

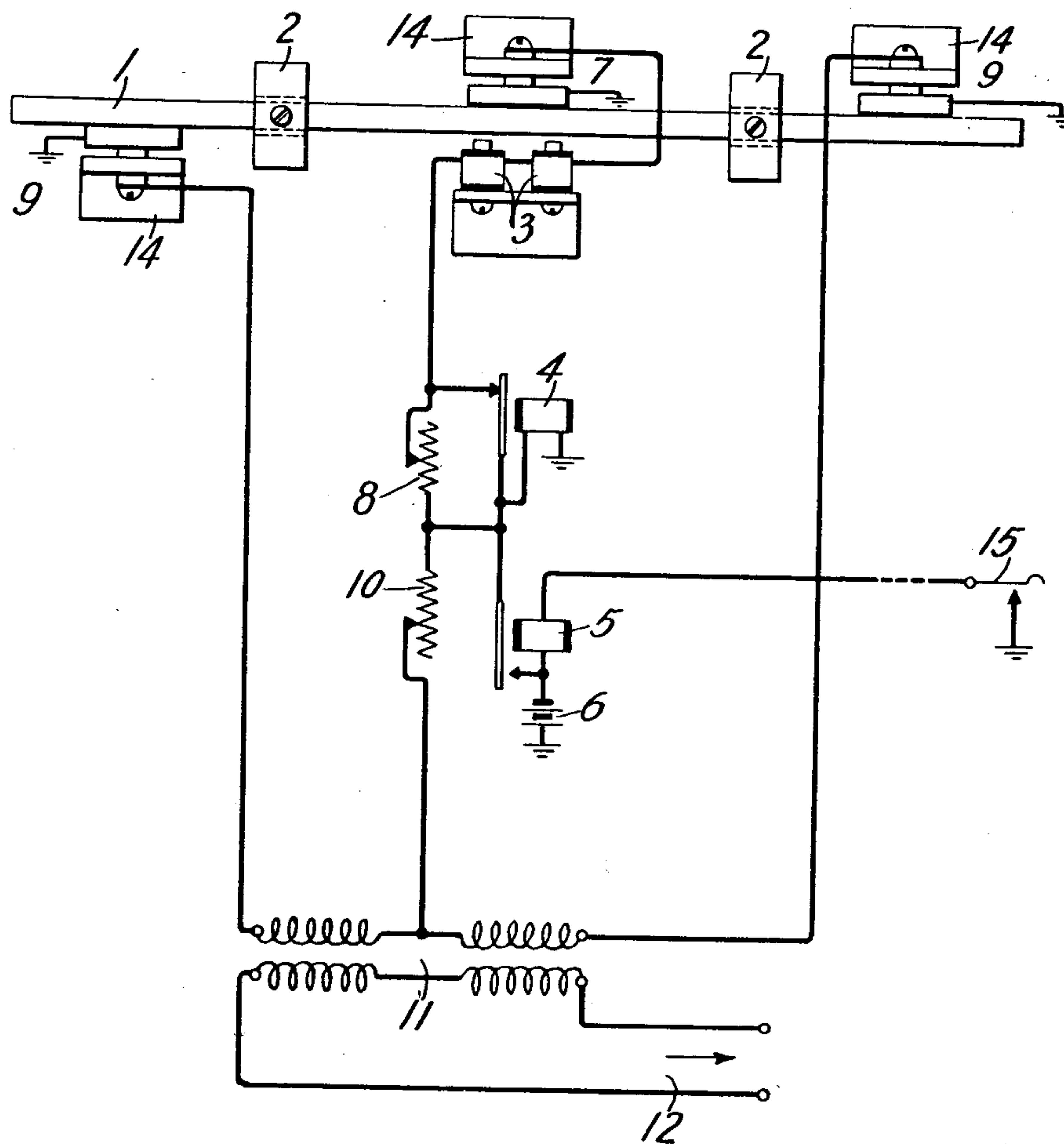
July 2, 1929.

F. M. WIESE

1,719,495

OSCILLATION GENERATOR

Filed Feb. 27, 1926



Inventor:
Floyd M. Wiese.

by J. E. Roberts Att'y.

Patented July 2, 1929.

1,719,495

UNITED STATES PATENT OFFICE.

FLOYD M. WIESE, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

OSCILLATION GENERATOR.

Application filed February 27, 1926. Serial No. 91,201.

This invention relates to oscillation generators of the type employing a mechanical vibrating element to determine the frequency of the generated oscillations.

5 An object of the invention is to improve the operation of such oscillation generators.

A related object of the invention is to provide a simple and efficient means for starting an electromechanical oscillator.

10 Certain types of oscillators, employing a mechanical vibrating element as the frequency determining means, possess many qualities which render them particularly suited for use as frequency standard systems
15 for determining and setting the frequency of electrical variations supplied by an alternating current source, and also, in another aspect, to provide a source of ringing current in telephone exchanges. The more im-
20 portant advantages of such oscillators are low cost, frequency stability, portability, and simplicity and robustness of structure.

An oscillation generator of the type described above, which may be used for a variety of purposes in the electrical arts, is disclosed and claimed in British Patent 268,880,
25 June 30, 1927. This oscillator consists, briefly stated, of a metal reed or bar supported at each of two nodal points which
30 are distant about one fourth the length of the rod from the ends thereof respectively.

The bar is provided with a driving circuit including a source of current in series with an electromagnet and microphone which are
35 placed at the center of the bar. The microphone is controlled by the bar, which in turn controls the driving electromagnet.

A divided circuit controlled by the bar includes a pair of microphones associated
40 with the respective ends thereof, the microphones being in push-pull relation in the circuit. This oscillator has been found to produce oscillations of substantially pure wave form and constant frequency, and under
45 ordinary conditions has also been found to start promptly under its normal driving current.

50 Since electromechanical oscillators are used for such purposes as toll ringing in telephone exchanges, and are required to start a great many times every day when actuated under the control of any one of a large number of telephone operators' keys, it is very important that they respond immediately to the initial driving impulse.
55

Tests have shown that an oscillator of the type described above will start under its normal driving current in many different situations, but that the normal driving current may be insufficient to start the oscillator after an extended period of intermittent operation. It will operate efficiently
60 however, if started by artificial means. Indeed, many oscillators, such as certain types of tuning fork oscillators, are not self-starting under any conditions, and hence have heretofore been wholly unsuited for such
65 intermittent operation.

This invention provides a simple and efficient arrangement for electrically starting
70 an electromechanical oscillator, which will materially prolong its useful period of service, and will render oscillators, which are not ordinarily self-starting, available for heavy duty intermittent operation. There-
75 fore, while a particular oscillator has been chosen for presentation above and in the following detailed description, it will be understood that the invention is equally applicable to various other electromechanical
80 oscillators.

The invention will be described in detail with reference to the accompanying drawing which is a diagrammatic illustration of an oscillation generator constructed in accordance with the invention.
85

A bar 1, vibrating at a definite frequency, establishes the frequency of the generated oscillations. The bar is pivotally mounted at
90 nodal points 2 in such manner that it has an antinode at the center and an antinode at each end. This mode of vibration is commonly referred to as "free-free" vibration. The theory of operation and the manner of
95 arranging such a vibrating element in a frequency standard is described in detail in Patent No. 1,543,124 to N. H. Ricker, issued June 23, 1925.

The driving element for the bar 1 is an electromagnet 3 placed at the middle antinodal point. When relays 4 and 5 are energized, in a manner and for a purpose hereinafter described, the electromagnet 3 is
100 actuated by current from a source 6, the current being varied in amplitude in response to vibrations of the bar by means of a microphone 7 mounted at the middle antinodal point of the bar and opposite the
105 electromagnet 3. Under such condition the variable resistance 8 is included in the driv-
110

ing circuit of the oscillator and serves to control the amplitude of the vibrations.

The output circuit of the oscillator consists of microphones 9 placed at the two ends of the bar, but on opposite sides thereof, and connected in push-pull relation, and also includes the source of current 6, variable resistance 10, and the primary winding of transformer 11. The secondary winding of transformer 11 is connected to the supply circuit 12, through which the oscillations generated may be transmitted to suitable translating devices.

The resistance 10, which is included in the common battery supply lead of the push-pull circuit, serves to regulate the potential impressed upon the outgoing circuit 12.

The various microphones 7 and 9 comprise a variable resistance element pressed lightly against the bar 1 and supported by a standard 14. The light pressure allows the bar to move freely in response to the driving force and introduces a minimum amount of damping to the vibrations, whereby a substantially pure and undistorted wave is produced as the resistance of the microphone increases or decreases according to the direction of movement. A type of microphone which may be employed is described in U. S. Patent 1,565,581, issued December 15, 1925, to C. R. Moore.

In accordance with the invention the relay 5 is controlled by means of a key 15, such as a telephone operator's key, which may be located at a point remote from the oscillator.

When it is desired to start the oscillator to transmit a ringing impulse over the outgoing circuit 12, the key 15 is closed, thereby energizing relay 5 over a circuit extending from ground, through key 15, relay 5, battery 6 to ground.

Immediately upon the energization of relay 5, current from the source 6 is transmitted through the driving element of the oscillator over a circuit including ground, battery 6, front contact and armature of relay 5, armature and back contact of relay 4, windings of electromagnet 3, microphone 7 to ground. At that instant the resistance 8 is short-circuited, and hence a pulse of abnormally high current is transmitted through the electromagnet 3 and microphone 7 which immediately sets the bar 1 in vibration. This pulse of abnormally high current, however, is only momentary as the relay 4 is almost immediately thereafter energized over a circuit including ground, battery 6, front contact and armature of relay 5, winding of relay 4 to ground.

Relay 4 in attracting its armature removes the short-circuit from around the resistance 8, thereby allowing current to flow from the source 6 to the electromagnet 3 and microphone 7 through the resistance 8 until such time as the key 15 is released. The ampli-

tude of the vibrations and consequently the amount of current in the output circuit 12 may be varied by adjusting resistance 8 as desired.

As the bar 1 vibrates, the resistance of the microphone 7 is caused to vary in synchronism therewith. A current of corresponding frequency is thereby produced in the driving circuit including the magnet 3, the flux of which is caused to vary at the same rate to maintain the bar vibrating at its resonant frequency.

The microphones 9, being disposed at antinodal points on opposite sides of the bar, will have their resistances varied at the same rate and will cause current variations of the resonant frequency of the bar to flow through the two halves of the primary winding of the transformer 11.

Since the microphones 9 are on opposite sides of the bar 1, the movement of the bar will cause the resistance of one microphone to decrease and the resistance of the other to increase, with the result that the change of current in the two halves of the primary winding of transformer 11 will be opposite in sign. Hence the system operates analogously to that of push-pull amplifiers, to introduce current variations in the secondary of transformer 11.

It has been found by test that the momentary pulse of abnormally high current which is transmitted through the electromagnet 3 and microphone 7 in accordance with the invention, in addition to giving the bar a mechanical plucking effect, also has a beneficial effect upon the microphone which results in the production of a more stable output than was obtained before the auxiliary starting circuit was employed.

What is claimed is:

1. An oscillation generator comprising a vibratable element, an electromagnetic device for driving said element, a source of current, means for transmitting a current of predetermined value from said source to said device to create vibrations in said element, and means for transmitting current of another value from said source to said device to continue said vibrations.

2. An oscillation generator comprising a vibratable element, a circuit including an electromagnet and a current controlling device for controlling the vibration of said element, a source of current, means for transmitting a current of predetermined value from said source to said circuit to create vibrations in said element, and means for transmitting current of another value from said source to said circuit to continue said vibrations.

3. An oscillation generator comprising a vibratory mechanical element, a driving magnet therefor, a source of current, a relay adapted when operated to cause a heavy cur-

rent to be transmitted from said source to said driving magnet to start the vibration of said element, and means controlled by the operation of said relay to thereafter
5 cause a smaller current to be transmitted from said source to said driving magnet to continue said vibration.

4. An oscillation generator comprising a vibratory mechanical element, a driving
10 magnet therefor, a source of current, a relay adapted when operated to connect said source in circuit with said driving magnet to initiate the vibration of said element, a resistance element, and a second relay oper-
15 ated by said first-mentioned relay and adapted to connect said resistance element in circuit with said driving magnet and said source, whereby a smaller current is im-
20 pressed upon said driving magnet to continue the vibration of said element.

5. An oscillation generator comprising a vibratory mechanical element, a driving circuit therefor including a driving magnet and a microphone adapted to vary the am-
25 plitude of the current in said driving cir-

cuit in response to vibrations of said ele-
ment, a source of current, a relay adapted
when operated to connect said source to said
driving circuit to initiate the vibration of
said element, a resistance element, and means
30 operated by said relay to connect said resist-
ance element in said driving circuit, whereby
a smaller current is impressed upon said
driving circuit to continue the vibration of
said element. 35

6. An oscillation generator comprising a vibratable member, a driving element there-
for, a source for supplying energy to said
driving element, means for transmitting a
momentary pulse of energy from said source
40 to said driving element to initiate the vibra-
tion of said member, and means for causing
said momentary pulse to have a magnitude
much larger than any succeeding pulse oc-
curring while said member is maintained in
45 vibration.

In witness whereof, I hereunto subscribe
my name this 26th day of February A. D.,
1926.

FLOYD M. WIESE.