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VISUAL INTERPRETATION OF ELECTRICAL CURRENTS

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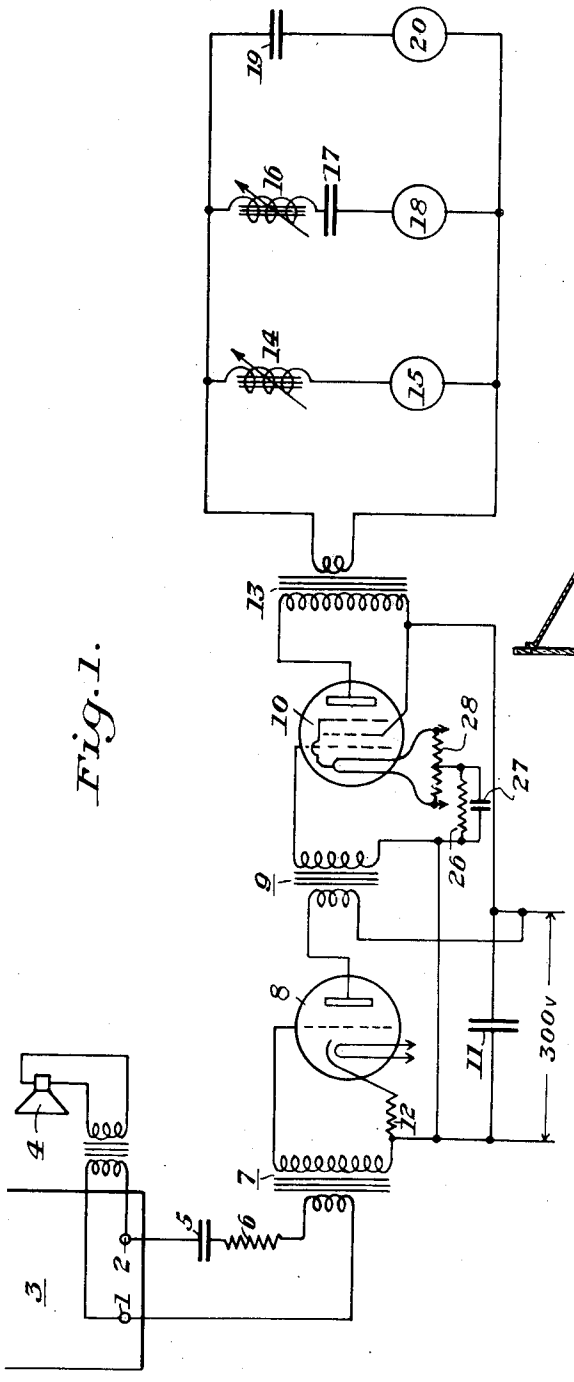


Fig. 1.

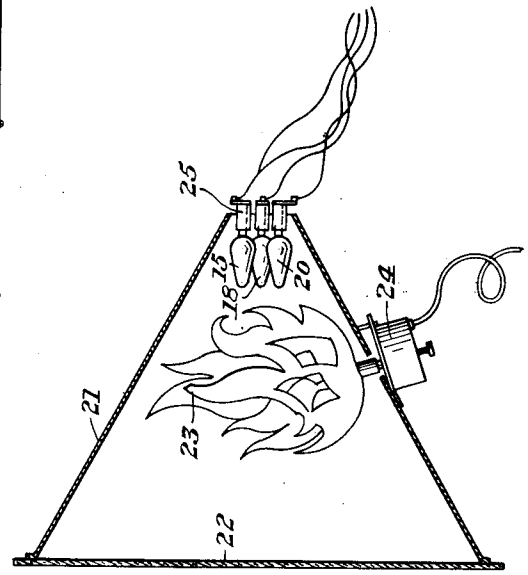


Fig. 2.

INVENTOR
Robert D. Burchfield
By, Clarence P. Byrnes
Attorney

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VISUAL INTERPRETATION OF ELECTRICAL CURRENTS

Robert D. Burchfield, Pittsburgh, Pa.

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6 Claims. (Cl. 84—464)

This invention relates to improved procedure for translating electrical currents into visible effects, and more particularly, to a system utilizing collected radio currents for energizing visual interpretations.

An important application of my invention arises in connection with automatic color-organs based upon the frequency analogy of sound and light, and/or sound and motion. In radio receivers and other systems for picking-up currents which are to be translated into sound and/or motion picture evidences, the question of also simultaneously translating such currents into visual color evidences is now becoming important.

Previous to my invention, the systems devised for color interpretation of sound waves such as music, etc., have been limited in their scope of utility because of their complexity and their type of visual interpretation. It has been customary to employ the current from a radio receiver circuit only as a variable control, for example, for varying the resistance of a separately energized vacuum tube circuit, wherein the circuit is employed to energize the colored lights. Thus, the colored lights require a separate energy source which is varied to change the intensity of illumination by impressed radio currents.

That is, previous to my invention, the belief has been that it is necessary to separately energize the colored lights or other visible evidences, and for this reason, those skilled in the art have endeavored to solve the problems involved by improving the separately energized circuits.

The need has been for a sensitive but smoothly and positively acting visual system, which is simple to construct and inexpensive to operate, and which will be able to pleasingly interpret musical selections, such as symphony orchestrations, etc., simultaneously with the tonal presentation thereof.

In a system such as is now employed for light and/or color interpretations, high voltage, low current, control energy is taken from a radio receiver, is separated into two or more frequency ranges, and each range is impressed upon a separately energized vacuum tube circuit in such a manner that the current energy (D. C.) supplied by such circuit to a light bulb is controlled by variations in the strength of the control current. The vacuum tube of such a circuit thus acts as a variable resistance in series with the light and with the (D. C.) energy source; saturating reactors, rectifiers, etc., all add to the complexity of each of such frequency range circuits. It is also customary to maintain each of the lights employed as visual interpreters at a predetermined minimum intensity; the control current is applied to increase the intensity, indicating the presence of current of a particular frequency range value.

Several important considerations appear from the above. In the first place, such a complex system cannot be conveniently mounted in the same cabinet as the radio receiver and its speaker. In the second place, the visual interpreters (lights) tend to flicker and their changes in intensity are oftentimes not visible. In the third place, they consume considerable extra current energy. There are also many other disadvantageous features which limit the utility of the present visual interpretation systems.

And, it has been an object of my invention to determine a factor which will eliminate the cause of a large proportion of the limitations and problems involved in connection with the visual interpretation of sound wave currents.

Another object has been to visually translate sound wave currents without employing separate energization.

Another object has been to employ alternating frequency currents for energizing and/or varying the intensity of visual interpreters.

A further object of my invention has been to provide a simple, effective, efficient, and/or practical system for visual interpretation of variable frequencies.

These and many other objects of my invention will appear to those skilled in the art from the following description taken in view of the claims and the accompanying drawing, in which:

Figure 1 is a circuit diagram of system embodying my invention; and

Figure 2 is a side sectional view in elevation of apparatus which may be employed in utilizing my invention.

In carrying out my invention, I preferably connect the system to the output terminals 1 and 2 of a radio receiver 3 or of some other suitable source of variable frequency current, see Figure 1. The loud speaker 4 is preferably connected in parallel with the output, in order that the system will not decrease the current flow therethrough, and vice versa.

The sound wave current is preferably passed through a couple of stages of audio frequency amplification, comprising vacuum tubes 8 and 10 and transformers 7 and 9. The numerals 5 and 6 represent a capacity and a resistance in series with the input to the primary of audio-frequency transformer 7 and the numeral 11 represents a

capacity in parallel with a suitable direct current plate potential.

The incoming audio current of varying frequency, after being amplified is then directed through a heavy duty audio transformer 13 which changes the incoming current of a high voltage low current value to an output current of a low voltage and a high current value. In other words, a specially constructed audio-frequency transformer 13 of the so-called "step-down" type is employed to "step-up" the current before it is fed to the visual interpretation circuit.

The latter circuit comprises a plurality of parallel, frequency selector circuits, each of which is provided with selector or filter apparatus and a light connected in series therewith.

For the purpose of illustration, I have only shown three lights 15, 18, and 20, and thus, three selector circuits whose sensitive frequency range is controlled by the agencies 14, 16 and 17, and 19, respectively. In accordance with the arrangements shown, an inductive reactor 14 selects a low frequency (low pitch) range, a series inductive reactor 16 and a capacitive reactor 17 select a medium frequency, and a capacitive reactor 19 selects a relatively high frequency range.

By determining that the factor of separate energization has been at the root of the problems involved in connection with visual interpreters and by discovering that such factor can be eliminated in a surprisingly simple manner, I have been able to provide a visual system of markedly improved characteristics. I have been able to utilize an alternating frequency current for lighting the lamps whereby the problems of flickering (which are incidental to the separate source, direct current energization) have been eliminated.

In accordance with my invention, the incoming radio currents of sound wave frequency ranges are amplified, and then, the current is stepped up at the expense of voltage before the current is directly fed to the visual system. The red light 15 will glow for low pitch, low frequency currents; the green light 18 will glow for medium frequency currents; and, the blue light 20 will glow for high frequency currents.

By suitably proportioning the circuit characteristics, the lights will glow and smoothly change their brightness with the strength of the sound waves; these lights only glow with relatively high current values and thus automatically eliminate the disharmony that would be caused by minor stray currents.

In the illustrated embodiment of my invention, I find that following circuit characteristics or values are effective:

Transformers 7 and 9—of ordinary audio type, preferably of a low ratio. 7 may be 3:1 and 9 may be 2:1.

Transformer 13—specially designed, voice-coil type, ratio about 450/1–500/1. Primary of approximately 4,000 to 7,000 ohms. Secondary of about 8 to 20 ohms.

Filter inductance 14, about 6 millihenries.

Filter inductance 16, about 3 to 3½ millihenries.

Filter capacity 17, about 4 microfarads.

Filter capacity 19, about 1½ to 2 microfarads.

Lights 15, 18, and 20, about 14 volts.

Resistances 12 and 26 have values of about 2000 and 400–500 ohms, respectively. Condenser 27 has a value of about .25 mmf. and tapped resistor 28 has a value of about 20–30 ohms. The condenser 5 is about .04 mmf., the resistance 6 is about 50,000 ohms, and the condenser 11 is about 4 mmf.

Of course, it will be recognized that the circuit characteristics given above are merely illustrative, and that the circuit values can be changed and other circuit arrangements made for carrying out the principles of my invention by those skilled in the art. For the values of the filter circuit apparatus given above, frequencies below 300 cycles are passed by the low pass filter circuit coil 14, frequencies substantially between 250 and 750 cycles are passed by the band pass circuit coil 16 and condenser 17, and frequencies above 600 cycles are passed by the high pass filter circuit condenser 19.

As a result of the overlapping of the frequency ranges, notes between 250 and 300 cycles will cause both the red and green lamps to glow and frequencies between 600 and 750 cycles will light both the green and the blue lights. The blending produces intermediate tones and/or mixtures.

In operation, it is advantageous to adjust the values of the inductances 14 and 16 by employing movable cores; in this manner the lamps may be caused to operate in a desired manner. Of course, the coils 14 and 16 may be varied by other suitable means, such as by tapping the turns; and, the condensers 17 and 19 may also be varied if desired.

I have shown a specific application of my invention in Figure 2. It comprises an optical machine having a conical housing 21, a translucent screen of flashed opal glass 22, a light modifier 23, a geared synchronous motor 24 for rotating the modifier 23, and suitable mountings 25 for the lamps 15, 18, and 20. Opal glass has been employed since it completely diffuses the light while ground glass, etc., only partly diffuses. The light modifier 23 serves to give motion and variety of form to the light while the colors follow the music; it may be made of sheet metal cut and bent in an irregular manner, in order to give a fantastic play upon the screen. It is preferably rotated at a slow speed, for example, at about one revolution per minute. The conical housing 21 is shaped and designed to act as a light reflector.

While I have described but one embodiment of my invention, it will be apparent that many changes, modifications, substitutions, additions, and omissions, or combinations thereof may be made in this system without departing from the spirit and scope of the invention as indicated in the appended claims.

I claim:

1. In a system for visually interpreting sound wave representing audio frequency currents, apparatus for supplying sound wave audio frequency currents of a plurality of frequency ranges, a plurality of lights connected to said apparatus for indicating sound variations of the currents of each of the plurality of ranges, a conical light reflector housing having its large end open and its small end closed, said lights being mounted to extend from the small end of the inner portion of said conical housing, a translucent screen of flashed opal glass mounted over the open end of said housing, and a rotatable light modifier mounted to extend inwardly of said housing for varying the form of the light projected by said lights on said screen.

2. In a system for visually interpreting sound-wave-representing audio frequency currents, a source of alternating audio frequency currents representing sound waves, at least a pair of visual

units connected in parallel with each other and connected to said source, each of said units including a series-connected filter and lamp, each of said filters being designed to by-pass only currents of desired frequencies, each of said units being designed to by-pass currents of different frequencies than another unit, so that a lamp of one unit will visually indicate currents of different frequencies than a lamp of another unit.

3. In a system for visually interpreting sound-wave-representing audio frequency currents, a source of alternating audio frequency currents representing sound waves, at least a pair of visual units connected in parallel with each other and in parallel with said source, each of said units comprising a series-connected filter and lamp, each of said filters being capable of filtering out undesired frequencies, the filter of one unit being capable of filtering out currents of different frequencies than the filter of another unit, the lamp of one unit visually indicating currents of frequencies by-passed by the filter of said particular unit, so that a lamp of one unit will visually indicate currents of different frequencies than the lamp of another unit.

4. In a system for visually interpreting sound-wave-representing audio frequency currents, a source of alternating audio frequency currents representing sound waves, a plurality of parallel-connected visual units, one of said units comprising a variable reactor connected in series with a lamp for visually indicating currents by-passed by said reactor, said reactor being adjusted to by-pass relatively low frequency currents; a second of said units comprising a variable reactor connected in series with a condenser and a lamp for visually indicating currents of frequencies by-passed by said reactor and condenser, said reactor and condenser being adjusted and designed to by-pass currents of intermediate frequencies; a third unit comprising a condenser and a lamp connected in series therewith for visually indicating currents of frequencies by-passed by said condenser, said condenser having characteristics for by-passing currents of relatively high frequencies, said parallel-connected units being connected in parallel with said source, so that each of said lamps will visually indicate currents of different frequencies.

5. In a system for visually interpreting sound-wave-representing audio frequency currents, a source of alternating audio frequency currents representing sound waves, a current step-up transformer, a frequency selection filter and an indicator, the "low current" side of said transformer being connected to said source, said filter and said indicator being connected in series with each other and being directly connected to the "high current" side of said transformer, said indicator having means for indicating currents of desired frequencies by-passed by said filter.

6. In a system for interpreting sound-wave-representing audio frequency currents, a source of alternating audio frequency currents representing sound waves, a frequency selection device and an indicator, said device and said indicator being connected in series with each other and being directly connected to said source, said indicator having means actuated by currents of desired frequencies by-passed by said device.

ROBERT D. BURCHFIELD.