

June 20, 1933.

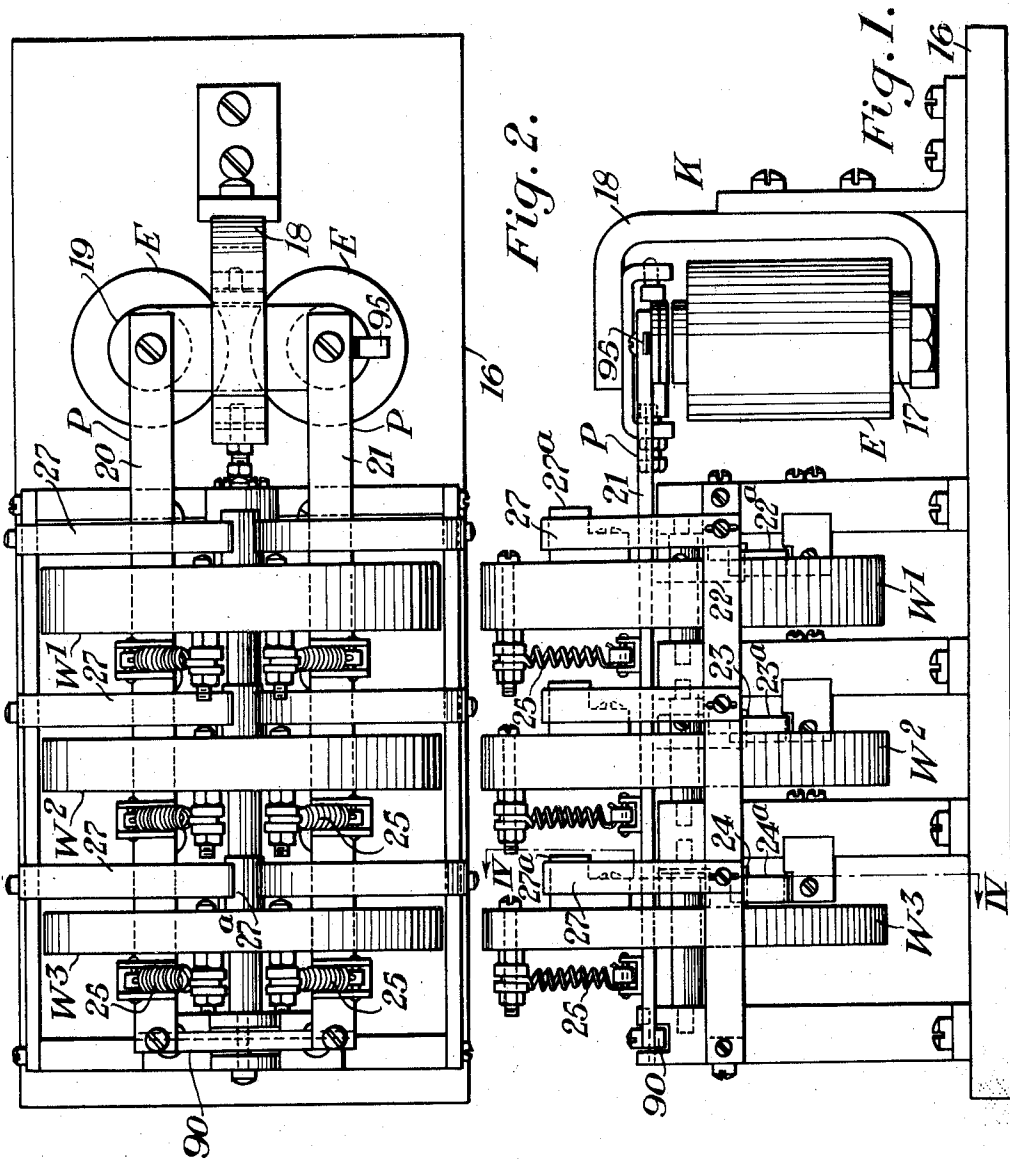
A. J. SORENSEN

1,914,929

ELECTRICAL APPARATUS

Filed Feb. 7, 1930

2 Sheets-Sheet 1



INVENTOR:

A. J. Sorensen,
by A. R. Verrill
His Attorney

June 20, 1933.

A. J. SORENSEN

1,914,929

ELECTRICAL APPARATUS

Filed Feb. 7, 1930

2 Sheets-Sheet 2

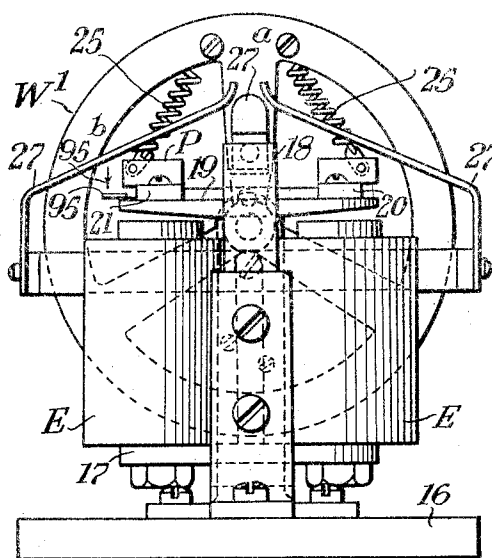


Fig. 3.

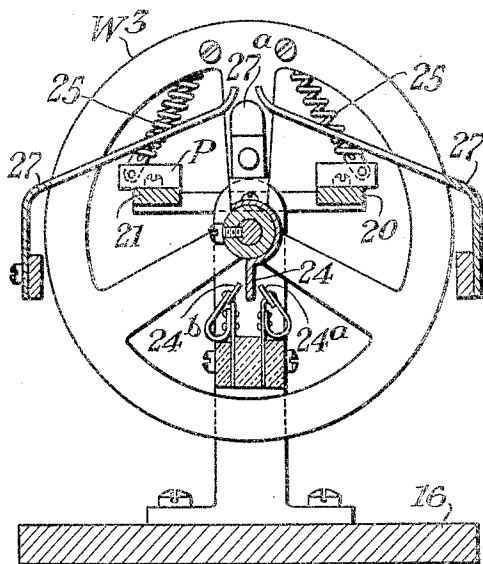


Fig. 4.

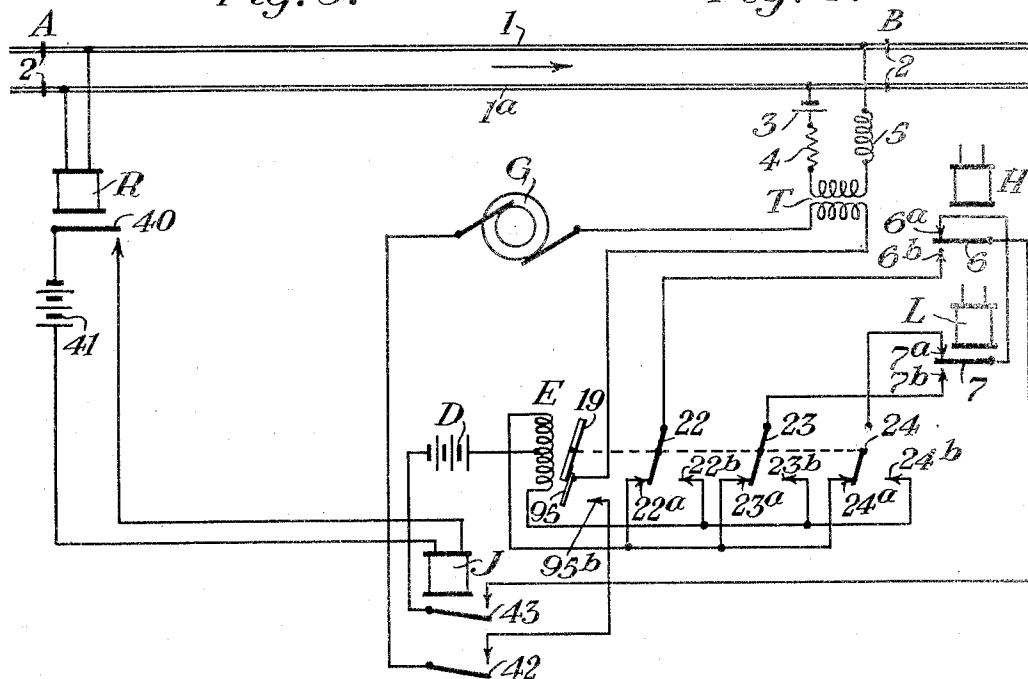


Fig. 5.

INVENTOR:
A. J. Sorensen,
by A. Z. Vencil
His Attorney

UNITED STATES PATENT OFFICE

ANDREW J. SORENSEN, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

ELECTRICAL APPARATUS

Application filed February 7, 1930. Serial No. 426,565.

My invention relates to electrical apparatus, and particularly to apparatus of the type comprising contacts controlled by mechanically resonant oscillating masses.

5 The present application is partly a continuation-in-part of my co-pending application, Serial No. 238,572, filed December 8, 1927, for Railway traffic controlling apparatus.

10 I will describe one form of electrical apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is 15 a view showing, in front elevation, one form of electrical apparatus embodying my invention. Figs. 2 and 3 are views showing in top plan and end elevation, respectively, the apparatus shown in Fig. 1. Fig. 4 is a vertical transverse sectional view along the line 20 IV—IV of Fig. 1. Fig. 5 is a diagrammatic view showing the apparatus illustrated in Figs. 1 to 4, inclusive as applied to the control of current to a section of railway track.

25 Similar reference characters refer to similar parts in each of the several views.

Referring first to Figs. 1 to 4, inclusive, the reference character K designates electrical apparatus which for convenience I will 30 term an "oscillator" and which embodies my invention. This oscillator comprises a base 16 carrying an electromagnet E which operates a pivoted armature 19. A permanent magnet 18 extends from the back strap 17 of 35 the electromagnet E to a position above the armature 19 for the purpose of polarizing the armature. The armature 19 constitutes one end of a driver P having two parallel side bars 20 and 21 and an end bar 90 pivoted in such manner that the driver is oscillated by the oscillation of the armature 19. 40

The armature 19 carries a movable contact 95 arranged to swing into engagement with a fixed contact 95^b when the armature occupies one extreme position, as will be apparent from an inspection of Fig. 3.

45 The oscillator K also comprises a plurality of movable masses, here shown as flywheels W¹, W² and W³, each pivotally mounted on suitable brackets on the base 16 and disposed 50

coaxially in such positions that the side bars 20 and 21 of the driver P extend through openings between the spokes of the wheels as best seen in Figs. 3 and 4. By means of helical springs 25, each of the side bars 20 55 and 21 of the driver P is attached to the rim of each of the wheels W at points adjacent the top of the wheel. When the driver P is at rest the two springs 25 acting upon the flywheels W are balanced, so that the flywheels then occupy positions of equilibrium. 60 When the driver P of the oscillator K is being swung from side to side, however, a variable moment is applied to each of the flywheels W to cause oscillation of the flywheels. The flywheels are constructed with different moments of inertia, and the resiliency of the several springs 25 is so adjusted that each of the flywheels W is mechanically resonant at a frequency which is different 65 for individual wheels. Each of the wheels W is provided with a damping mechanism here shown as a post 27^a attached to the wheel and cooperating with two fixed damping springs 27. When the wheel oscillates in 70 either direction from a middle position in which it is illustrated in the drawings, a polished face of the post 27^a engages one or the other of the damping springs 27. The damping mechanism, thus constructed, operates in a manner analogous to resistance in a tuned electrical circuit to broaden the tuning of the wheels so that each wheel will be resonant at frequencies within a "band" 75 rather than sharply resonant at a single frequency.

As best shown in Fig. 4, wheel W³ carries a movable contact 24 which is arranged to engage alternately with two fixed contacts 24^a and 24^b at the limits of the motion of the wheel W³ when this wheel is being oscillated by operation of the driver P. It will be apparent that due to the permanent magnet 18, the armature 19 will be held against one pole 80 or the other of the electromagnet E when the electromagnet is deenergized so that contact 24—24^a or contact 24—24^b is closed at all times when the oscillator is at rest. In similar manner, the wheel W¹ operates contacts 22— 85 90 95 100

22^a and 22—22^b and wheel W² operates contacts 23—23^a and 23—23^b.

It will be apparent from the foregoing that by controlling the supply of current to the electromagnet over contacts controlled by a selected one of the flywheels W, the oscillator may be operated at the resonant frequency of the selected wheel. This operation may be utilized in many forms of apparatus and the oscillator thus far described may for example be applied to the control of train governing current to the track rails in a system of automatic train control as shown in Fig. 5. Referring to the latter view, the reference characters 1 and 1^a designate the track rails of a stretch of railway track, over which traffic normally moves in the direction indicated by the arrow. These track rails are divided by means of insulated joints 2 to form a section A—B. A track relay R is connected across the rails adjacent one end of the section, and track circuit current for controlling this relay is supplied across the rails adjacent the other end of the section from suitable means, here shown as a battery 3, through the usual resistor 4. Train controlling current is at times supplied to the rails of section A—B from a suitable source of alternating current here illustrated as a generator G, through a transformer T, the secondary of which is connected across the rails of section A—B in series with battery 3, resistor 4 and the usual impedance 5.

The supply of current from generator G to transformer T is controlled in part by contact 95—95^b operated by the armature 19 of oscillator K and also by an approach relay J. This relay J is normally deenergized; but, when a train enters section A—B to deenergize the track relay R and close back contact 40 thereon, current from battery 41 energizes relay J. As shown in the drawings, section A—B is unoccupied so that track relay R is energized and relay J is open. Under these conditions, the oscillator K is at rest, and the circuit for the primary of transformer T is open at front contact 42 of relay J and also at contact 95—95^b operated by armature 19 of the oscillator K. When a train enters section A—B, relay R becomes deenergized, thereby picking up relay J and supplying current to electromagnet E over contacts controlled by a selected one of the wheels W. The selection between the several wheels is preferably controlled in accordance with traffic conditions in advance and may be accomplished in any suitable manner such for example as by a home relay H and a distant relay L. The circuits for controlling these two relays form no part of my present invention and are omitted from the drawings for the sake of simplicity. For present purposes, it is sufficient to state that home relay H is normally energized but is deenergized when a train occupies the section immediately to the right of point B. The

distant relay L is also normally energized but is deenergized when a train occupies either the first or the second section immediately to the right of point B. As here shown, relays H and L are both energized, so that when relay J becomes energized, current flows from battery D, over front contact 43 of relay J, front contact 6—6^a of relay H, front contact 7—7^a of relay L, contact 24—24^a of oscillator K and through a portion of electromagnet E back to battery D. When this circuit is closed, armature 19 is reversed, thereby operating all of the flywheels controlled thereby and opening contact 24—24^a but closing contact 24—24^b. When this happens, current is supplied over a circuit similar to that just described but serving to supply current of the other polarity to electromagnet E and thereby again reversing the armature 19. Since the reversals of armature 19 are controlled by contacts on the flywheel W³, it is apparent that the armature will be operated at the resonant frequency of this flywheel. Furthermore, since front contact 42 of relay J is now closed, the operation of contact 95—95^b driven by the armature 19 varies the current supplied to the transformer T at the frequency of operation of the armature, one impulse being delivered to the transformer for each complete cycle of operation of the armature. Under these conditions, therefore, the trackway is supplied with alternating current periodically varied at a frequency determined by the flywheel W³. When relay H is energized and relay L is deenergized, while relay J is closed, the operation of the apparatus is similar to that just described except that since contact 7—7^b of relay L is now closed, the electromagnet E of oscillator K is controlled by contacts 23—23^a and 23—23^b operated by wheel W² instead of the corresponding contacts of wheel W³. Under these conditions, the trackway is supplied with alternating current periodically varied at the frequency determined by wheel W². In similar manner, when relay H is deenergized, the closing of contact 6—6^b introduces the contacts 22—22^a and 22—22^b operated by wheel W¹ in the control circuits for the electromagnet E, and when relay J is energized, the oscillator K operates to periodically vary the current supplied to the track rails at the frequency determined by wheel W¹.

It is manifest that the frequencies of operation of the oscillator K may be adjusted to any reasonable values by properly choosing the constants of the oscillating masses. For example, the parts may be constructed so that the natural period of wheel W¹ is 80 oscillations per minute, the natural period of wheel W² is 120 oscillations per minute, and the natural period of wheel W³ is 180 oscillations per minute, but these particular values are mentioned only by way of illustration.

The current supplied to the track rails by

the apparatus illustrated in Fig. 5 may be utilized to control governing means on the train in any suitable manner. For example, the apparatus on the train may be selectively responsive to the frequency of the variations in the current supplied to the track rails but not selectively responsive to the current itself.

Although I have described my invention as applied to the control of train governing current supplied to the trackway, it should be understood that my invention is not limited to this particular arrangement but is generally applicable wherever it is desired to control a contact at different controlled frequencies.

Although I have herein shown and described only one form of electrical apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, a movable driver, means for operating said driver at different frequencies, a plurality of pivotally supported flywheels having different moments of inertia, resilient means connecting each flywheel with said driver, and contacts controlled by each said flywheel.

2. In combination, a base, a plurality of coaxial wheels pivotally mounted on said base, a driver comprising two bars extending parallel with the axes of said wheels, resilient means for connecting each bar of the driver with each wheel, means for oscillating said driver at different frequencies about an axis parallel with the axes of said wheels to impart an oscillating movement to each said wheel, and a contact operated by each said wheel, the wheels being separately mechanically tuned to resonance at different frequencies.

3. In combination, a plurality of pivoted wheels mechanically tuned to resonance at different frequencies, a magnet operated armature for oscillating all of said wheels at different frequencies, and a plurality of contacts one controlled by each said wheel.

4. In combination, a plurality of masses mounted to oscillate and mechanically resonant at different frequencies, an electromagnet, an armature driven by said electromagnet for oscillating all of said masses at different frequencies, and a plurality of contacts one controlled by each said mass.

5. In combination, an electromagnet, a pivoted driver oscillated by said electromagnet at different frequencies, a plurality of masses mounted to oscillate independently and mechanically resonant at different frequencies, resilient means for connecting each said mass

with said driver, and a plurality of contacts one controlled by each said mass.

6. In combination, a single driver mounted to oscillate, a plurality of masses each mounted to oscillate and separately connected with said driver, means for tuning said masses to mechanical resonance at different frequencies, means for oscillating said driver at different frequencies, and a plurality of contacts one controlled by each said mass.

7. In combination, a plurality of masses mounted to oscillate and mechanically resonant at different frequencies, a single motor for oscillating all said masses, a plurality of contacts one controlled by each said mass, means for controlling said motor by a selected one of said contacts, and an additional contact controlled by said motor.

8. In combination, an electromagnet, a pivoted driver oscillated by said electromagnet, a plurality of masses mounted to oscillate independently and mechanically resonant at different frequencies, means for controlling said electromagnet by a selected one of said masses to oscillate said driver at the resonant frequency of such selected mass, and an additional contact controlled by said driver.

9. In combination, an electromagnet, a pivoted driver oscillated by said electromagnet, a plurality of masses mounted to oscillate independently and mechanically resonant at different frequencies, means for controlling said electromagnet by a selected one of said masses to oscillate said driver at the resonant frequency of such selected mass, a load, a source for supplying energy to said load, and an additional contact interposed between said load and said source for varying the supply of current to the load at the resonant frequency of said selected mass.

10. In combination, an electromagnet, an armature controlled by said electromagnet, a plurality of pivoted wheels having different movements of inertia, a plurality of contacts one controlled by each said wheel, means for supplying current to said electromagnet over a selected one of said contacts, resilient means for separately connecting each of said wheels with said armature, an additional contact controlled by said armature, a load, and means including said additional contact for supplying energy to said load.

11. In combination, a plurality of masses mounted to oscillate and mechanically resonant at different frequencies, a single motor for oscillating all said masses, a plurality of contacts one controlled by each said mass, and means for controlling said motor by a selected one of said contacts.

12. In combination, an electromagnet, a pivoted driver oscillated by said electromagnet, a plurality of masses mounted to oscillate independently and mechanically resonant at different frequencies, and means for controlling said electromagnet by a selected one

of said masses to oscillate said driver at the resonant frequency of such selected mass.

13. In combination, an electromagnet, a pivoted driver oscillated by said electromagnet, a plurality of masses mounted to oscillate independently and mechanically resonant at different frequencies, means for controlling said electromagnet by a selected one of said masses to oscillate said driver at the resonant frequency of such selected mass, a load, a source for supplying energy to said load, and an additional contact interposed between said load and said source and operated directly by said pivoted driver for varying the supply of current to the load at the resonant frequency of said selected mass.

14. In combination, an electromagnet, an armature controlled by said electromagnet, a plurality of pivoted wheels having different movements of inertia, a plurality of contacts one controlled by each said wheel, means for supplying current to said electromagnet over a selected one of said contacts, resilient means for separately connecting each of said wheels with said armature, an additional contact operated directly by said armature, a load, and means including said additional contact for supplying energy to said load.

15. In combination, a plurality of masses mounted to oscillate and mechanically resonant at different frequencies, a single motor for oscillating all said masses, means for controlling said motor by a selected one of said masses, a load, and means for controlling said load by the selected one of said masses.

16. In combination, a plurality of masses mounted to oscillate and mechanically resonant at different frequencies, a single motor for oscillating all said masses, means for controlling said motor by a selected one of said masses, a load, and means for supplying current to said load at the frequency of resonance of the selected mass.

In testimony whereof I affix my signature.

ANDREW J. SORENSEN.