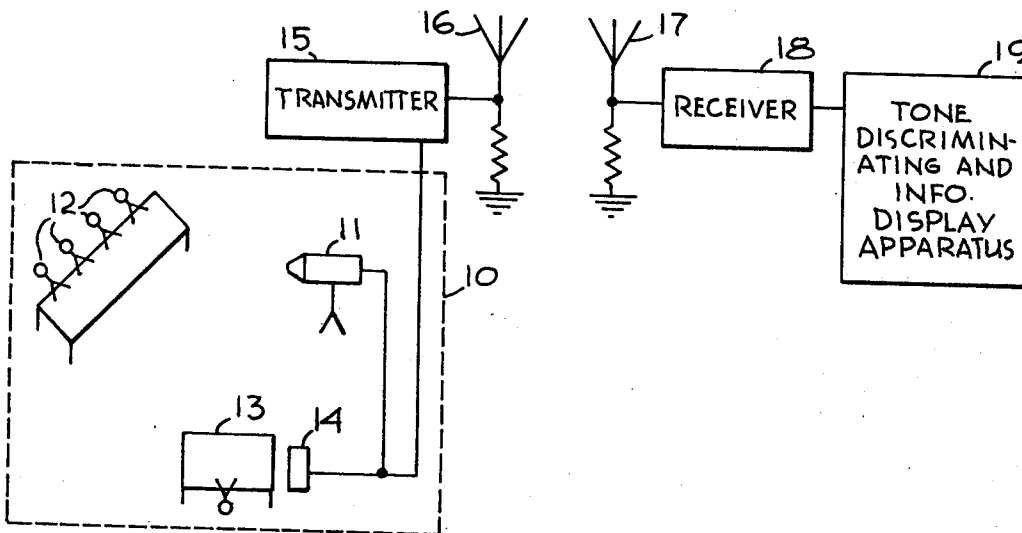
[54] **tone signal communications apparatus**
 5 Claims, 2 Drawing Figs.

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 178/5.8, 343/225
 [51] Int. Cl..... H04b 7/00,
 H04q 9/00
 [50] Field of Search..... 340/171;
 178/5.8; 343/225; 340/224, 332

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ABSTRACT: The present invention provides the means by which one or more signals can be employed to operate one or more load devices. Embodiments of the invention have widespread application, but are particularly useful in the broadcast field where these tone signals can be generated in the broadcast studio and then, via radio or television, received in the home where they can be made to operate apparatus that will display to the home listener or viewer the information represented by these tone signals. In this way, the home listener or viewer is directly involved and made a participant of the program being broadcast.



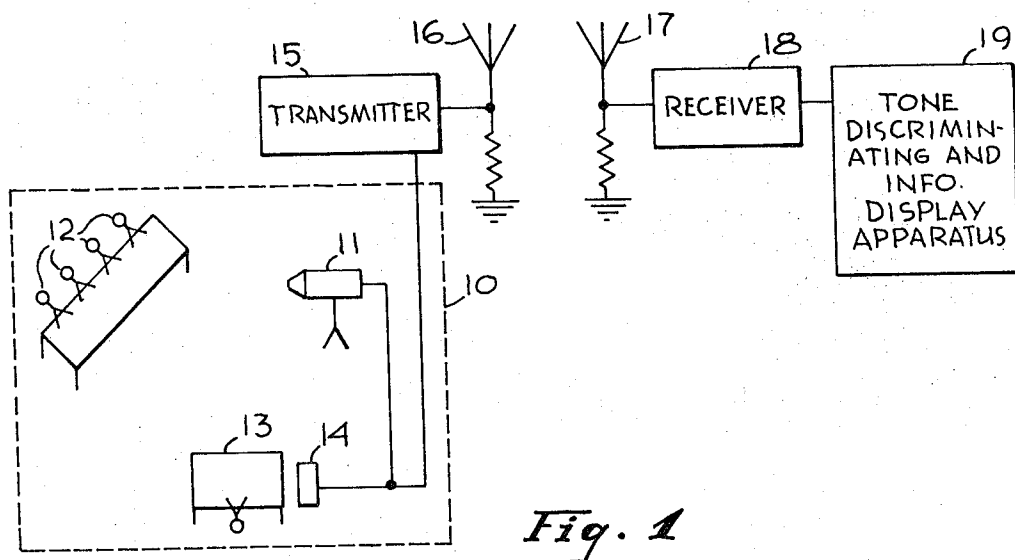


Fig. 1

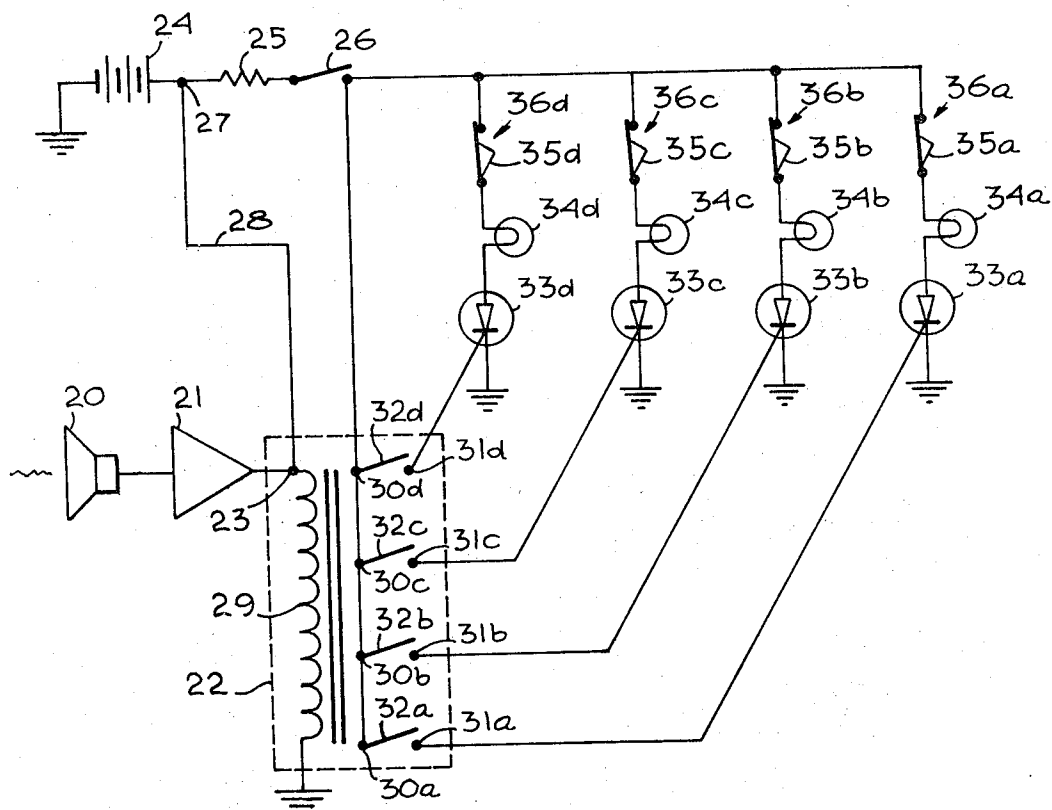


Fig. 2

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TONE SIGNAL COMMUNICATIONS APPARATUS

This application for patent is a continuation-in-part of the earlier application filed Dec. 29, 1965, and having Ser. No. 517,408. Accordingly, said prior application is abandoned with the filing herewith of this continuation-in-part.

The present invention relates in general to systems of communication and more particularly relates to such a system in which communications are accomplished by means of tone signals in the audible range.

Although the present invention has application to a wide variety of fields, such as sports, games, radio and television broadcasting, education, etc., for sake of clarity and expediency, the invention will be described and illustrated herein in connection with only one of these fields. Thus, in the field of television or radio broadcasting, for example, there are certain programs where audience participation, particularly home audience participation, is desirable because it provides a much higher degree of rewarding and satisfying entertainment to the general public. However, although attempts have been made in the past to involve the home audience, such as by flashing or whispering information to the home viewer or listener that is not yet known by the program participants, home audience participation and involvement has nevertheless been very limited, primarily because those in the home audience could not themselves take active steps that would involve them in the program being broadcast, that is to say, they were forced to be passive by the very nature of things. Equally important is the fact that participation was limited to and dependent upon the memory of the viewer or listener. In this latter instance, participation in any program could obviously be only as good as the participant's memory or powers of retention.

The present invention significantly and materially overcomes the limitations mentioned by providing a tone discriminating and information display apparatus that makes direct involvement and participation of the home audience with the studio program entirely possible. The umbilical cord that binds the home audience to the broadcasting studio are certain tone signals that are generated at the studio and received in the home, the apparatus of the present invention responding to one or more of these tone signals to annunciate in some manner, such as by light or buzzer, the information represented by these signals. A tone discriminating and information display apparatus according to the present invention is compact, of simple construction and inexpensive, thereby making a system of communications between the broadcast studio and the home entirely practical. Of equal importance is the fact that the medium of communications is sound, in the form of discrete tone signals, a medium that is currently being used and, therefore, one that poses no problems.

It is, therefore, an object of the present invention to provide a system of communicating by tone signals between distant points.

It is another object of the present invention to provide in the broadcasting art an audience participation system based on the use of tone signals as a communicating medium.

It is an additional object of the present invention to provide an apparatus by means of which information in the form of tone signals can be received for annunciation.

It is further object of the present invention to provide apparatus by means of which certain types of loads and load circuits can be operated in response to tone signals.

The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawing in which an embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description only and is not intended as a definition of the limits of the invention.

FIG. 1 is a basically a block diagram of a tone transmission and receiving system as it may be adapted and designed for audience participation purposes in the broadcasting art; and

FIG. 2 is a schematic circuit of a preferred embodiment of a tone discrimination and information display apparatus that may be used in the FIG. 1 system.

Referring now to the drawing for a detailed understanding of the invention, the FIG. 1 system is shown to basically include a broadcasting studio 10 having the usual TV cameras 11 in suitable locations for televising the participants 12 engaged in a program of some type, such as a quiz program, with a moderator 13 having access to a tone-control device 14 that is so manipulated by the moderator as to selectively generate different tone signals that are within the audible range, each being indicative of a certain type of information, such as "Yes," "No," "True," "False," multiple choice numbers 1, 2, 3, 4, etc. The televised images as well as any tone signals that may have been produced are fed to a transmitter 15 wherein they modulate a carrier signal or wave generated within the transmitter for transmission via antenna 16. The tone signals may be generated and, therefore, transmitted individually or in pairs or in any combination that will represent given pieces or bits of information that have to be utilized in a given manner.

Camera 11, transmitter 15, and antenna 16 are certainly standard pieces of equipment and all are well known in the art. Accordingly, no further description of them appears to be necessary. The same thing may be said of tone-control device 14 which is nothing more than a plurality of individually controlled and operated oscillators with each tuned to a different frequency. As is well known by those skilled in the art, oscillators of the kind involved in this invention are very commonplace devices and, therefore, no further showing or description of them is deemed necessary here. Accordingly, suffice it to say that there are as many different oscillators as different tone signals used, each, when activated, producing a signal for a predetermined period of time.

The modulated carrier is intercepted by a home receiver antenna 17 which feeds the signal to a receiver 18 which may be either a radio or television set. Since a television broadcast has already been assumed here for illustrative purposes, it will therefore likewise be assumed that receiver 18 is a television set wherein the modulated carrier is demodulated to reproduce not only the original picture and utterances of the program participants, but also the original tone signals generated in the studio by tone-control device 14. As they are regenerated, these tone signals are propagated throughout the surrounding space, with the result that they are ultimately received by tone discriminating and information display apparatus 19 which, in response thereto, is activated to annunciate in some manner, such as by panel lights, the information intended to be conveyed by these tone signals. Thus, in this way, the home viewer and/or listener can be brought into direct involvement with the program being presented, such as a game or contest of some sort. Of course, two-way communications are available with the aid of the telephone.

Antenna 17 and receiver 18, whether the latter be a radio or TV set, are commonplace items and no detailed showing or description of them is deemed necessary here. With respect to tone discriminating and information display apparatus 19, however, this apparatus involves an entirely new combination of elements and, therefore, to obtain a full understanding of its construction and operation, reference is now made to FIG. 2 wherein this apparatus 19 is schematically illustrated.

As shown therein, it includes a conventional microphone 20 coupled to an audio amplifier 21, the amplifier output, in turn, being connected to a frequency selective vibrating reed relay 22. The junction between amplifier 21 and relay 22 is designated 23. The apparatus also includes a voltage source, such as a battery 24, a resistor 25, and an ON-Off switch 26, the resistor being connected between one terminal of the switch and the positive terminal or anode of the battery, the negative terminal or cathode of the battery being connected to ground. As shown in the FIG., the junction between battery 24 and resistor 25 is designated 27 and this junction is connected directly to junction 23 by means of line 28.

With respect to relay 22, it includes an energizing coil 29 whose terminals are connected between junction 23 and ground. It also includes a first set of contact terminals 30a—30d, a second set of contact terminals 31a—31d, and a set of vibrating reeds 32a—32d, the reeds respectively being connected at one end to terminals 30a—30d and slightly spaced or separated from terminals 31a—31d at their other end. The reeds mentioned herein are designed to vibrate at specific or discrete frequencies only and, therefore, in electronic parlance, each reed is the mechanical equivalent of a sharply tuned electronic circuit. In this regard, the reeds are of different lengths so that they might vibrate at respectively different frequencies. Reeds such as these vibrate in response to signals applied to them at the frequencies for which they were designed to vibrate, and when they vibrate, the amplitude of the vibrations continues to grow until the free end of the reeds makes contact with the terminals from which it has been separated. The whole thing takes only a fraction of a second and it can therefore be seen that the reeds and their associated contact terminals are nothing more than a plurality of frequency discriminating switches that close in response to signals having the frequencies for which they were respectively designed. Vibrating reed relays of the kind therefore heretofore described are manufactured by and may be purchased from the Bramco Controls Division of Ladex Inc., College and Self Streets, Piqua, Ohio.

Finally, the apparatus includes a plurality of silicon controlled rectifiers 33a—33d, a plurality of lamps or pilot lights 34a—34d and a corresponding plurality of switches 35a—35d, the rectifiers lamps and switches respectively being connected in series to form four identical circuits, generally designated 36a—36d, that are connected in parallel between ground and the output terminal of On-Off switch 26. As may be seen from the FIG., this output terminal of switch 26 is also connected directly to terminals 30a—30d, terminals 31a—31d, on the other hand, respectively being connected directly to rectifiers 33a—33d to provide the control needed in the operation of these rectifiers, as will be seen later. As may also be seen from the FIG., in each of the series-connected circuits 36a—36d, the rectifier anode is connected to ground whereas the cathode thereof is connected through the associated lamp and switch to switch 26, and it should be mentioned that it is immaterial whether the cathode connects directly to the lamp or to the switch, that is to say, it is immaterial whether a lamp is mounted between the rectifier and the switch or a switch mounted between the rectifier and the lamp. Insofar as switches 35a—35d are concerned, they are preferably of the momentary break type which are customarily spring operated.

Considering now the operation of this tone discriminating and information display apparatus, it will be assumed that switch 26 has been closed and, therefore, is in its On position. Accordingly, when a tone signal is transmitted and thereafter reproduced by receiver 18, as aforesaid, the same tone signal is subsequently incident upon microphone 20, which, in response thereto, produces and applies a corresponding electrical oscillation to amplifier 21 which materially increases its power. This electrical oscillation is applied to relay coil 29 which has already been positively biased by a small DC current going through it as a result of its connection to battery 24, the purpose of the bias being to maximize linearity and thereby minimize distortion of the oscillations when they are applied to the reeds. By minimizing distortion, the disturbing effects of harmonics on the reeds are also minimized. In response to the electrical oscillation applied to it, coil 29 produces an electromagnetic oscillation which, depending upon the frequency of said oscillation, affects one of the reeds until, in accordance with the principles previously explained, the relay switch controlled by that reed is closed. By way of example, if reed 32a is designed to operate or function at a frequency of 1600 cycles per second, then an incoming tone signal at a frequency of 1600 cycles per second will cause reed 32a to make contact with terminal 31a. The same results would be obtained with the other reeds, namely, reeds 32b—

—32d, when tone signals corresponding to their natural frequencies of vibration are received.

When a reed makes contact with its terminal as described, the silicon controlled rectifier to which it is connected is thereby triggered into operation, with the resultant that the panel light in the associated series circuit is lighted to annunciate the information that this light represents. Again by way of example, when reed 32a closes to make contact with terminal 31a, rectifier 33a, which is normally inoperative, is triggered into operation, with the result that electrical current is now able to and does flow from battery 24 through lamp 34a. Consequently, lamp 34a lights up to provide the home viewer or listener with the information that lamp 34a represents, namely "True," "False," "Yes," "No," 1, 2, 3, or 4, or information of a similar nature. Needless to say, the operation just described in connection with reed 32a and series connected circuit 36a is equally valid for the other reeds and circuits in the FIG., except that they will operate when tone signals having their particular frequencies are received. For purposes of emphasis, it should once again be mentioned that more than one tone signal may be transmitted and received, either simultaneously or in succession, so that more than one reed and more than one light may be affected within any interval of time. It should also be mentioned here that although four reeds 32a—32d and series connected circuits 36a—36d have been shown and described, more than or fewer than this number of reeds and circuits may be used or incorporated in an embodiment of the present invention.

Considering the operation of the FIG. 2 apparatus still further, the characteristics of a silicon controlled rectifier is such that once it is triggered into operation and becomes conductive, it continues to operate or conduct so long as a continuous uninterrupted current supply is available. Thus, a silicon controlled rectifier will remain conductive until such time as the flow of current is interrupted, even momentarily, despite the absence of the original initiating signal. Accordingly, to turn off a lamp in any one of circuits 36a—36d, it is only necessary to render the rectifier in that circuit nonconductive and this can be done by momentarily opening the switch in the same circuit. Thus, using the same examples as before, to turn off lamp 34a and thereby prepare the apparatus for the next step in the game or contest, it is only necessary to momentarily open switch 35a.

As has already been mentioned, the invention as embodied herein can be utilized in a variety of ways and not only in the field of broadcasting. More particularly, other kinds of load devices may be substituted for the lamps, such as horns, buzzers, chimes or bells. Similarly, power relays could be substituted for these lamps and these power relays, in combination with additional circuitry, could then be used to operate such things as the opening and closing of doors, the activation and deactivation of appliances, etc., and all under the control of tone signals. Accordingly, insofar as utility is concerned, great flexibility is indicated by the present invention when it is considered that the activating control tones can be transmitted by most conventional communications media or supplied in prerecorded form on magnetic tape, phonograph records, or programmed tone generating sequencing devices.

Although a particular arrangement of the invention has been illustrated and described above by way of example, it is not intended that the invention be limited thereto as can be seen from the wide variety of uses to which it can be put. Accordingly, the invention should be considered to include any and all modifications, alternations, or equivalent arrangements falling within the scope of the of annexed claims.

I claim:

1. A system of communications comprising: first means at a first location for generating a carrier signal that is modulated by selected ones of a number of discrete tone signals representing a corresponding number of discrete bits of information; second means at a second location that is spaced from said first location, said second means including a receiver for demodulating said carrier signal to audibly reproduce said

selected tone signals, and tone discriminating means spaced from said receiver and yet close enough to it to receive said reproduced audible tone signals, said tone discriminating means having output terminals equal in number to the number of discrete tone signals, one output terminal for each such tone signal, and being operable in response to said audible tone signals to produce electrical signals at the output terminals corresponding thereto, said tone discriminating means including a vibrating reed relay having as many reeds as discrete tone signals, said reeds being electrically conductive and respectively designed to vibrate in response to the audible tone signals, said tone discriminating means further including sound pickup means for applying the audible tone signals to said reeds, said reeds respectively vibrating to make contact with said output terminals in response to the application of the tone signals thereto, and output circuits equal in number to said output terminals and respectively connected thereto, each output circuit including a load element, said output circuits respectively being operable in response to electrical signals applied to said output terminals to respectively operate the load elements therein; and third means for transmitting said modulated carrier signals from said first to said second locations.

2. The system defined in claim 1 wherein said first location is a broadcast studio and said first means includes a tone-control device manually operable for selectively generating successive groups of discrete tone signals, the tone signals in each

group occurring simultaneously and for the same period of time.

3. The system defined in claim 1 wherein said first means includes a member on which said tone signals have been recorded in a predetermined sequence, and apparatus for reproducing the tone signals recorded on said member in the sequence recorded.

4. The system defined in claim 1 wherein said tone discriminating means includes a vibrating reed relay having as many reeds as discrete tone signals that can be generated, said reeds being electrically conductive and respectively designed to vibrate in response to the discrete tone signals reproduced, said reeds being operable when they are vibrating to make contact with said output terminals.

5. The system defined in claim 2 wherein said third means includes a transmitter wherein a carrier wave is generated, said transmitter being connected to said tone-control device and having a network therein for modulating said carrier wave with the tone signals generated; a transmitter antenna coupled to said transmitter for transmitting said modulated carrier wave through space; a receiver antenna at said second location for receiving said modulated carrier wave; and a receiver for demodulating said modulated carrier wave to produce the generated tone signals, said receiver being coupled to said receiver antenna.

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