United States Patent

Longnecker

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[54] MODEL RAILROAD ELECTRIC LOCOMOTIVE SOUND SYSTEM

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[52] **U.S. Cl.** ..... **46/232**, 46/243 P, 46/217

[51] **Int. Cl.** **A63h 19/10**, A63h 19/14

[58] **Field of Search** ..... 46/216, 232, 243 P

[56] **References Cited**

UNITED STATES PATENTS

2,826,996	3/1958	Smith	46/232 X
3,061,973	11/1962	Oberdorf	46/232
3,339,307	9/1967	Floyd et al.	46/232 X
3,341,842	9/1967	Brequet	46/232 X
3,425,156	2/1969	Field	46/232

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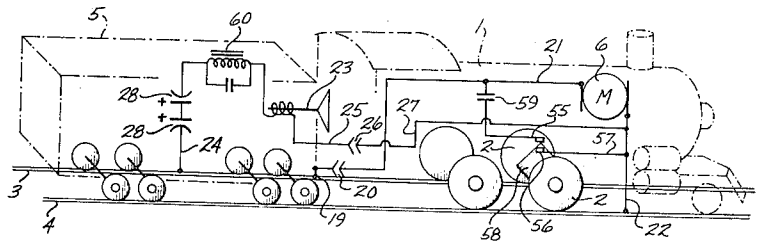
[57] **ABSTRACT**

An accessory includes a speaker mounted in the locomotive tender electrically driven by an audio frequency signal from one or more electronic sound generators simulating respectively a bell, escaping steam either from an engine exhaust, leakage or blowoff, and a whistle. The engine exhaust sound is timed by periodically grounding the radio frequency oscillator of a timing circuit for the escaping-steam-simulating generator by intermittently closing a switch in the circuit effected by rotation of a driver wheel of the locomotive. Selective controls enable the bell and whistle to be operated at will and further enable the nature of the sounds of the bell, exhaust and whistle to be modified. Direct current for the locomotive driving motor, the audio frequency signal to drive the speaker and the radio frequency signal to the locomotive-carried switch for timing the simulated engine exhaust are all simultaneously impressed on the two rails but electronic blocking components included in the circuit prevent the engine-driving direct current and the radio-frequency signaling current from interfering with the speaker operation and prevent the audio frequency signal and the radio frequency signal from leaking into the direct-current power circuit.

17 Claims, 5 Drawing Figures



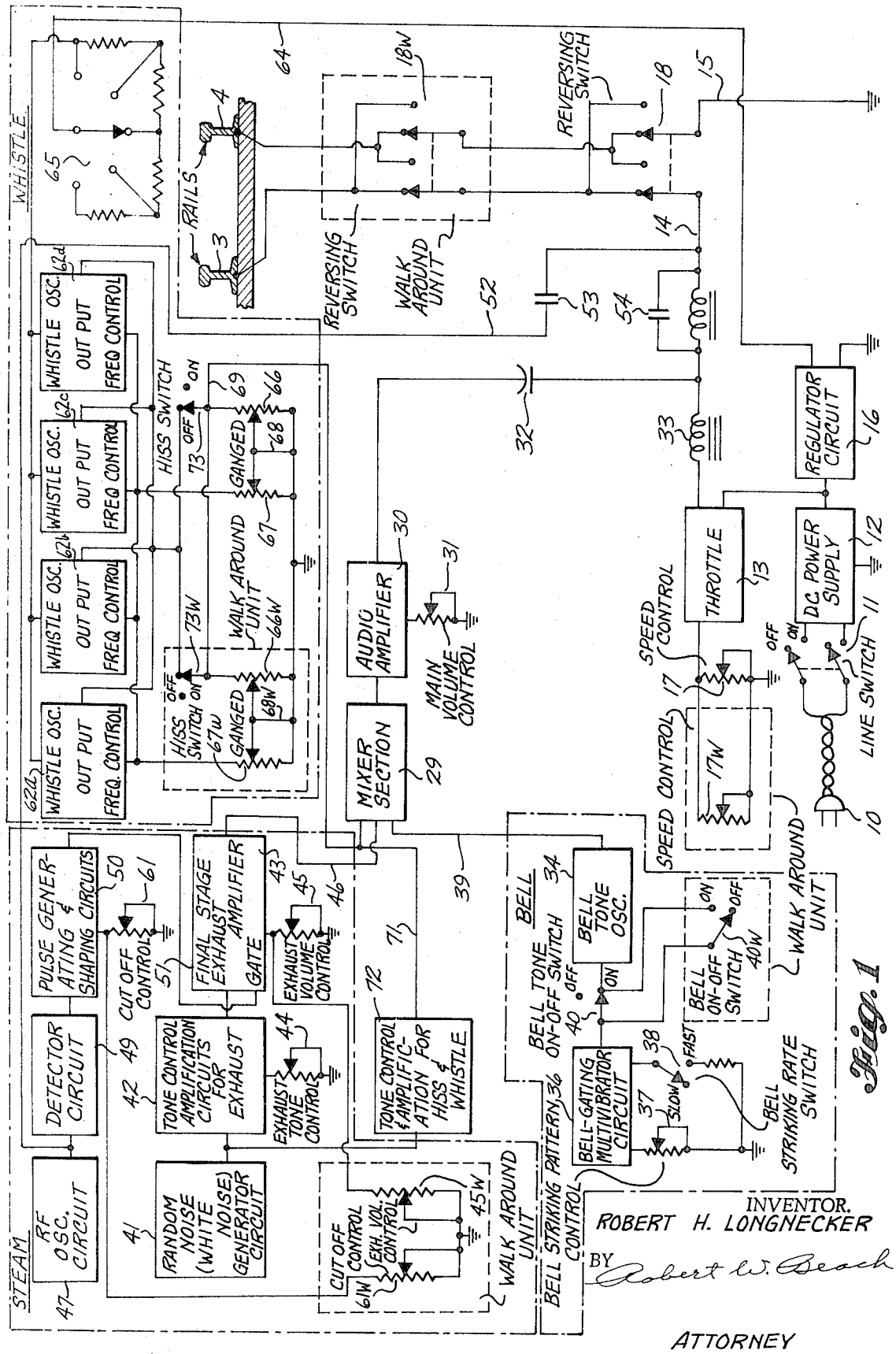


Fig. 1

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Patented May 23, 1972 3,664,060

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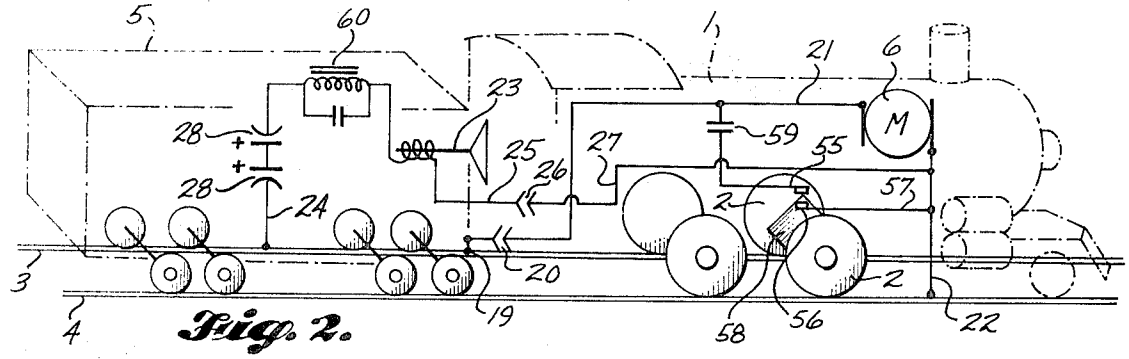
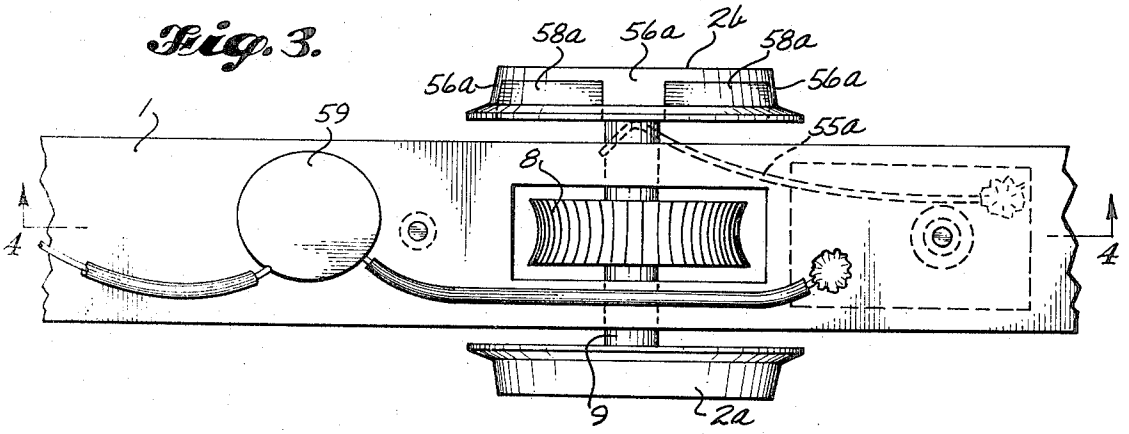


Fig. 2.

Fig. 3.



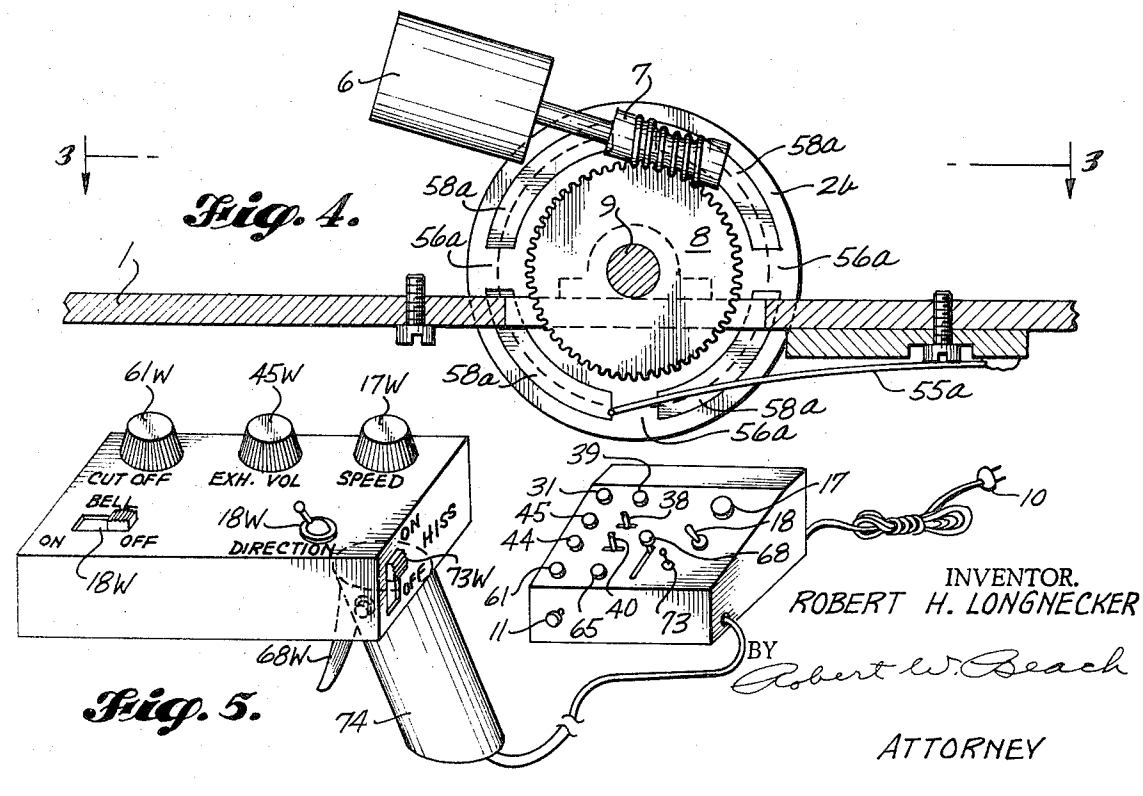


Fig. 4.

Fig. 5.

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MODEL RAILROAD ELECTRIC LOCOMOTIVE SOUND SYSTEM

A principal object of the present invention is to provide a single electronic sound system accessory for model railroad locomotives which can produce the sound of a bell, a whistle, or escaping steam either as chuffing while the locomotive is traveling or steam leakage when the engine is stopped, or steam blowoff.

A particular object is to provide an accessory by which any of these sounds produced will be very realistic, and which can be controlled to alter the tone, the volume and the duration.

Specifically it is an object to enable the sound of escaping steam to be simulated as chuffing of the locomotive in precise synchronism with the speed of the locomotive, as well as enabling the sound to be altered to simulate working under heavy load or light load.

A further object is to promote the realism of the sounds produced by emitting them from the locomotive.

It is also an object to enable the operator to control the timing and duration of the simulated bell, whistle and steam blowoff sounds at will.

An additional object is to enable such simulated locomotive sounds to be produced and controlled without interference with the propulsion of the locomotive and the ability of the operator to control its speed and direction of movement.

It is an object to provide such a locomotive sound system in which the sounds emanate from the locomotive without requiring any additional transmission wires or the use of radio transmission and reception, but simply by using the railway tracks as conductors.

FIG. 1 is a block circuit diagram including the circuitry for the locomotive driving power and for the several electronic sound-producing components.

FIG. 2 is a diagrammatic top perspective showing the circuitry in the locomotive including cam mechanism closing a switch periodically.

FIG. 3 is a fragmentary horizontal section of a portion of a locomotive showing an alternative type of periodically closable switch mechanism viewed from line 3—3 of FIG. 4.

FIG. 4 is a fragmentary vertical section taken along line 4—4 of FIG. 3.

FIG. 5 is a top perspective of stationary and portable control units.

Operating model trains have been available for a considerable period of time. In many instances such trains have been accurate scale replicas of the rolling stock of various railroads. Such model trains have been powered to be operated by remote controls at various speeds and, alternatively, in forward and reverse directions. Moreover, such trains have been operated over elaborate trackage systems. A principal deficiency of previous systems has been their inability to simulate realistic locomotive sounds such as the bell, the whistle and escaping steam.

Conventionally, a model train includes a locomotive **1** shown diagrammatically in phantom in FIG. **2**, propelled by driving wheels **2** running on rails **3** and **4**. A simulated steam locomotive has a tender **5**, also shown in phantom perspective in FIG. **2**, trailing behind the locomotive, which usually is disengageably attached to the locomotive. The driving wheels **2** of the locomotive are driven by an electric motor **6** turning a worm **7** which meshes with a worm gear **8**, shown in FIGS. **3** and **4** as being secured on the axle **9** carrying the driving wheels **2**.

Motive Power

Power for the locomotive propulsive system and sound system is supplied from a conventional 110-volt alternating current supply source through a conventional plug **10**, which is connected to the main line switch **11** shown in the circuit of FIG. **1**, and on the stationary control box of FIG. **5**. The alternating current source supplies power for the direct-current power supply **76** which is of conventional type and may include a transformer, a full-wave rectifier, and a filter capacitor. Such DC power supply is connected through the throttle **13**, which is a cascaded current amplifier, to the rails **3** and **4** by way of a wire **14** and a grounded wire **15**. The DC power supply is also connected to ground.

Electrical power is supplied to the various components of the sound system accessory by a regulator circuit **16** which provides a constant-voltage direct-current source, such for example as 10 volts, irrespective of considerable fluctuation in the voltage of the alternating current supply or differences in voltage of different supplies. Because of the large number of components of the sound system powered by such constant voltage direct-current supply, such power supply connections are not shown in FIG. 1. Also many of such circuit components are individually connected to ground, but for simplicity such ground connections also are not shown.

The speed of the motor **6** driving the locomotive driving wheels can be altered at will by movement of the speed-control potentiometer **17**, which controls the current output of throttle **13**. Such motor is of the reversible type, and its direction of rotation, and consequently the direction of rotation of the locomotive driving wheels, can be reversed at will by interchanging the leads to the rails **3** and **4** by shifting the reversing switch **18**. The motor **6** is always connected in the same relationship to the rails **3** and **4** unless the locomotive is turned end for end.

Locomotive Construction

The manner in which the connection is made between the rails **3** and **4** and the motor **6** can be conventional. The locomotive wheels are insulated from the locomotive frame on one side, and the tender wheels are insulated from the tender frame on the opposite side. The tender frame **19** thus constitutes one side of the motor circuit to which it is connected through a separable connector **20** and a wire **21**, and the locomotive frame **22** constitutes the other side of the electrical circuit. Such components are indicated diagrammatically as electrical circuit components in FIG. **2**. The locomotive frame and the tender frame are connected by an insulating mechanical drawbar-type coupling.

Sound Propagation

In order to produce the most realistic locomotive sound propagation it is desirable both that the simulated sounds generated be of high fidelity and that the sounds emanate from the locomotive as their source. The simulated locomotive sounds are generated by electronic audio frequency signal synthesizing means for driving a speaker **23** carried by the model train, which conveniently can be mounted in the locomotive tender **5**. One terminal of the speaker is connected by wire **24** to the frame of the tender in circuit with rail **3**, and the other terminal of the speaker is connected by wire **25**, connector **26** and wire **27** with the frame **22** of the locomotive which is in circuit with rail **4**.

Through the connections mentioned above, the speaker **23** is connected in circuit with the rails **3** and **4** continually, as long as the locomotive **1** and tender **5** are coupled together, so that the connector **26** connects wire **25** in the tender with wire **27** in the locomotive. Electrolytic capacitors **28** are connected in back-to-back series relationship in the wire **24** between the speaker and the tender frame to provide a non-polarized capacitance for blocking flow to the speaker of direct current for energizing the driving motor **6** irrespective of the direction in which the direct current flows. The value of such capacitors is not critical but must be large enough to pass the lowest audio frequency signals from the sound system destined for the speaker.

Locomotive sounds are produced by the speaker **23** driven by audio frequency alternating current which may be composed of a blend of several audio frequency signals integrated by the mixer section **29** and amplified by the audio amplifier **30**. Such mixer section may include a transformer mixing stack, the transformers of which correspond respectively to the several types of signals generated for the various locomotive sounds to be propagated. The intensity of the blended audio frequency signal can be adjusted by the main volume control potentiometer **31** to alter the overall volume of the sound emanating from the speaker **23**.

A blocking capacitor **32**, preferably of the electrolytic type, is interposed in the wire connecting the audio amplifier **30** to the wire **14** connected to one of the rails for the purpose of blocking flow to the audio amplifier **30** of direct current from the circuit powering the motor **6**. Also a choke coil **33** is included in the circuit between the throttle **13** and the connection from the audio amplifier for the purpose of blocking flow of the audio frequency signal to the throttle direct-current circuit, which would drain energy from the audio frequency signal and overload the audio amplifier **30**. The choke coil must be of sufficiently low resistance to enable the direct current to flow from the throttle through wire **14** to the motor **6** substantially unaltered. Since the audio frequency signal for driving the coil of speaker **23** is of alternating current character, it is immaterial as far as the speaker operation is concerned in which position the reversing switch **18** is set.

Bell

The portion of the circuit which produces the bell component of the audio frequency signal is within the dot-dash line enclosure of FIG. **1**, labeled "BELL." The bell tone is generated electronically by an oscillator **34** which is gated by a bell-gating multivibrator circuit **36**. Such circuit produces intermittent bell-gating pulses from the outputs of both halves of the multivibrator. These pulses are properly shaped by resistance-capacitance networks to provide a wave shape that will closely simulate the rise and decay of a bell tone.

The striking pattern of the bell can be regulated at will primarily by adjustment of the potentiometer **37** in one-half of the multivibrator circuit. The basic symmetry of the multivibrator can also be altered by opening or closing the switch **38** to the amount of resistance in the other half of the multivibrator circuit **36** primarily to vary the striking rate of the bell. Operation of these two controls provides sufficient variation of the ringing pattern and rate to simulate a wide range of bell ringing effects. The bell audio frequency component of the sound system passes to the mixer section **29** through the wire **39** when the bell tone on-off switch is in the "on" position shown in FIG. **1**.

Escaping Steam

Steam escaping from an engine produces several different types of sound, including the chuff of the exhaust from the steam engine when the engine is propelling the locomotive, the hiss of steam leakage and the blowoff effected automatically by opening of a pop safety valve or intentionally in blowing down the boiler for cleaning it out. The sound of escaping steam is basically the same in all instances, and the circuit component for providing an audio frequency signal simulating escaping steam in the various instances mentioned is within the dot-dash line enclosure of FIG. **1** labeled "STEAM."

The basic audio frequency for simulating the escape of steam is generated by a random noise or white noise generator circuit **41**. This circuit will generate an audio frequency signal corresponding to a wide range of sound frequencies. To modify such audio frequency signal to simulate the sound of a steam engine exhaust a portion of such signal is fed to the tone control and amplification circuits for exhaust designated **42** in FIG. **1**, and then to the final stage exhaust amplifier **43** where it is gated to pulse in synchronism with the speed of rotation of the model train. The desired tone of the engine exhaust chuff can be selected by adjusting the exhaust tone control potentiometer **44**, and the intensity of the exhaust sound can be altered by adjustment of the exhaust volume control potentiometer **45**. The modified audio frequency signal for producing the simulated engine exhaust sound is impressed on the mixer section **29** by way of wire **46**.

Chuff Control Circuit

Periodic interruption of the random noise audio frequency signal reaching the final stage exhaust amplifier **43** to simulate the chuff of a steam engine exhaust is accomplished by a radio frequency control circuit which effects electronic gating of the final stage exhaust amplifier. Such radio frequency signal is originated by the radio frequency oscillator **47**. Such radio frequency signal passes to the detector circuit **49**, then to the pulse generating and shaping circuits **50**, and finally by way of wire **51** to the gate of the final stage exhaust amplifier **43**.

A wire **52** is connected between the radio frequency oscillator **47** and the detector circuit **49** to a wire **14** connected to one of the rails **3** and **4**, depending upon the position of the reversing switch **18**. A capacitor **53** is interposed in wire **52** to block flow of direct current from the locomotive driving electric motor circuit to the oscillator **47** and detector **49**. A radio frequency trap **54** including an inductance and capacitance in parallel forming a resonant circuit tuned to the frequency of oscillator **47** is interposed between the connection of wire **52** to wire **42** and the throttle **13** direct-current circuit for preventing the flow of radio frequency to the throttle circuit so as to avoid overloading the oscillator **47**.

The radio frequency signal will pass from rail **3** through the tender frame **19**, connector **20** and wire **21**, to one contact **55** of a switch in the locomotive. The other switch contact **56** is connected by a wire **57** to the locomotive frame **22**, which is in circuit with the other rail **4**. When the radio frequency signal is continuous the signal at the gate of the final stage exhaust amplifier **43** prevents passage of an audio frequency signal through wire **46** to the mixer section **29**. When the radio frequency signal generated by oscillator **47** is grounded by closing of switch **55,56**, the detector **49** produces a gating pulse which triggers the final stage exhaust amplifier to transmit only a single pulse to the mixer section.

The switch contact **56** is raised into engagement with the stationary switch contact **55** when engaged by each corner of the square cam **58**. Such a cam is mounted to turn with the locomotive driving wheels **2**, so that the switch **55, 56** will be closed momentarily four times during each revolution of the driving wheels. Such switch closure produces a short circuit between the rails **3** and **4** for the radio frequency signal, so that each time the switch **55,56** closes the connection between the oscillator **47** and the detector circuit **49** is grounded through the wire **52**, the switch short between the rails, and the ground wire **15**. When the switch is closed, therefore, the final stage exhaust amplifier **43** is gated to allow passage of only a single audio frequency chuff signal from such amplifier by way of wire **46** to the mixer section **29**.

The shorting between rails **3** and **4** through switch **55,56** is effective with respect to the radio frequency gate control signal only, as described above, because the switch circuit has in it a capacitor **59**, which blocks transmission of the direct current for energizing motor **6** from flowing through the switch **55,56** and bypassing the motor. Also a radio frequency trap in the form of the inductance-capacitance resonant circuit **60** tuned to the frequency of oscillator **47** is included in the lead **24** from the tender frame to the driving coil of speaker **23** so as to block flow of the radio frequency signal from the rail to the speaker coil. Such trap prevents the speaker coil from overloading the oscillator **47**. It is not necessary to provide a radio frequency trap in wire **21** to block the radio frequency signal from reaching the motor **6** because the windings of such motor have sufficient inductance themselves to choke out the radio frequency signal.

The detector **49** generates one and only one pulse each time the switch **55,56** is closed in the locomotive. The pulse-generating and shaping circuits **50** monitor the output of the detector circuit **49** and vary the amplitude, shape and decay rate of the pulse in such a manner as to provide a realistic chuff when fed as a gating pulse to the gate of the final stage exhaust amplifier **43**. The cutoff control potentiometer **61** can be adjusted to vary the basic length of the exhaust pulse so as to produce a chuff which will simulate that produced either by a lightly loaded or a heavily loaded locomotive as the operator may prefer.

FIGS. **3** and **4** illustrate a communicating type of switch mechanism as an alternate to the switch **55,56** operated by the square cam **58** shown in FIG. **2**. In FIG. **3** the wheel **2***a* engageable with track **3** is insulated from the locomotive frame **22**. The wheel **2***b* which engages rail **4** is not insulated from the frame, but is connected electrically to it through the axle **9**.

The wheel 2*b* has four sectors 58*a* of insulating material and the remainder of the wheel including the portions 56*a* between the insulating sections are conductive and engage the rail 4. The sections 56*a* constitute one switch contact member.

A spring silver contact wire 55*a* is mounted to press lightly on the back of the uninsulated driver wheel 2*b*, but will touch conductive sections 56*a* of that wheel at only four locations between the insulating sectors 58*a*. Contact of the wire 55*a* with such uninsulated portions of the wheel 2*b* close the radio frequency shorting circuit between the rails 3 and 4.

The commutating type of switch construction shown in FIGS. 3 and 4 has practical advantages over the cam-operated switch mechanism of FIG. 2. Principally, engagement of the contact member 55*a* with the back of wheel 2*b* produces very little resistance to rotation of such wheel, and such resistance is uniform in all rotated positions of the wheel instead of the resistance varying with the rotative position of the wheel as in the case of the square cam shown in FIG. 2. Also the switch structure of FIGS. 3 and 4 is more economical to construct and can be installed readily on existing model locomotives to which the sound system accessory of the present invention is applied.

Whistle

The circuitry for providing the whistle-simulating component of the audio frequency signal transmitted to the speaker 23 is within the dot-dash enclosure of FIG. 1 labeled "WHISTLE."

To produce an electronic audio frequency signal for simulating realistically the sound of a four-chime steam-operated whistle, four whistle-tone-generating oscillators, designated 62*a*, 62*b*, 62*c* and 62*d* in FIG. 1, are connected in parallel. By a variable resistance in each oscillator circuit the basic frequency of each individual oscillator can be set. Also, the basic tone of the whistle can be adjusted by altering in five increments the oscillator-operating voltage supplied by wire 64. Such voltage is altered by a five-position rotary switch 65.

The amplitude of the combined outputs of the whistle-tone generators 62*a*, 62*b*, 62*c* and 62*d* is varied by one potentiometer 66 of ganged potentiometers. The frequencies of the four oscillators are varied simultaneously by the other potentiometer 67. Both of the potentiometers 66 and 67 are adjusted simultaneously by swinging a control lever 68, common to the two potentiometers. Such whistle-control lever is shown on the stationary control panel of FIG. 5 and can be swung to provide whistle blast combinations of various types, such as the typical crossing warning whistle, for example.

In addition, a controlled amount of audio frequency signal simulating escaping steam is fed into the whistle component of the circuit by wire 69 connected to the mixer section 29 and to wire 71 leading to the random noise generator circuit 41. A tone control and amplification circuit for the hiss and whistle, designated 72, is interposed in the circuit 71. Such added steam hiss audio frequency component contributes greatly to the reality of the simulated steam whistle sound.

In addition, the lever 68 may be manipulated to control escaping steam sound simulating blowoff of steam occurring when a pop safety valve opens, or for blowing down the boiler. Such effect can be accomplished by moving hiss switch 73 from the "off" position to the "on" position, in which latter position the whistle-tone oscillators are disconnected from the wire 69 leading to the audio-frequency mixer section 29 leaving only the steam hiss circuit connected to such mixer section. By manipulation of the lever 68 with the switch in this position, the intensity and duration of the steam blowoff sound can be controlled.

Portable Control

Where the track system for a model railroad is extensive, it is desirable to enable the sound accessories described above to be operated by a portable control rather than from the stationary panel illustrated at the right of FIG. 5. Such a portable control, which may be called a "walk-around unit," shown at the left in FIG. 5, can be held in the hand by a pistol grip 74. On the body of this portable control device various control elements are illustrated which are electrically connected in circuit with the corresponding controls on the stationary control panel, so that either control can be manipulated to obtain the desired effect.

Specifically, the portable control device includes the speed control potentiometer 17W for regulating the speed of travel of the locomotive when corresponding potentiometer 17 is in low speed position. Switch 18W can reverse the direction of travel of the locomotive in whichever position corresponding switch 18 is positioned on the stationary control panel. The bell can be energized or de-energized by manipulation of the switch 40W when the corresponding switch 40 on the stationary panel is in the "off" position. The sound of the chuff can be regulated by the control 61W, and its volume can be adjusted by the control 45W when the corresponding controls 61 and 45 on the stationary panel are in their full on positions. Blowoff of steam or whistle can be selected by the switch 73W, when the corresponding switch 73 on the stationary panel is in the "on" position. A whistle or blowoff can be controlled by pulling the trigger 68W when the lever 68 on the stationary control panel is in the full on position.

I claim:

1. A locomotive sound mechanism for a model train device comprising a locomotive, a speaker, and electronic audio frequency signal synthesizing means for generating an audio frequency signal generally matched to simulated locomotive sound and operable to drive said speaker for emitting such simulated locomotive sound and said electronic audio frequency signal synthesizing means being remote from the train device.

2. The locomotive sound mechanism defined in claim 1, in which the speaker is carried by the model train device.

3. The locomotive sound mechanism defined in claim 2, in which the locomotive is propelled by an electric motor to which driving current is supplied through rails on which the train device travels, and the audio frequency signal synthesized by the electronic audio frequency signal synthesizing means is transmitted to the speaker through the rails on which the train device travels.

4. The locomotive sound mechanism defined in claim 1, in which the audio frequency signal synthesized by the electronic audio frequency signal synthesizing means is generally matched to simulated locomotive sound including simulated locomotive bell sound.

5. The locomotive sound mechanism defined in claim 1, in which the audio frequency signal synthesized by the electronic audio frequency signal synthesizing means is generally matched to simulated locomotive sound including simulated locomotive whistle sound.

6. The locomotive sound mechanism defined in claim 5, in which the audio frequency signal synthesizing means includes a plurality of oscillators generally matched to different locomotive whistle sound frequencies, respectively, and means for combining the audio frequency signals produced by said plurality of oscillators.

7. The locomotive sound mechanism defined in claim 1, in which the audio frequency signal synthesized by the electronic audio frequency signal synthesizing means is generally matched to simulated locomotive sound including simulated combined locomotive whistle and escaping steam sound.

8. The locomotive sound mechanism defined in claim 1, in which the audio frequency signal synthesized by the electronic audio frequency signal synthesizing means is generally matched to simulated locomotive sound including simulated locomotive escaping steam sound.

9. The locomotive sound mechanism defined in claim 8, in which the escaping steam sound includes simulated engine exhaust chuffing.

10. The locomotive sound mechanism defined in claim 9, and timing means synchronized with the speed of the model train device for timing the simulated engine exhaust chuffing sound.

11. The locomotive sound mechanism defined in claim 10, in which the timing means is synchronized with the rotation of a wheel of the train device.

12. The locomotive sound mechanism defined in claim 11, in which the timing means includes commutating switch means.

13. The locomotive sound mechanism defined in claim 11, in which the timing means includes a radio frequency signal timing circuit transmitting a radio frequency signal to the train device.

14. The locomotive sound mechanism defined in claim 13, in which the radio frequency signal timing circuit includes rails on which the train device travels by way of which the radio frequency signal is transmitted to the train device.

15. The locomotive sound mechanism defined in claim 1, in which the audio frequency signal synthesized by the electronic audio frequency signal synthesizing means is generally matched to simulated locomotive sound including at least two separately generated audio frequency signals generally matched, respectively, to corresponding sounds selected from the group consisting of locomotive bell sound, locomotive whistle sound, escaping steam sound and engine exhaust chuffing.

16. The locomotive sound mechanism defined in claim 15, and integrating means for integrating separately generated audio frequency signals simulating different locomotive sounds to be impressed on the speaker.

17. The locomotive sound mechanism defined in claim 1, in which the audio frequency signal synthesizing means includes two components, one component being generally matched to simulated locomotive sound including simulated locomotive whistle sound and the other component being generally matched to simulated locomotive sound including escaping steam sound, actuating means, and means operable to condition said actuating means for controlling independently and selectively the component generally matched to simulated locomotive whistle sound and the component generally matched to simulated escaping steam sound.

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