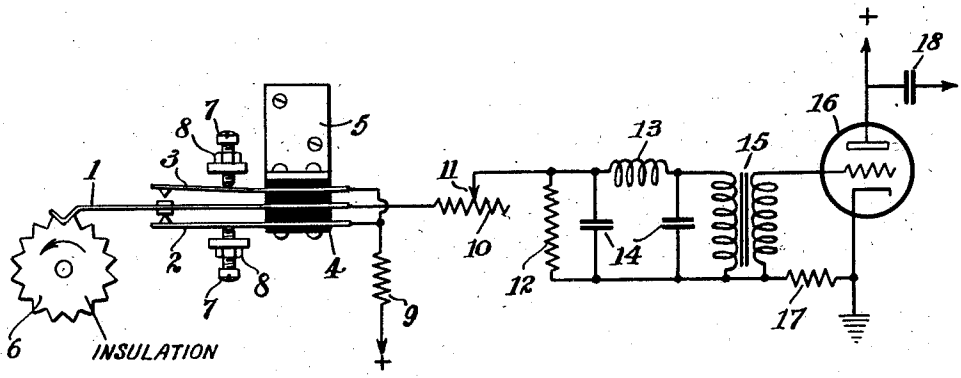
March 30, 1943. R. D. HUTCHENS 2,315,374

SQUARE WAVE GENERATOR

Filed May 24, 1940



Inventor

Raymond D. Hutchens,

By H. S. Grover

Attorney

Patented Mar. 30, 1943 2,315,374

UNITED STATES PATENT OFFICE

2,315,374

SQUARE WAVE GENERATOR

Raymond D. Hutchens, New York, N. Y., assignor to Radio Corporation of America, a corporation of Delaware

Application May 24, 1940, Serial No. 336,903

6 Claims. (Cl. 175—373)

This invention relates to square wave generators and more particularly to a device which is mechanically controlled for interrupting an electrical circuit whereby a square wave of any desired frequency may be produced within a reasonably wide range.

The primary object of my invention is to provide a simple low cost square wave generator, and one which may be easily adjusted to deliver impulses whose square peaks bear any desired ratio of duration with respect to the interruption periods.

A further object of my invention is to provide means operable to produce circuit interruptions at twice the frequency of oscillation of a controlling member, thereby to increase the maximum frequency limit in relation to the inertia of the moving parts of the apparatus.

Other objects and advantages of my invention will be made apparent in the specification to follow.

In telegraph communication systems it is common practice to electro-mechanically motivate a perforated tape transmitter under control of a periodically interrupted current. Sinusoidal waves are sometimes used, although square waves are often preferable.

Various devices such as tuning forks, commutator and brush arrangements, and vibrating springs have been used for controlling the frequency of the generator. Any suitable means well known in the art may be provided for controlling the frequency of interruption of the square wave current which is to be utilized in a synchronous telegraph system.

One of the problems involved in the design of a satisfactory square wave generator is to provide suitable means for proportioning the make time to the break time of a control circuit. Another problem is to devise structure which will operate dependably at the tone frequencies which are generally employed. The higher the frequency, the greater the mechanical strain that is imposed on an interrupter. In the case of interrupters of the contact spring type, the greatest difficulty arises in obtaining uniform make and break periods at high frequencies. In cases where a current is to be reversed it was necessary to vibrate a spring between two contacts, one of which is positively polarized while the other is negatively polarized. Systems of that type were necessarily limited in application because of the appreciable travel time of the movable spring between its front and back contact.

As will be seen from the following detailed description, my improved square wave generator comprises a circuit interrupter in which the travel time of the movable contact spring is utilized to good advantage.

A preferred embodiment of the invention is illustrated in the accompanying drawing which comprises only one figure.

Referring to the drawing, I show therein a "pile-up" of contact springs 1, 2 and 3 assembled between insulators 4. The "pile-up" constitutes a unit which may be securely mounted on any convenient base or bracket 5 of the instrument.

The contact spring 1 has its free end suitably formed to engage with a cam wheel 6 which may be provided with any number of teeth or raised portions on its periphery. The wheel 6 is rotated by any suitable motive mechanism and at a speed which will vibrate the spring 1 to produce the desired frequency by contacting alternately with the outer springs 2 and 3, and by maintaining an open circuit condition for a desired fixed portion of the total time. The travel time of the spring 1 between contacting positions is, of course, the circuit interruption time. Usually the integrated travel time will be adjusted to equal substantially the total time of contacting engagement of the spring 1 with the two outer springs.

The springs 2 and 3 are flexed somewhat by contact with the spring 1. The time of contact in relation to the travel time of the spring 1 between contacts is made adjustable by means of screws or other biasing means 7 bearing upon the contact springs 2 and 3.

When the spring 1 is raised by a tooth of the wheel 6 so that it contacts with the spring 3, the duration of contact may readily be adjusted by the setting of the screws 7. Correspondingly the duration of contact between springs 1 and 2 may be adjusted by the screw 7 which bears upon spring 2, so that when the formed end of the spring 1 rests in the space between the teeth of the cam 6 this contact will be of proper duration. Lock nuts 8 are provided for holding the screws 7 in their adjusted positions.

Preferably the adjustments of the screws 7 will be such that each contact period will be equal to the travel time of the spring 1 between contacts. With this adjustment it is obvious that the circuit will be interrupted for periods equal to the closure periods and that the two closure periods obtained by upper and lower contacts will be equal. In certain instances, however, the circuit closure time is preferably made either greater or less than the interruption time.

The circuit interrupter above described may be used to deliver a square wave to a filter system and thence to an amplifier tube, as will now be shown.

Current is fed through a resistor 9 from any suitable source (not shown) to the springs 2 and 3. The spring 1 is connected to a filter arrangement comprising a shunt resistor 12, a series-inductance 13, two shunt capacitors 14 and the primary of a transformer 15. The secondary of the transformer 15 is in circuit between the cathode and the grid of an amplifier tube 16. The cathode of the tube 16 is grounded and the grid is self-biased by means of a resistor 17. For class-C tube operation, however, a grid biasing source may be placed in circuit between the cathode and grid. Anode potential is supplied to the tube 16 from any suitable source.

It will be clearly understood by those skilled in the art that the operation of the vibrator spring 1 under the control of the cam 6 will cause the interrupted circuit filtered through the filter system and transformed by the transformer 15 to control the tube 16, thereby to deliver a substantially square wave output. The output energy from the tube 16 may be impressed across a blocking condenser 18 and applied to any suitable utilization circuit.

In practicing my invention it has been found that by vibrating spring 1, otherwise termed a rocker-arm or contact tongue, considerable advantage was to be derived from the production of double the frequency of electrical oscillations with respect to the mechanical oscillations of the tongue itself. It was not necessary to drive the cam wheel at an excessive speed. It was found also that the contacts were more dependable. That is to say, there was less chattering at the desired interruption frequency.

Various modifications of my invention will be suggested by the foregoing description and may be applied by those skilled in the art without departing from the spirit and scope of the invention itself. The invention is, therefore, limited only in accordance with the claims.

I claim:

1. A square wave generator comprising means for interrupting a direct current, said means including a movable contact spring interposed between two outer contact springs, means for vibrating said movable contact spring at a constant rate, means providing equality between the moments of circuit closure and of travel-time of said movable contact from one outer contact spring to the other, means for feeding currents of like polarity and potential to both of the outer contact springs, and utilization means responsive to an interrupted current fed thereto by said movable contact springs, said utilization means including an electron discharge tube having an input circuit under control of said interrupted current, and a filter system electrically interposed between said movable contact spring and said input circuit.

2. A circuit interrupter comprising a rotary cam having a toothed periphery, an active contact member mounted for oscillation by engagement of its free end with the teeth of said cam, a pair of passive contact springs between which said active contact member is caused to be actuated, means for rotating the cam at a constant speed, means for adjusting the moments of contact of each passive contact spring with said active contact member so that they shall have an integrated time value equal to substantially 50% of the total time, and means for filtering and amplifying the interrupted currents fed through said contact springs.

3. A square wave generator comprising a spring pile-up including a movable contact spring and two outer springs, means including a rotary cam having regularly spaced upraised peripheral portions for engaging with and actuating the free end of said movable contact spring, means for positioning the outer springs to be contacted alternately by said movable contact spring, a current source having one terminal grounded and the other terminal connected to both of said outer springs, and a circuit arrangement connected to said movable contact spring and adapted to deliver a square output wave under control of the circuit interruptions produced by said spring pile-up.

4. A wave generator comprising a spring pile-up, including a single movable contact spring and only two outer contact springs, means for producing continuous reciprocal movement of said movable spring between alternate contacting positions with the two outer springs, a current source having one terminal grounded and the other terminal connected to both of said outer springs, said outer springs being so adjusted that their contacting time with the movable spring substantially equals the non-contacting travel time of said movable spring, and means including an electronic circuit controlled by the interrupted current fed by said outer springs to said movable spring, the last said means being arranged to deliver an output wave having twice the frequency of oscillation of said movable spring.

5. A wave generator according to claim 4, wherein the first said means includes a rotary cam for producing the reciprocal movement of said movable spring.

6. A wave generator according to claim 4, wherein the first said means includes a cyclically driven actuator having teeth on its periphery for engagement with the free end of said movable spring.

RAYMOND D. HUTCHENS.