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PHOTOCELL CONTROLLED REPEATER CIRCUIT

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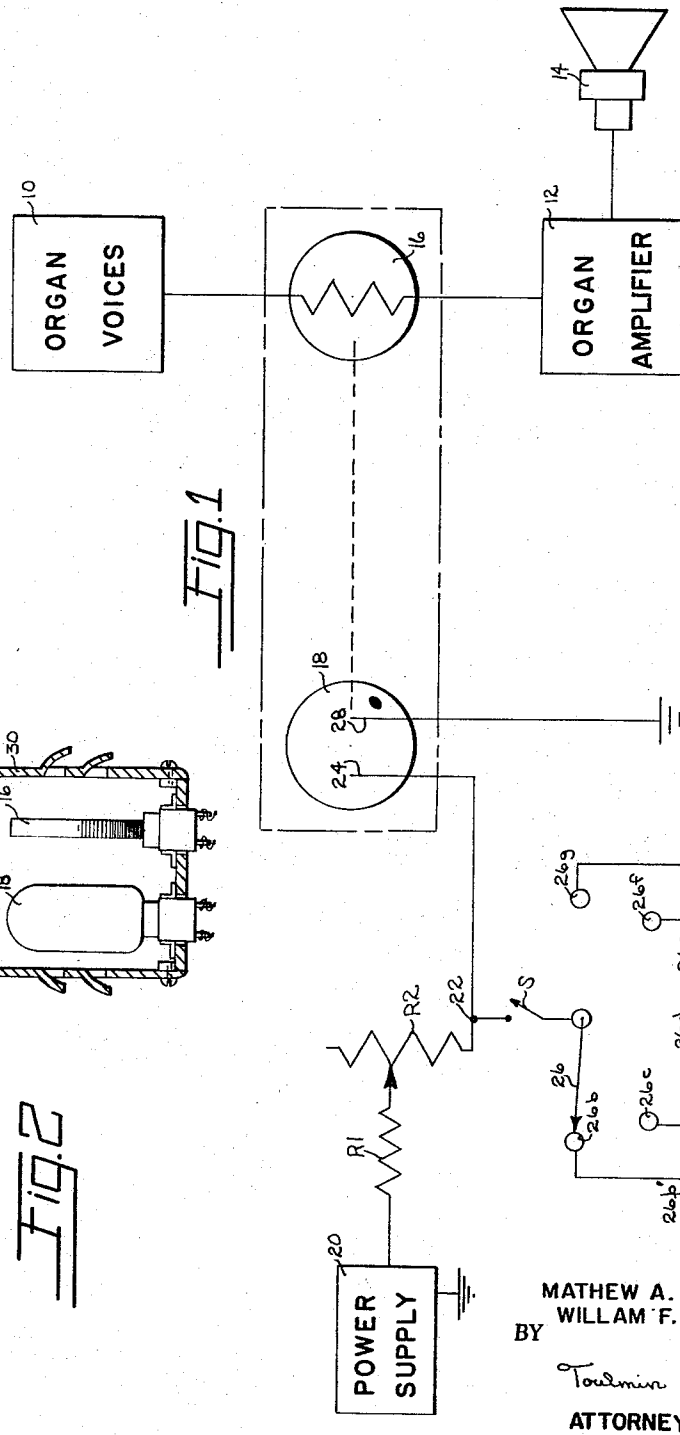



Fig. 1

Fig. 2

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# PHOTOCELL CONTROLLED REPEATER CIRCUIT

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## ABSTRACT OF THE DISCLOSURE

Circuit for obtaining repetitive percussion or plucked string effects in an electric organ in which a photocell in the circuit connected in controlling relation to the signal which will produce the sound is, in turn, selectively controlled by a neon lamp which flashes at a rate which is varied by exchanging condensers in a resistance-condenser circuit which supplies the lamp.

This invention relates to circuitry for musical instruments such as electric organs and the like, and is particularly concerned with a novel and improved circuit of the type known as a repeater circuit.

A repeater circuit is employed many times in connection with musical instruments, particularly electric and electronic organs, to produce the effect of a plucked string to simulate the sounds of a variety of strings and what are referred to as "fretted" instruments such as guitars, banjos, marimbas, xylophones, marimbaphones and similar instruments wherein the sound is produced by plucking or picking a string or by striking note producing elements by a hammer means. The simulation of sounds with electric circuitry is somewhat difficult because usually such sounds have a very steep angle of attack and decay somewhat gradually. Many circuit arrangements have been employed for the purpose of simulating such sounds usually in the form of auxiliary oscillatory circuits and the like of a special nature which serve to modify the signal corresponding to the tone or tones to be modified. The heretofore known circuits of this nature have been expensive and relatively complex, and thus have been the source of considerable trouble and have required considerable service.

With the foregoing in mind, it is a particular object of the present invention to provide a greatly simplified circuit of the repeater type and one in which close simulation of the desired sounds can be effected.

A still further object of the present invention is the provision of a circuit of the repeater type which is readily adjustable to vary the repeating speed of the effect obtained.

A still further object of this invention is the provision of a circuit of the repeater type in which simple, easily replaceable components are utilized so that servicing of the circuit, if necessary, can be quite simply accomplished.

These and other objects and advantages of this invention will become more apparent upon reference to the following specification taken in connection with the accompanying drawings, in which:

FIGURE 1 is a schematic circuit diagram showing a repeater circuit according to the present invention, and

FIGURE 2 is a view showing the manner in which the light source and photocell forming important parts of the circuit might be housed in a unitary housing.

Referring to the drawings somewhat more in details, **10** indicates a source of signals such as might be found in an electric or electronic organ, and which signals are developed in the tone generators and which are under the control of the playing keys of the instrument, and which signals may be further modified to impart the particular character to the signal desired. The rectangle **10** diagrammatically illustrating this is marked "Organ Voices," and it will be understood that this may consist of conventional electric or electronic organ circuitry or the electric or electronic circuitry pertaining to other musical instruments and is preferably, although not necessarily, that point in the circuitry which is connected directly to amplifier **12**, which, in the drawings directly to amplifier **12**, which, in the drawings, is marked "Organ Amplifier," but it will be understood that this element is any suitable amplifier for the signals emanating from rectangle **10**. Amplifier **12** is connected to speaker means **14** from which the sounds issue.



Connected in series between signal source **10** and amplifier **12** is light sensitive photocell means **16**. This arrangement is a photo-conductive unit of the cadmium sulfide or cadmium selenide type, for example, and has a high resistance when not illuminated and a low resistance when illuminated.

Adjacent cell **16** is a neon tube **18** arranged to illuminate cell **16** when tube **18** is energized. Energization of tube **18** is effected by voltage derived from a power source **20** which is conveyed through resistor R1 and adjustable resistor R2 to a point **22** which, on one hand, is connected to one of the plates **24** of neon tube **18**, and on the other hand, is connected to movable switch arm **26** via selector switch S.

The other plate **28** of neon tube **18** is connected to ground to complete the circuit back to power source **20**.

Switch arm **26** is movable so as to sweep over a bank of contacts **26***b*, **26***c*, **26***d*, **26***e*, **26***f* and **26***g*.

Each of contacts **26***b* thorugh **26***g* is connected through a condenser to a ground point. The several condensers have the same numbers applied thereto as their pertaining contacts with the addition of a prime. Each of the condensers is of a somewhat different size and each condenser provides, as is well known, a sort of timing circuit for the neon tube for producing pulses of light therefrom.

For example, if switch blade **26** is in the position shown in FIGURE 1, the power supply will charge up condenser **26***b'* until the condenser voltage reaches the starting voltage of tube **18**, whereupon tube **18** will become conductive and the condenser will discharge through the tube. The tube will thus become illuminated and illuminate cell **16** and thus cause it to be highly conductive. The conductivity of cell **16** will, of course, vary with the illumination of tube **18**, and the effect of the circuit arrangement is to cause neon tube **18** to become illuminated substantially instantaneously at high intensity and to decay at a relatively slow rate, at least with respect to the rapidity of the initial illumination of tube **18**. Adjustment of the circuit components can produce substantially any desired effect, which has heretofore been most difficult to obtain even using much more expensive devices such as balanced modulators and the like.

The several condensers, as mentioned, are of different size and each has a different charging time so that each condenser will produce a different rate of pulses of illuminating energy to the tube **18**. Thus, in a very simple manner, the repeater circuit can be caused to repeat at a very rapid rate or at slow rates down to as slow as desired.

Switch S will permit instant activation or de-activation of the repeater circuit at will, therefore, permitting the repeater effect at any interval during play. This is an advantage since the rate of repeat can be preset without going through the complete sequence from 0 to the desired frequency.

Also, the steady state operation of neon tube **18** is kept constant regardless of the speed selected or preset. Resistors R1 and R2 are not changed during normal operation of the organ.

The lamp **18** and cell **16** can advantageously be con-

tained within a housing **30** of a simple type shielded so as not to be influenced by stray illumination from other sources.

It will be appreciated that resistor R2 provides an adjustment for the degree of illumination of tube **18** that is effective when the tube is in a condition of steady state illumination, namely, when switch S is open, whereas, when blade **26** is resting on any of the contacts **26***b* to **26***g*, and switch S is closed, the resistor R2 provides means for adjusting the speed of operation of the repeater circuit within predetermined limits by effecting adjustment of the time required to charge the pertaining condenser up to the starting voltage of tube **18**. Resistor R2 is a service adjustment and is not used during normal organ operation.

From the foregoing it will be seen that the present invention provides for a relatively simple inexpensive easily adjusted circuit of the repeater type, and presenting as a particularly beneficial characteristic feature that of rapid attack of the controlled signals, while the said characteristics are at the same time adjustable to control the final sound effects. As mentioned before, the invention is particularly useful with electric or electronic organs and can be incorporated not only in new manufacture but can also be readily installed in existing units of this type, and is also adaptable to other electric and electronic musical instruments where conditions are such that a repeater effect may be desired.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions; and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed is:

**1.** In combination; a tone generator, an amplifier, a photo-conductive cell connected between the generator and the amplifier through which the signals pass from the generator to the amplifier, a neon tube adjacent said cell, a source of direct current, resistance means connecting one terminal of said source to one plate of said neon tube, a return circuit connecting the other plate of said neon tube with the other terminal of said source, a plurality of condensers of respectively different size, each condenser having one terminal connected to said return circuit, and switch means having one element connected to said one plate of said neon tube and other elements connected to the other terminals of said condensers, said one element of said switch means being adapted for selective engagement with the said other elements thereof, and a selector switch in series with said switch means.

**2.** In combination; a tone generator, an amplifier, a photo-conductive cell connected between the generator and the amplifier through which the signals pass from the generator to the amplifier, a neon tube adjacent said cell, a source of direct current, resistance means connecting one terminal of said source to one plate of said neon tube, a return circuit connecting the other plate of said neon tube with the other terminal of said source, a plurality of condensers of respectively different size, each condenser having one terminal connected to said return circuit, and switch means having one element connected to said one plate of said neon tube and other elements connected to the other terminals of said condensers, said one element of said switch means being adapted for selective engagement with the said other elements thereof, a selector switch in series with said switch means, said cell and neon tube being arranged in closely adjacent relation whereby energization of the neon tube will illuminate said cell, and housing means enclosing said tube and cell so as to shield at least the cell from light other than that developed by energization of said tube.



**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,160,694 | 12/1964 | Meinema | 84—1.26 X |
| 3,247,308 | 4/1966 | Peterson | 84—1.26 X |
| 3,267,196 | 8/1966 | Welsh et al. | 84—1.18 |


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