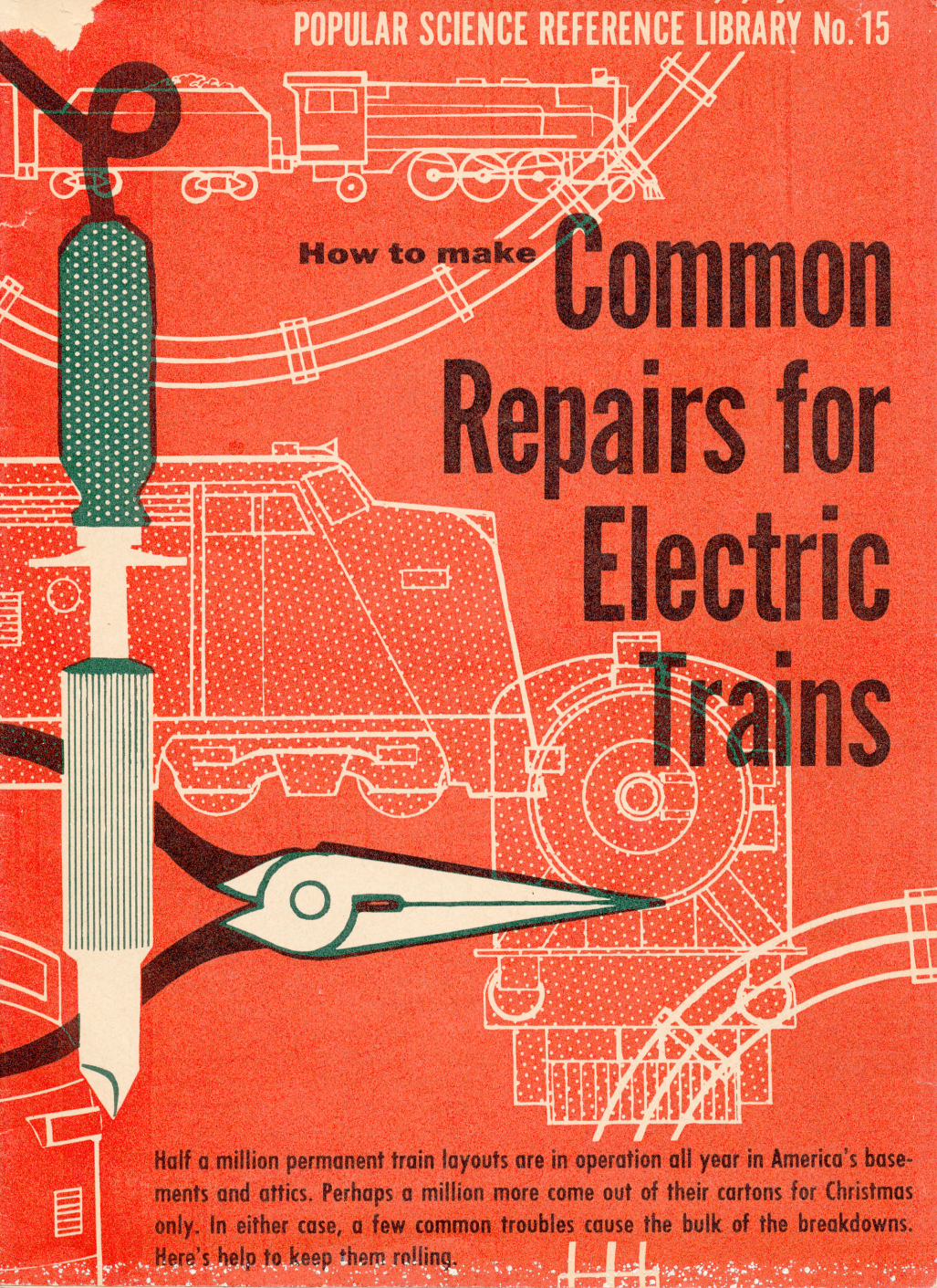


How to make

# Common Repairs for Electric Trains

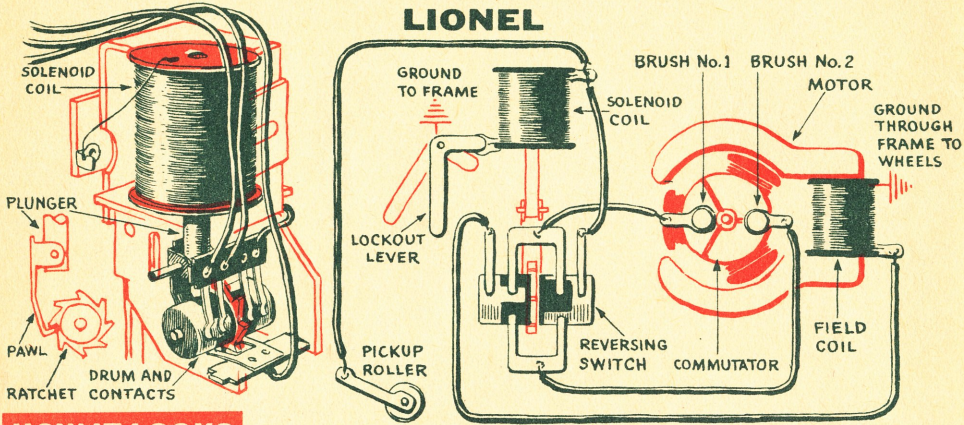
A stylized illustration on a red background. On the left, a screwdriver with a green handle and a silver shaft is positioned vertically. To its right, a pair of silver pliers is shown horizontally. The background features white line drawings of a train layout, including a locomotive at the top, a passenger car in the middle, and a large circular component, possibly a motor or wheel, at the bottom right. The entire scene is set against a red background with a fine white dot pattern.

Half a million permanent train layouts are in operation all year in America's basements and attics. Perhaps a million more come out of their cartons for Christmas only. In either case, a few common troubles cause the bulk of the breakdowns. Here's help to keep them rolling.



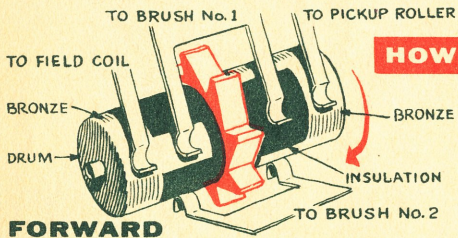
# Understanding the Reversing

## LIONEL

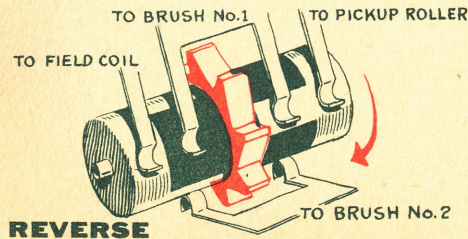
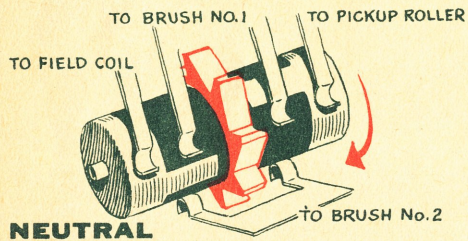


HOW IT LOOKS

HOW IT'S WIRED



HOW IT WORKS

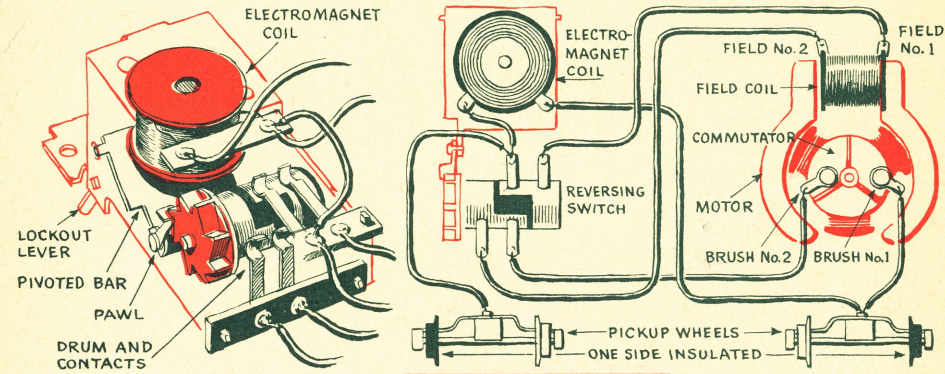


REVERSE

At fault in 60 percent of all locomotives returned to manufacturers for repair, the reversing unit is a sensitive but uncomplicated little drum switch. Each time a train is stopped, either a solenoid (Lionel) or an electromagnet (American Flyer) becomes de-energized and drops a pawl. When power is turned on again the pawl is drawn upward, engaging a ratchet that gives the drum a  $\frac{1}{8}$  turn. Each time this happens, a combination of contacts and insulated drum areas either breaks a motor circuit, leaving the engine in neutral, or changes the connections between the brushes and the field coil, reversing the motor. The two actions alternate as the drum is inched from one position to the next, making it necessary to shut off current at the transformer twice for each reversal. The neutral positions

# Unit, No. 1 Cause of Breakdowns

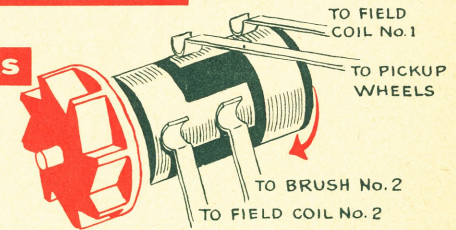
## AMERICAN FLYER



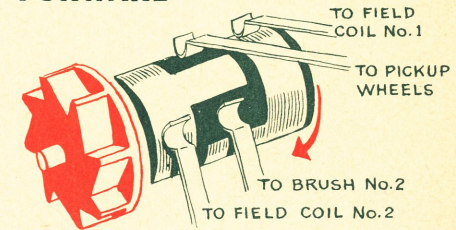
HOW IT LOOKS

HOW IT'S WIRED

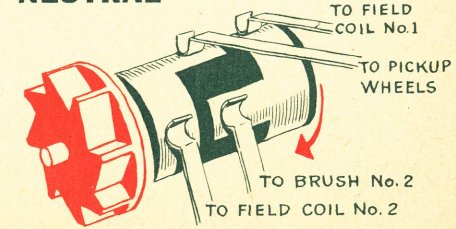
HOW IT WORKS



FORWARD



NEUTRAL



REVERSE

prevent a locomotive from changing direction, violently, whenever the power supply is accidentally interrupted.

Comparing Lionel (opposite page) and American Flyer (above) circuit diagrams, note that in the latter one brush bypasses the reversing unit. Otherwise, their operation is the same.

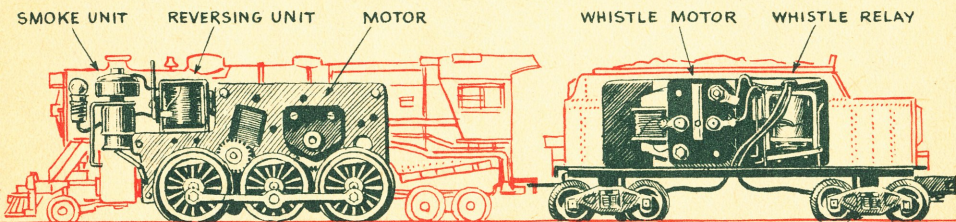
You'll also see that the fixed contacts on both reverse-unit switches are delicate, fingerlike tines. It's here that trouble usually occurs. When these contacts wear excessively, become bent, or oxidize through lack of use (along with the drum surfaces), you're bound to have a "dead" engine.

Cleaning and straightening contacts are simple fix-its. But if the problem is wear, your best bet is to buy a completely new replacement unit from the manufacturer or a hobby-supply house.



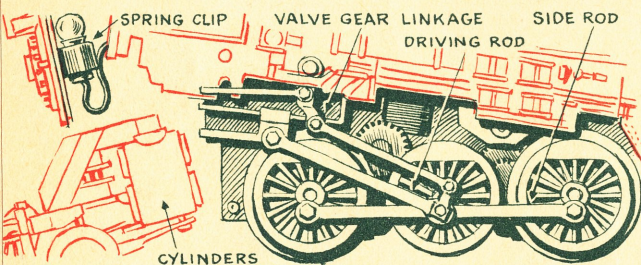
# How to Get at the Reversing

## LIONEL

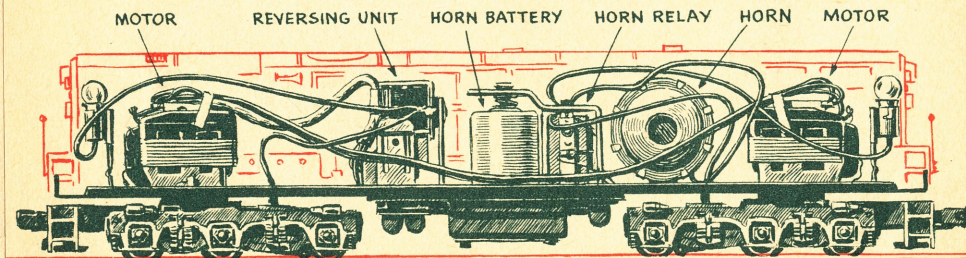


Remove locomotive body from chassis by backing out machine screw at one end, then sliding tongue out of slot at

the other. This exposes motor and smoke unit, as well as reversing unit, for repairs. Tender houses whistle parts.



Valve gear usually slides easily out of the cylinders. On some engines, it may be necessary to pry off boiler front, remove cow-catcher assembly, and unscrew valve-gear linkage at side rods.

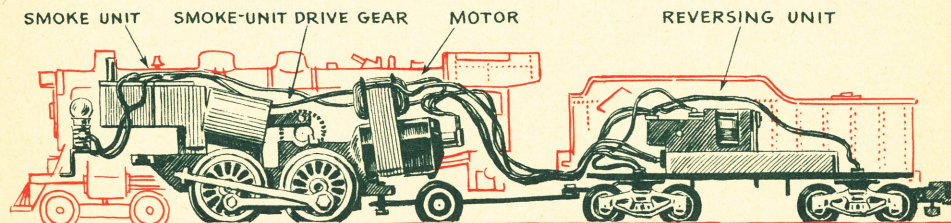


Diesel bodies can be lifted free of the frame after screws under the frame or at the end of the body have been re-

moved. A single reversing unit with two sets of leads controls both power plants on dual-motor locomotives.

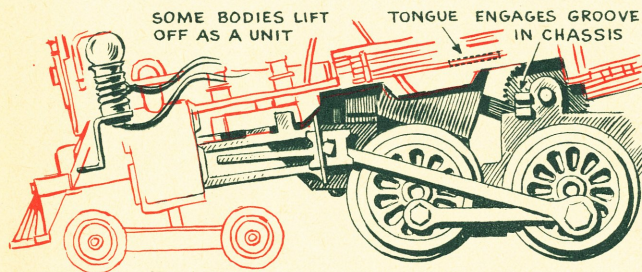
# Unit When Trouble Occurs

## AMERICAN FLYER

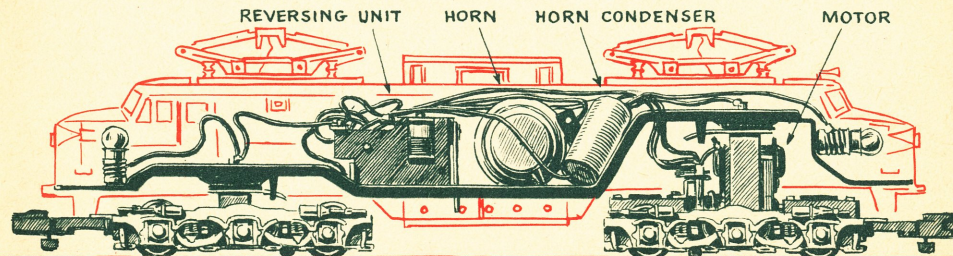


Look in the tender on most steam locomotives to find the reversing unit (some earlier models have the unit in the loco-

motive). To get at a tender-mounted job, remove four screws from frame. Avoid breaking wires to cab.



To reach reversing unit housed in locomotive, position valve gear for disassembly by touching transformer wires briefly to current-pickup wheels. They can't be turned by hand because gears lock.

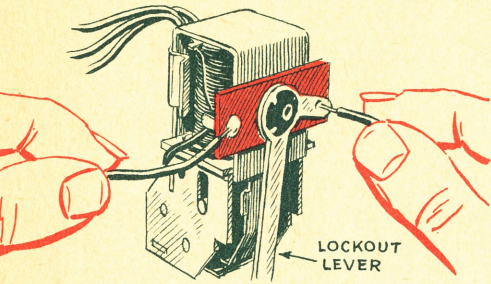


A single screw located on top of the body holds together some diesels in the American Flyer line. When taking any

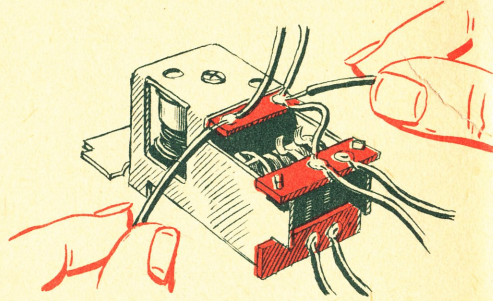
loco apart, try to replace screws loosely in their threaded holes. This will avoid nightmarish mixups later.



## Repairs You Can Make

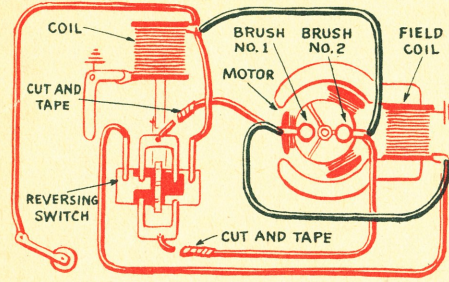


With the transformer on, touch its wires to terminals indicated above. If drum doesn't turn, look for break in one of fine coil leads and solder it. If

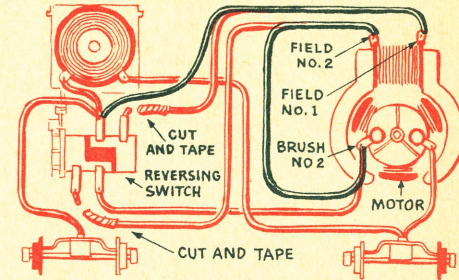


drum rotates but engine won't run, bend all contact fingers firmly against drum. If action is sluggish, clean moving parts with rubbing alcohol or track cleaner.

## to the Reversing Unit

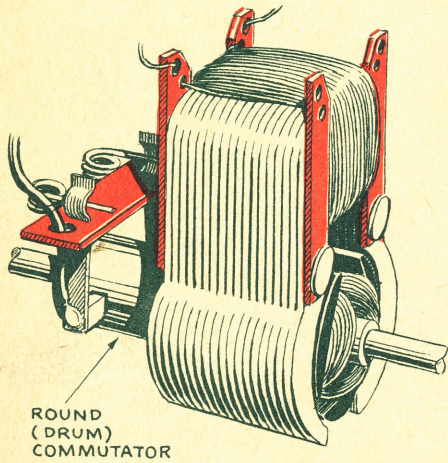


Can't be fixed? Then bypass reversing unit to keep train running forward until a new unit is obtained. Cut and reconnect wires as indicated (in black).

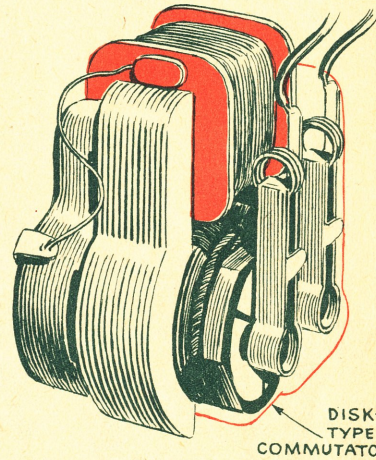


Run engine before you solder wires to be sure they're not connected to terminals that will make it run only backwards. Switch connections if this happens.

## What You Should Know



ROUND (DRUM) COMMUTATOR

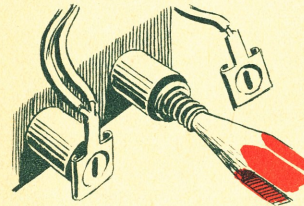


DISK-TYPE COMMUTATOR

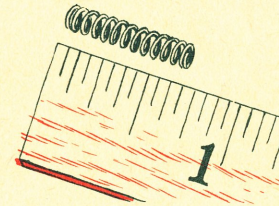
**What kind of motor?** In your locomotive you'll find one of two types, possibly different in size or shape to fit inside the body. Motors with flat, disk-

like commutators are most common, but round commutators are used in some American Flyer engines. The basic circuit is the same for both motors.

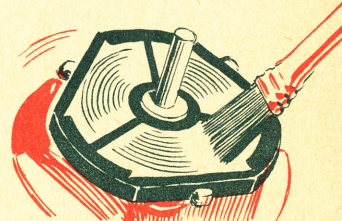
## About Motor Repairs



**Press brushes** with stick or pencil while motor is running. Sudden speed-up indicates worn brushes or weak brush springs.



**Replace coiled brush springs** if less than 3/4" long. Bend flat springs slightly toward commutator to increase tension.

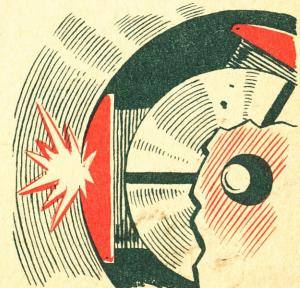


**Swab commutator and brush holders** with alcohol to remove dirt and old oil. Polish commutator with fine sandpaper.



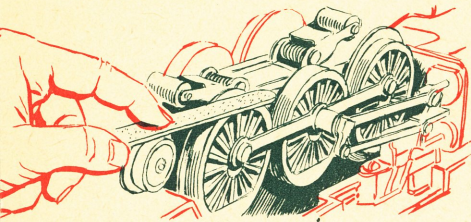
**Clean spaces** between commutator segments with a pointed stick to remove dirt and short-circuiting metal dust.

**Old engines** can develop so much looseness in bearings that armature shorts against field. The best repair: new brush plates.

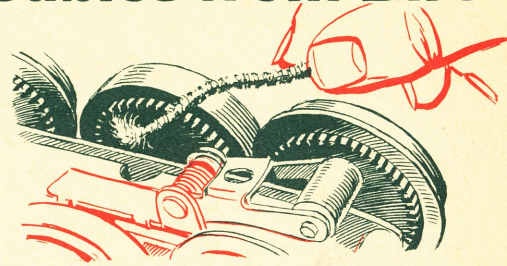




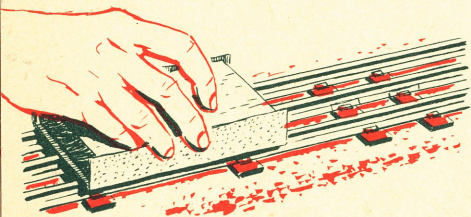
## Troubles from Dirt



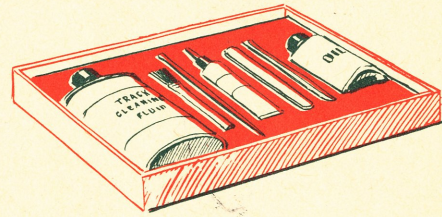
Poor electrical contact and binding mechanism result from dirt, congealed oil, and lack of oil. Sand loco wheels and



pickup rollers bright, and use a pipe cleaner to pick dust and lint out of gears and other hard-to-reach places.

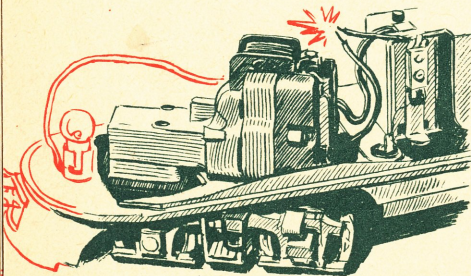


Clean track thoroughly with track cleaner. Use sandpaper if it's rusted. Current interruptions caused by dirt

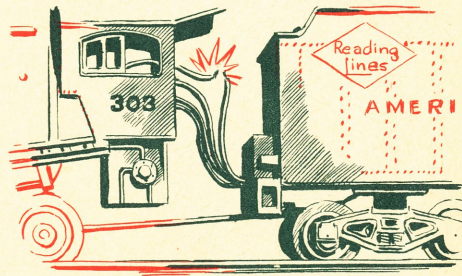


can make an engine stop or reverse itself unexpectedly. A maintenance kit (shown above) will help with the job.

## Tracking Down Defective

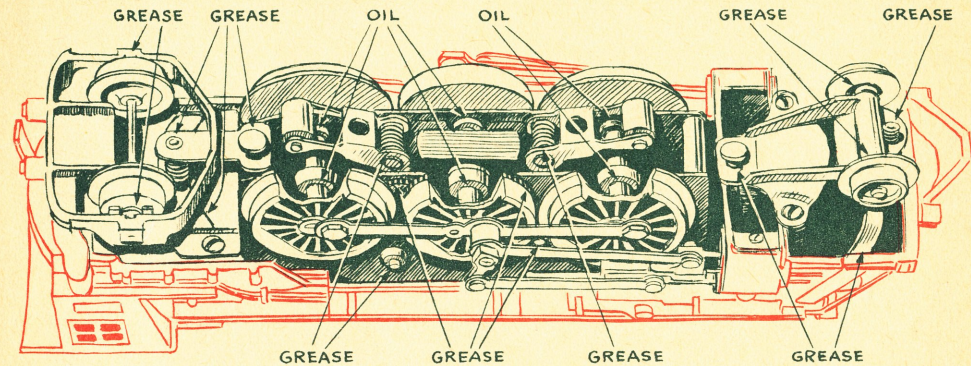


Constant pivoting of motor trucks on curves keeps wires flexing inside diesels. Tape insulation if it's chafed and resolder any broken connections.

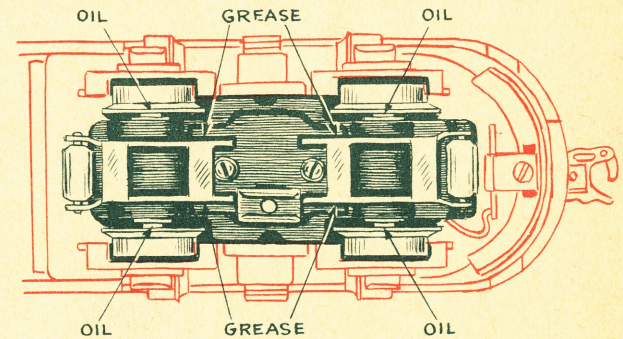


Exposed wires connecting tender to steam loco can be broken by rough handling as well as flexing. Replace them with stranded wire of same size.

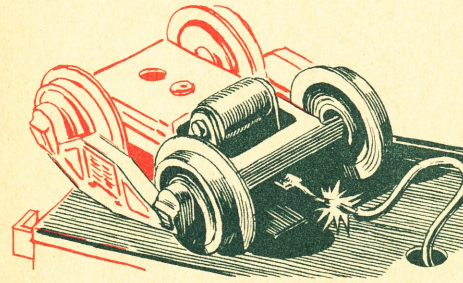
## and Lack of Oil



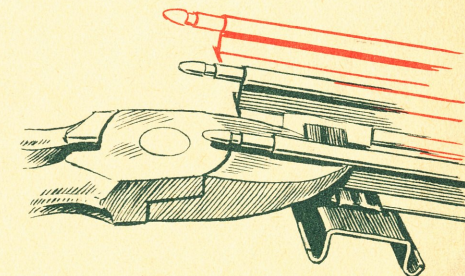
Lubrication is the most important single item of maintenance. Cars with dry trucks drag and are hard to pull. Loco bearings and valve gear add friction that makes an engine seem sluggish. But use lubricants sparingly. (Note: Lubricate both ends of armature shaft.)



## Wiring and Poor Contacts



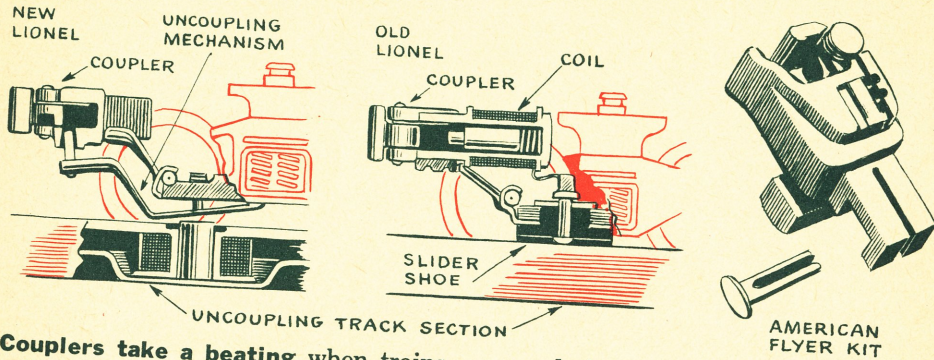
Elusive short can be caused by a broken pickup wire in an illuminated car. The spark test on page 12 will help you to locate this ticklish one.



Resistance in loose track joints lowers voltage at the far side of the layout. Crimp pins tightly in rails and see that insulators are in proper position.

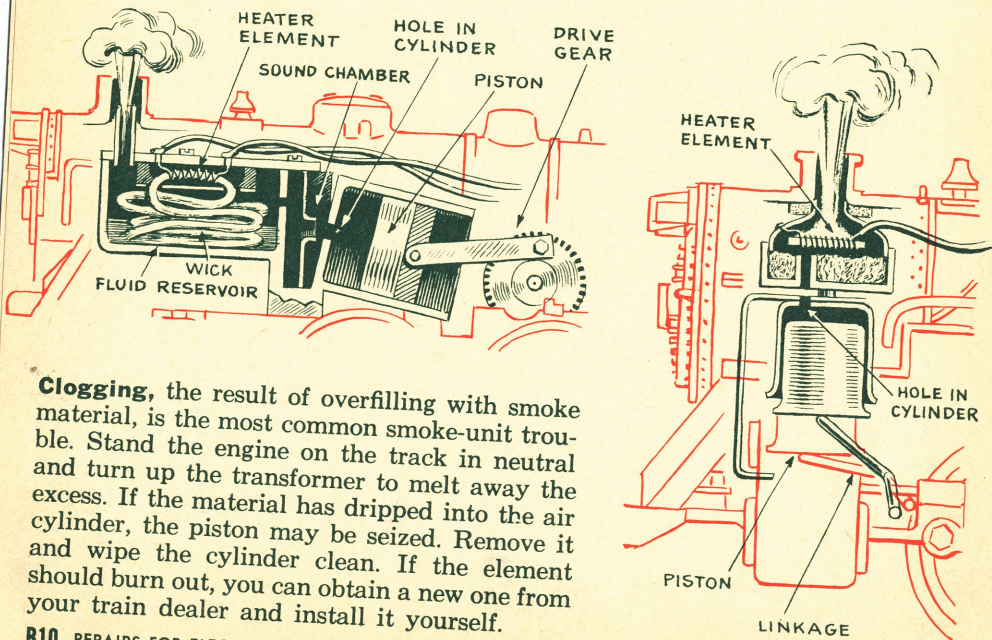


## Broken Couplers



Couplers take a beating when trains collide or fall. Dealers sell inexpensive coupler kits that include detailed instructions for replacing broken couplers or updating older equipment having couplers that are obsolete. Or you can purchase new trucks that come complete with new couplers.

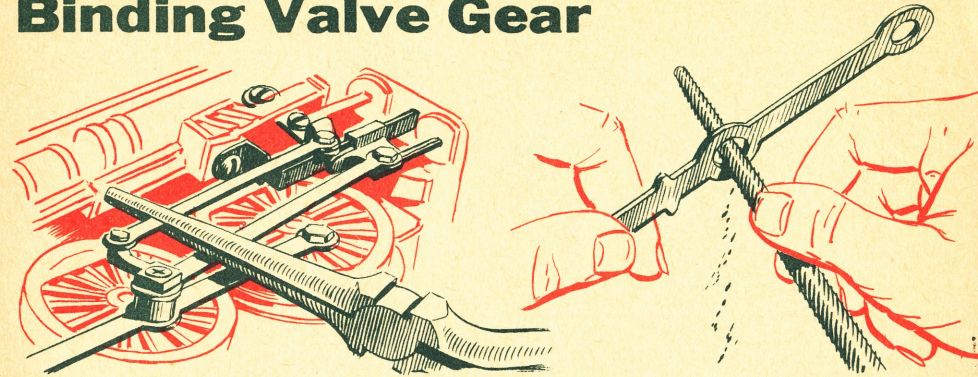
## Inoperative Smoke Unit



**Clogging**, the result of overfilling with smoke material, is the most common smoke-unit trouble. Stand the engine on the track in neutral and turn up the transformer to melt away the excess. If the material has dripped into the air cylinder, the piston may be seized. Remove it and wipe the cylinder clean. If the element should burn out, you can obtain a new one from your train dealer and install it yourself.

B10 REPAIRS FOR ELECTRIC TRAINS

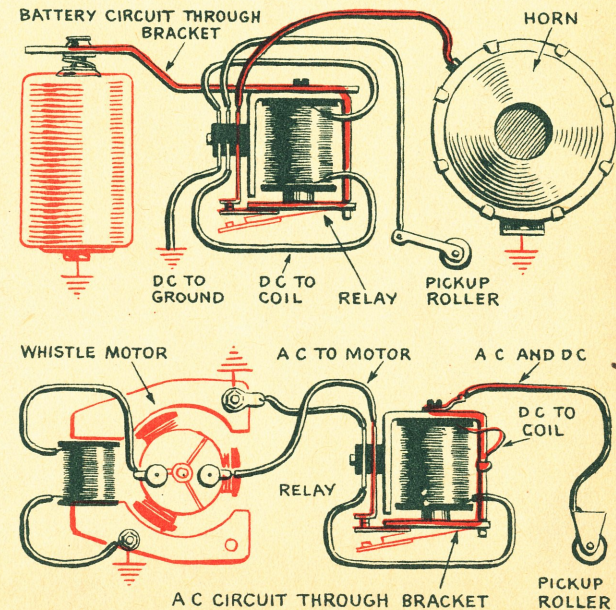
## Binding Valve Gear



A steam loco that limps along the track or stops dead at slow speed could be struggling against binding valve gear or drive rods. If the wheels feel tight in spots when turned by hand, bend any rods that rub together, or enlarge the holes with a small file to provide greater freedom of movement.

## Inoperative Horn or Whistle

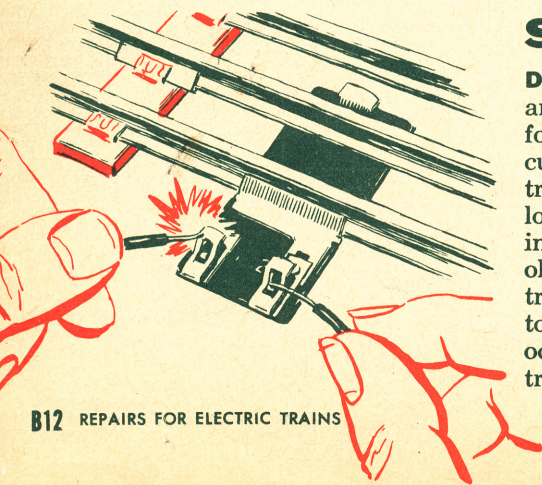
A surge of DC is sent along the track to the train each time you press the whistle control. This has no effect on the AC motor, but it closes a DC relay to operate the horn or whistle. Lionel's horn is powered by a flashlight cell and the whistle is driven by a motor that operates off track current. American Flyer operates the horn by DC fed through a condenser. In case of failure, look for broken wires, weak battery, too-tight adjustment of the horn, worn or dirty brushes in the motor of the whistle, or a shorted condenser.





# Trouble Chart and Index

TROUBLE	POSSIBLE CAUSE	SEE PAGE
<b>Engine won't run</b>	No current from transformer .....	12
	Faulty reversing unit .....	2
	Broken wires .....	8
	Short circuit .....	8, 12
	Binding mechanism .....	11
	Faulty motor .....	6
<b>Engine won't run on track (runs when tested)</b>	Poor connections to track .....	9, 12
	Short circuit in track .....	12
	Dirty track, wheels, or pickup roller .....	8
	Loose coupler touching rail .....	10
	Derailed car on track .....	12
<b>Engine is sluggish or stalls under power</b>	Dirty wheels, pickup roller, or track .....	8
	Loose connections .....	8, 9
	Binding mechanism .....	11
	Faulty motor .....	6
	Lack of lubrication .....	9
	Dirt in gears .....	8
<b>Engine runs erratically, reverses itself</b>	Dirty wheels, pickup roller, or track .....	8
	Loose track joints .....	9
	Loose connections in engine .....	8
	Intermittent short in engine .....	8
	Loose coupler touching rail .....	10
<b>Engine won't reverse</b>	Lockout lever holding reversing unit in forward position .....	2
	Faulty reversing unit .....	2
<b>Train separates while running</b>	Worn or broken couplers .....	10
	Short causing jerky operation .....	8
	Loose track joints .....	9
<b>Horn won't operate</b>	Weak battery .....	11
	Pitted relay points .....	11
	Broken wires .....	8, 11
	Shorted condenser .....	11
	Defective DC rectifier in transformer .....	Return to factory
<b>Whistle won't operate</b>	Pitted relay points .....	11
	Broken wires .....	8, 11
	Faulty whistle motor .....	11
	Defective DC rectifier in transformer .....	Return to factory
<b>Smoke unit won't operate</b>	Air hole clogged with smoke material .....	10
	Piston fouled with smoke material .....	10
	Broken wires .....	8, 10
	Burned-out element .....	10



## Spark Test

**Disconnect power wires** at the track and brush them together with the transformer at half range. A spark tells you current is coming through. Remove all trains and touch the wires to the track lock-on. A spark here indicates a short in the track. If the track checks out okay, place the engine and cars on the track one at a time, touching the wires to the lock-on after each car. If a spark occurs after any car is placed on the track, that car is short-circuited.