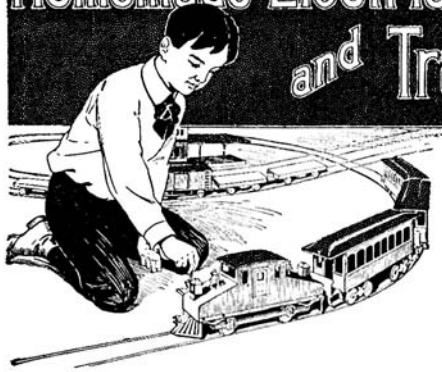
Homemade Electric Locomotive Model and Track System



By A. E. ANDREW

PART II—Construction of the Locomotive Truck and Cab

SUCCESSFUL operation and construction that is feasible, yet of a reasonable standard of workmanship, are the essentials of the locomotive truck and cab described as the second feature of the locomotive and track system under consideration. The materials suggested are those found to be satisfactory, but substitutes may be used if caution is observed. The completed locomotive is shown in Figs. 1 and 2. The outward aspect only is presented, and, for the sake of clearness, the portions of the motor and driving rigging attached to it, that project below the cab, are omitted. These parts are shown assembled in Fig. 12, and in detail in the succeeding sketches.

The locomotive, apart from the motor, consists of two main portions, the truck and the cab. Consideration will be given first to the building of the truck and the fitting of the motor into it. The mechanical and operative features are to be completed before beginning work on the cab, which is merely a hood fixed into place with screws, set into the wooden cab base.

Begin the construction with the wheels, shown in Fig. 3. Make the axles of ⅛-in. round steel rod, cut 3 3/16 in. long.

Turn four wheels of ⅜-in. brass. Drill a ⅛-in. hole in two of them so that they may be forced on the slightly tapered ends of the axle. Drill a ¼-in. hole in each of the other wheels, and solder a collar, A, Fig. 3, on the inside surfaces of them. Two fiber bushings, B, should be provided to fit in the ¼-in. openings in the wheels and to fit tightly on the ends of the axles. This insulates the wheels on one side of the truck from those on the other. If the rails forming the track are insulated from each other, the current supplied to the motor may pass in on one rail to the two insulated wheels, then to a brush, which bears on the brass collar A, through the windings of the motor, through the reversing switch to the other set of wheels, and back to the source of energy over the other rail, as shown in Fig. 15.

The wheels of the truck should fit on the axles tightly, since no means other than the friction will be employed in holding them in position. If the ends of the axles are tapered slightly, the wheels may be forced into place and will stay firmly. Do not force them on until the truck is finally assembled.

The truck frame should be constructed next, and its details are shown in Figs. 4 and 5. Make two sidepieces of 1/16-in. brass, 9¾ in. long and 1⅝ in. wide, cutting out portions, as shown, in order to reduce the weight. This also gives the appearance of leaf springs.

The two rectangular openings are to accommodate the axle bearings. They should be cut to precise dimensions, and their edges should be squared off. Extensions, 1/16 in. wide, are provided at the middle of the upper edges of each of these openings. They are to hold the upper end of the coil springs, which are to rest in the holes cut into the bearings, as shown at G, Fig. 7, and also in assembled form, Fig. 6.

Next drill four ⅛-in. holes in each of the sidepieces, as indicated at the letters H_1 to H_4, Fig. 5. For the cross supports use four pieces of brass rod, ¼ in. square, and square off the ends to a length of 2¾ in. Drill holes in the center of the ends and tap them for ⅛-in. machine screws. Join the side and crosspieces as shown in Fig. 4. Two fiber washers about 1/16 in. thick should be placed on each axle at E and F, to hold the wheels from contact with the sidepieces.

Details of a bearing for the axles are shown in Fig. 7. The hole G carries the lower end of the coil spring, and the hole J is the bearing socket for the axle. Four spiral springs, having an outside diameter of ⅛ in. and a length of ½ in. when extended, should be provided. The extensions on the sides of the bearings fit against the inner faces of the sides of the truck. They hold the bearings in position and prevent them from falling out.

The base of the cab is made of wood, dimensioned as in Fig. 10. The center of the piece is cut away so as to provide a space for the motor, which extends above the upper edge of the truck, as shown in Fig. 12. This block is fastened in place by four screws through the upper crosspieces at the ends of the truck. The base should be made and fitted into place temporarily so as to be available in observing how the motor and its fittings are placed in relation to it. For convenience in assembling the parts of the truck and setting the motor, it may be removed readily.

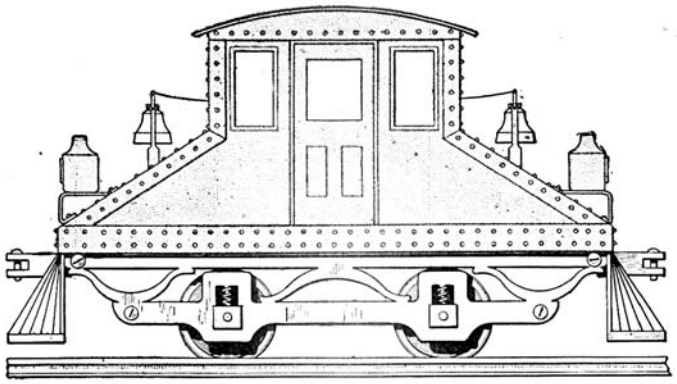
Assembling the truck, including the motor, probably requires the most painstaking effort of any part of the construction of the locomotive. Too great care cannot be taken with it, as the dimensions are carefully worked out and failure to observe them may cause errors sufficient to make the locomotive unserviceable. Before undertaking this work it would be well to examine carefully the arrangement of the parts as shown in Fig. 12. The upper view shows the relation of the driving gears in mesh and the lower view shows the machinery of the truck as seen from above.

The power from the motor is transmitted to one set of wheels by means of a small gear on the armature shaft engaging an intermediate gear, which in turn engages a large gear attached to the inside of one of the truck wheels. The center of the armature shaft is 1 5/16 in. from the center of the power axle, when both axles are in the slots provided in the motor frame, Fig. 12. The gears for the transmission may now be selected. The gear on the armature shaft should be as small, and that on the axle as large, as practicable. The intermediate gear should be of such a size that it will close the space between the small gear on the armature shaft and the large one on the axle. Gears suitable for the transmission may be purchased at a clock store for a small sum. If gears of exactly the proper size cannot be obtained readily, the position of the intermediate gear may be adjusted to produce a proper meshing of the gears.

Mount the small gear on the end of the armature shaft away from the commutator, so that there will be about 1/16-in. clearance between the outside surface and the shoulder at the end of the shaft. Fit it on tightly so that no other means of fastening will be necessary. Mount the large gear on the inside surface of one of the truck wheels, as shown in Figs. 3 and 12. Place the axle of the truck into the proper grooves in the motor frame, and mark the position of the center of the intermediate gear, when it engages the other gear. Drill a hole in the extension on the motor frame, provided as a support, to fit a small bolt with which the intermediate gear is fastened.

Place a washer between the gear and the piece upon which it is mounted, and a locknut on the threaded end of the bolt, drawing it up so that the gear has only sufficient play.

The slots in the motor frame to fit



SIDE AND FRONT VIEW OF COMPLETED LOCOMOTIVE

FIG. 1

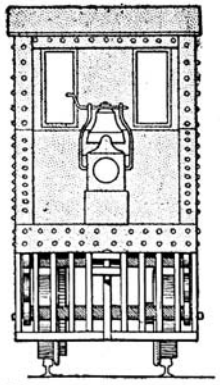
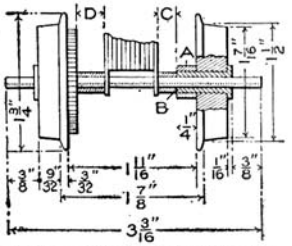
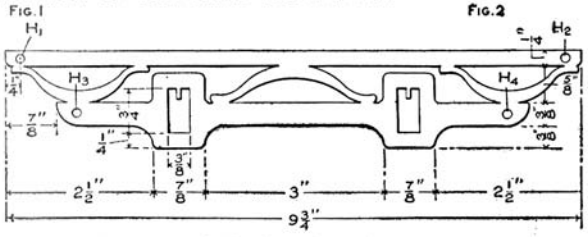


FIG. 2



CONSTRUCTION OF WHEELS

FIG. 3



SIDE OF TRUCK

FIG. 5

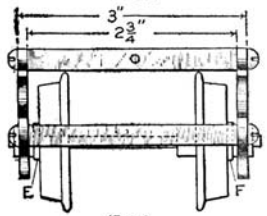


FIG. 4

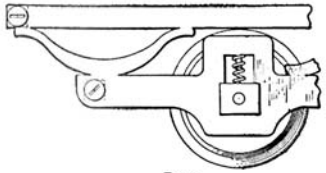
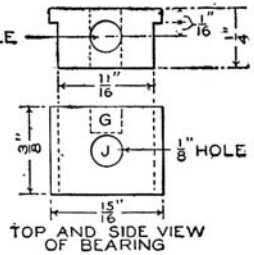


FIG. 6



TOP AND SIDE VIEW OF BEARING

FIG. 7

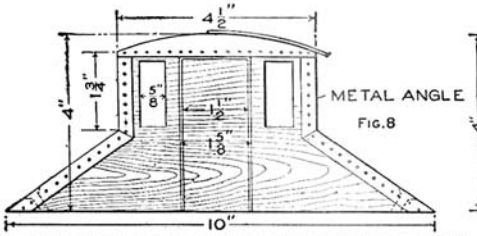


FIG. 8

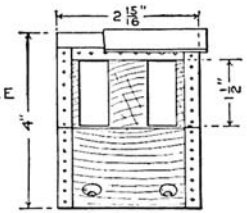
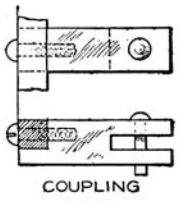


FIG. 9



COUPLING

FIG. 11

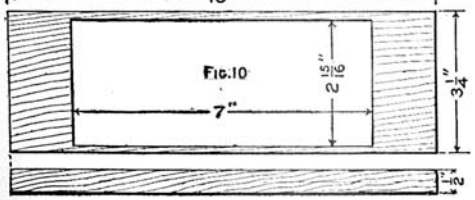


FIG. 10

BOTTOM OF LOCOMOTIVE CAB

Successful Operation, Based on Feasible Construction and a Reasonable Standard of Workmanship, Is the First Consideration in the Locomotive. The Dimensions should be Observed Closely in Order That the Parts may be Assembled Satisfactorily. The Construction of the Cab Is Suggestive Only, and the Inventive Builder may Design One in Conformity with the Materials Available or the Individual Taste

the free axle may now be cut, as shown in Fig. 12. Place the motor in position on the axle so that the gears

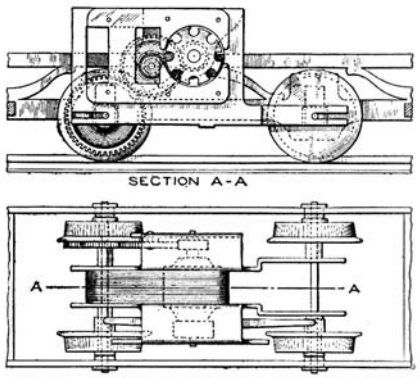


Fig. 12, Installation of the Motor, Showing Gears and Switch Contact Spring

all mesh properly. Fit tubes of insulating material with an outside diameter of ⅜ in. at C and D, Fig. 3, and as also shown in Fig. 12. Insulation tubes should be provided for the second axle so as to hold the motor in position, and to keep the wheels in line. In mounting the various parts sufficient play should be allowed to prevent excessive friction.

The reversing switch, which is to be mounted on the under side of the motor frame, is shown in Figs. 13 and 14. It is provided with a control lever which projects out from under the

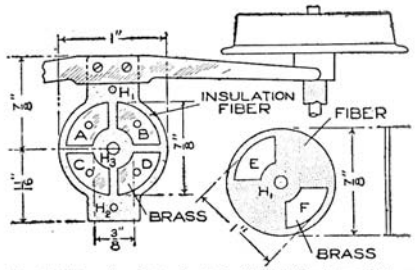


Fig. 13, Details of the Switch, Shaded Portions Being of Fiber Insulation

truck frame. A small movement of the lever will produce the necessary changes in the connections. The operation of the switch may be understood readily from the diagram shown in Fig. 15. The moving element of the switch carries two pieces of copper, E and F, which connect the four stationary pieces of copper, A, B, C, and D, when the lever attached to E and F is moved to either side of its central position. The pieces of copper which are moved—E and F—are shown outside of the stationary pieces in Fig. 15 for purposes of a diagram only, and are actually directly over the ring formed by the stationary pieces.

The operation of the switch is as follows: Assuming that the current enters at the terminal marked 1 and leaves at the terminal marked 2, then the direction of the current in the armature and series field will be as indicated in the diagrams. The direction of the current in the series-field winding is different in the two cases, which will result in opposite rotation of the armature.

The base of the switch is made of 1/16-in. fiber insulation; its dimensions are shown in Fig. 13. It is to be mounted on the two pieces projecting outward on the under side of the motor frame, as shown in Fig. 14. Drill a small hole in each of these projections, as indicated by the letters H_1 and H_2, and tap them to take a small machine screw. Next drill two holes, H_1 and H_2, Fig. 13, in the piece of insulation, with centers the same distance apart as those drilled in the projections. One end of this piece of insulation is extended to form a mounting for a thin brass spring, the ends of which bear on the brass collars insulated from the axles, as shown in Figs. 12 and 13. The form of this spring and the method of mounting it are also shown in Fig. 13.

The sections which come into contact in the switch are made as follows: Mount four pieces of thin copper or brass on the fiber base with rivets having their heads countersunk. Cut a disk, 1 in. in diameter, from a piece of sheet insulation and drill a hole H_1 in the center of it. Also drill a similar hole H_2 in the center of the switch base. Mount two pieces of copper or

brass, E and F, on the under side of this disk. The edges and ends of all six pieces of metal should be rounded off so that the pieces E and F will move freely over those on the base. The disk, or upper part of the switch, may be attached to the base by means of a small bolt placed through the holes at the center. A small spiral spring should be placed between the disk and the lower end of this bolt so as to keep the pieces of metal on the disk in contact with those on the base. Attach a small handle to the disk so that it will extend out on one side of the truck. Fix the switch into place by bolts through the holes H_1 and H_2, Fig. 14, on the bottom of the motor frame. The electrical connections should be made as shown in Fig. 15.

The detail of the couplers is shown in Fig. 11. They are made of brass, fitted to the upper crosspieces and fixed to them by machine screws. "Cowcatchers" may be made for the ends of the locomotive. Sheet metal, corrugated appropriately and bent to the proper shape, will afford the easiest method of making them. Those shown in Figs. 1 and 2 are made of strips soldered together, and also to the upper crosspieces; they are strengthened by a cross strip at the bottom, opposite the point.

The cab is to be made apart from the truck and is to fit upon the base,

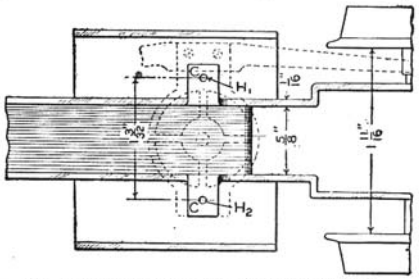


Fig. 14, View of the Under Side of the Motor, Showing How Switch is Fixed into Place

as shown in Figs. 1 and 2. It is fixed into place by four screws and can be removed easily for examination of the locomotive mechanism. The dimensions for the cab are shown in Figs. 8 and 9, and may be varied by the builder.

Sheet metal or wood may be used

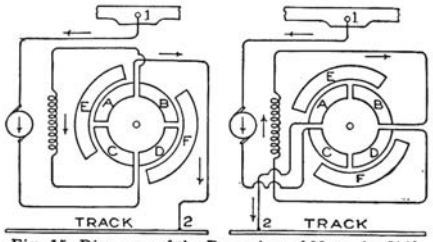


Fig. 15, Diagrams of the Reversing of Motor by Shifting Switch to Form Contact between Pairs of Brass Sectors Set in the Fiber Switch Base

in the construction, and the joints soldered on the inside or riveted, as shown in the illustration. The window and door openings may be cut out or painted on. Small bells may be mounted on the ends of the cab, adding to its appearance. The headlights shown in Figs. 1 and 2 may be cut from wood or made of sheet metal. Light bulbs may be installed, and their voltage should correspond to that of the motive energy. The terminals for the sockets of the headlight lamps should be connected to the frame of the truck and to the spring, which bears upon the brass collars on the wheels, which are insulated from the axles, as shown at A, Fig. 3.

This completes the locomotive in all essential details and it is ready to be placed upon the track to be tested. The track system will be considered in a subsequent article.