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2,826,996

VIBRATOR OPERATED LOAD AND SIGNAL SYSTEM

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1 Claim. (Cl. 104—150)

This invention relates to an improved circuit arrangement in electrical sound generating systems for causing, through remote track-side control, the emission of whistle or horn imitating sounds by means of electrically impulsed apparatus that is small enough to be carried by and concealed within the rolling stock of toy electric trains.

In a copending application of Raymond E. Smith, Serial No. 251,426, filed October 15, 1951, now U. S. Patent 2,791,972, granted May 14, 1957, it is proposed to employ a train carried miniature electromagnetic "speaker" for emitting the sound of a whistle or diesel horn. The speaker is operably sensitive to current pulsations generated by potential peaks of relatively high frequency in an ordinary 60 cycle, train operating, alternating current. The high potential peaks are occasioned by the circuit breaking action of an electromagnetic vibratory circuit interrupter located in the supply line that feeds current to the track from a variable voltage toy transformer. There is a manually operated electric switch by means of which the circuit interrupter can be rendered inoperative or brought into operation to cause generating of the whistle or horn imitating sound by the train carried miniature speaker.

Since the same fundamental 60 cycle alternating current is used to run the train both when the speaker operating circuit interruptions are and are not called into action to sound the whistle, and since it is desired that the sounding of the whistle shall never perceptibly interfere with, nor slow down nor make irregular the running of the train, there is desirable a minimum of spacing between the circuit making and breaking contacts in the vibrator to favor continued delivery of unimpaired train running electric power. However, it is found that minimizing the contact spacing reduces the speaker energizing electrical forces and militates against desirable loudness of sound producible by the speaker.

One object of the present invention is to permit increased tolerance in the accuracy of spacing adjustment of circuit interrupting contacts in a vibrator used for the subject purpose. Such increase of tolerance reduces the requirements for close inspection in manufacture of the vibrator and makes the unit more immune to impairment by accidental disturbance of the original adjustment from such causes as shocks in transportation or deterioration of the contact surfaces in service.

The improvements also aim to preserve the delivery of maximum power to the track while the train carried speaker is being operatively energized so that not only the train propulsion motor, but also a train carried motor reversing relay and other electrically energized train carried accessories deriving current from the track, shall receive sufficient power for their proper operation while the vibrator is acting to interrupt the fundamental current wave.

A further object of the invention is to enable the speaker to be energized more strongly than heretofore for producing a louder whistle sound at times when the track

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is deprived of sufficiently powerful current to propel the train.

These and related aims of the invention will appear in greater detail in the following description of my improved electrical system having reference to the appended drawing wherein:

Fig. 1 shows an assembly of toy electric railway and control apparatus incorporating the invention comparable to that shown in Fig. 1 of the aforesaid copending application.

Figs. 2 and 3 are respectively broadside and edgewise elevations of the vibratory circuit interrupter of Fig. 1.

Fig. 4 represents one of possible hook-ups of electric circuits that may incorporate the present invention.

As in the aforesaid Patent No. 2,791,972 the toy train in Fig. 1 is represented by rolling stock comprising a car 12 hauled by a toy locomotive 13 driven by its carried electric propulsion motor 14, universal for A. C. and D. C., and fashioned externally to represent a Diesel locomotive equipped with dummy signalling horns 15. The casing of locomotive 13 is partially broken away to expose in its interior a sound signaling device 18. Details of a suitable construction of sound signaling device are shown in Fig. 4 of my aforesaid copending application.

The train 12, 13 is shown as standing or traveling on a course of electrically conductive, relatively insulated toy track rails 19 supported by and insulated from sleepers 20 as usual. Electrical connections shown in Fig. 4 indicate that the propulsion motor 14 derives electric current through the track rails 19 and through relatively insulated traction wheels on respectively opposite sides of the locomotive and is controlled as to starting, stopping and reversal of the direction of train running by an electromagnetic relay or step switch 21 which also is carried by the locomotive as is conventional in toy trains impelled by alternating current. As will later appear herein, the present improvements permit, as substitutes for step switch 21, the use of a variety of types of relays beyond those that are practicable of use with certain of the hook-ups proposed in my copending application.

Figs. 1 and 4 show an electrical lead 24 connecting one of the track rails 19 with the reed 62 of an electromagnetic vibrator 35, and another lead 44 connecting the other rail with the binding post 43 at the high voltage terminal of the transformer secondary 28, 42 in the train controller 29. The transformer is capable of delivering, say, 15 volts. Binding post 27 constitutes a variable tap terminal along the transformer secondary in controller 29 capable of delivering, say, 7½ to 15 volts. Binding post 45 of the controller forms the other extreme or base terminal of the transformer secondary. Binding post 27 is in constant electrical connection with a manually swingable, voltage varying, current take-off arm 30 that wipes conductively along the train running section 28 of the secondary winding, thus furnishing the track with selected potentials between the aforesaid 7½ volts and 15 volts.

Controller 29 may be stationed at the trackside, or remote from the track if desired, and serves to govern the speed and direction of running of the train when the handle 30' of wiper arm 30' is manually swung. The primary winding 31 of the transformer derives power from any suitable source of alternating or house current (not shown), preferably at 60 cycles, through an attachment cord 32.

The sound generating device 18 is mounted on the interior of locomotive 13 and may be an electromagnetic speaker, either of the horn type or of the cone type, but preferably is of the dynamic loud speaker type incorporating either a permanent type of field magnet or an electromagnetic field.

The vibrator 35 is equipped with reed motivated make-

and-break contacts effecting a frequency of circuit interruption sufficiently higher than the frequency of pulsations or alternations of the fundamental current in the interrupted circuit to fall within an audio range of frequency. Referring more particularly to Figs. 2 and 3, the vibratory reed 62 is normally biased toward the right of the axis of the magnet core of the driving coil 36 so as normally to make circuit between reed carried contact 63 and one of the stationed contacts 64. But the contact 65 that is stationed on the opposite side of the reed is normally separated from reed carried contact 63'. Vibratory contacts 63 and 63' are united conductively with each other and with the metal blade of the reed.

Differing from comparable circuits in Fig. 10 in the aforesaid Patent No. 2,791,972, a supply of current at 15 volts which is available at binding post 43 of the controller is not, according to the present improvements confined to a circuit path containing the driving coil 36 of the vibrator 35. Instead, in the hook-up herein shown, the full 15 volt supply is made available also, and regardless of the take-off position of wiper arm 30, to the normally open stationary contact 65 in the vibrator through a branch in a high power circuit inclusive of lead 59 that taps into this relatively high voltage source at the location 60 in lead 23. Thus the 15 volt supply is available to contact 65 without reduction of potential by the resistance or reactance of the vibrator coil 36 and irrespective of the speed at which the train is being run. The other, normally alive, stationary contact 64 in the vibrator remains connected as in the circuits of my copending application to the intermediate binding post 27 of the controller from which the normal train speed varying current ranging from $7\frac{1}{2}$ volts to 15 volts is derived.

In the use of this improved circuit, when the vibrator is idle because of manual switch 38 being normally open, the track is furnished with train running current through the constantly closed vibrator contacts 63, 64 with manually selected power within the said range, $7\frac{1}{2}$ to 15 volts, of train running current potential and at an uninterrupted, sixty cycle frequency. When manual switch 38 is momentarily closed to sound the horn or whistle, the driving coil 36 of the vibrator becomes energized through lead 23 as heretofore. But each time the reed 62 flexes to close the stationary vibratory contacts 65 and 63', a full 15 volt potential is intermittently shot into the track rails regardless of the setting of the wiper arm 30.

Because by the present improvements the vibration interrupted full 15 volt potential from controller terminal 43 is permitted to pass directly to the track around the driving solenoid 36 and through the vibratory contacts 63' and 65, there can be tolerated a desirably larger gap of separation between the vibratory contacts. While this enables the speaker 18 to emit a desirably loud whistle or horn imitating sound it does not deprive the train of sufficient power while the speaker is generating sound to cause the train to slow down or suffer any other perceptible effect upon its smoothness, quietness or speed of running.

The wider tolerance in contact gap thus permitted also eliminates the requirement of extremely accurate setting of the contact spacing and solves the problem of economical vibrator manufacturing and maintenance.

In the foregoing description of operation it is assumed that the train carried elements as shown are electrically linked in the system as specified in the aforesaid copending patent application.

The operation of the complete electrical system will now be explained with reference to Fig. 4 of the drawings. It has already been explained that when the vibrator coil is out of circuit and idle because of switch 38 being normally open, the track is furnished with train running current of $7\frac{1}{2}$ to 15 volts through circuit ele-

ments 43, 44, 19, train, 24, 64, 25, 27, 30 so that shifting of take-off arm 30 by means of controller handle 30' starts, stops and varies the traveling speed of the train. The train carried electromagnetic relay 21, 22 that controls the reversible propulsion motor 14 advances one step each time current supply to the track is cut off and resumed by the controller handle 30'. The successive steps of the relay cause the following repeating cycle of respective effects upon the running of the train: start-stop-reverse-stop, and repeat.

When normally open switch 38 is momentarily closed to sound the whistle or horn, the track is likewise furnished with current except that the current is interrupted at contacts 63, 64 for each excursion of reed 62. The reed vibrates responsively to the coil 36 which is energized through the circuit elements 43, 44, 40, 60, 23, 38, 23, 45. But according to these improvements there is further and newly projected into the track circuit a reed interrupted full 15 volt supply through the following circuit elements 43, 44, 19, train, 19, 24, 62, 65, 59, 60, 23, 38, 23, 45. This full 15 volt supply is undiminished either by change of position of take-off wiper 30 along the supply secondary or by the resistance of or reactance of vibrator coil 36, wherefore the hereinbefore mentioned advantages are obtained.

For purposes of distinguishing between a relatively low frequency, as for instance the 60-cycle frequency of an ordinary alternating current, and a relatively higher frequency, sometimes but not necessarily an even multiple of 60 cycles, the relatively lower frequency whatever it may be is herein sometimes referred to as a subsignaling frequency and the higher frequency as a signaling frequency.

Many variations of the circuit arrangement herein illustrated that can be made within the principles of this invention will be suggested to workers in the art by the disclosure hereof wherefore the following claim is directed to and intended to cover all variations, substitutes and equivalents of the parts and arrangements illustrated herein which come fairly within the broadest interpretation of its terms.

I claim:

An electrical system comprising, an electromagnetic sound signalling device adapted to remain silent when subjected to alternating current reversals of subsignalling frequency, a translatable inductive load, a normally made electric circuit constantly including said device and said load, a normally broken electric circuit intermittently made on occasion and also including said device and said load, a source of continuous current alternating at subsignalling frequency comprising a transformer including a secondary winding tapped and connected to deliver relatively low potentials to said normally made circuit and differently tapped and connected to deliver relatively high potential to said normally broken circuit, and a vibratory current interrupter including an electromagnet connected to be energized by alternating current derived from said source said interrupter including, a magnetically responsive reed arranged in the field of said electromagnet to be vibrated thereby in a manner to perform excursions at subsignalling frequency, electric contacts contained respectively in said normally made and normally broken circuits arranged to be opened and closed momentarily by vibrations of said reed in a manner to make and break said circuits sequentially a plurality of times at signalling frequency during each vibratory excursion of said reed at subsignalling frequency, thereby to make and break said circuits at sufficiently high frequencies under sufficiently high voltage to produce sound signalling operation of said device while said load is energized.

No references cited.