Complication for Simplicty's Sake

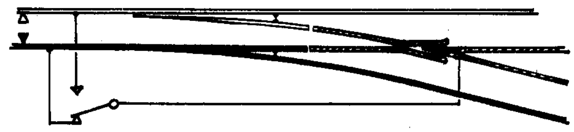


Fig. 1

Stewart Hine explains how to save time — the hard way

Our hobby generates its fair share of daft statements. One recently made to me must come near the top of the league: 'I never read the electrical articles; if it can't be done with two bits of wire it can't be done at all.' Quite apart from the fact that many layouts contain at least three bits of wire, the author of this remark shows, I think, a laudable regard for the virtue of simplicity—but a misplaced one.

Most model railway textbooks and many articles show the same emphasis on simplicity. A sort of superstitious awe of electrical wiring and switchery has grown up, together with a kind of 'standard' wiring technique which produces layouts which are simple to build—but the result is often tedious to operate and prone to operator error. The full-size railways, on the other hand, have often gone to considerable lengths of structural complication in order to make life easier and safer for those who have to work them. Being a basically lazy soul with a bad memory, I fully support this approach; I'd rather do the complicated bit once than land myself with operational complication for evermore.

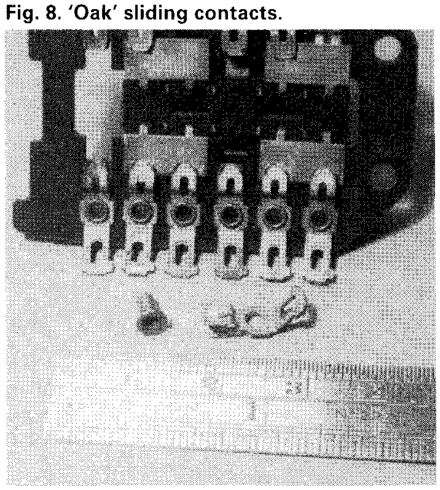
Take switched frogs, for example. Unless one's locos have something very special in the way of pick-ups, even with the flattest of track and the truest of chassis, one can never be sure which wheel is taking the weight on either side at a given moment. If this happens—as usual—to be the one resting on the plastic bit of a dead frog, all motion stops. Compensation or springing, and pick-up off bogie and tender wheels, are partial (and highly desirable) solutions; but as one perceptive reader pointed out, what do you do about an 0-4-0 dock tank? The real answer is to provide a continuous current feed right through the crossing; the conventional live-frog turnout does this by treating the whole crossing area as a single electrical unit, connected to one or other stock rail by a change-over switch.

One could, I suppose, dispense with the 'complication' of ganging this switch to the point tongues, but I don't think even the most simplistic modeller would willingly take on the task of throwing the point *and* setting the switch each time. Using the tongues themselves as the switch is an old dodge but a prolific source of trouble on its own account; not only is the contact between stock rail and tongue non-wiping and so very prone to being put out of action by dust, but because the open tongue is at the same potential as the opposite stock rail, there is a very good chance of a 'short' each time a metal wheel passes through the gap. Far better to use a proper switch; there are several neat ways of doing this, of which more in a moment.

Beyond such a turnout the usual procedure is to 'jumper' the stock rails to those at the toe end, and if it is felt necessary to isolate a loco on the 'wrong' road, to insert a dead-section switch. But if, instead, the two rails of the crossing nose are simply extended to connect to the inner rails of the double track, the rails of the 'wrong' road will be connected together by the switch and isolation is automatic; one less thing for the operator to remember. Furthermore, the system can be extended indefinitely; a single feed can be switched through a whole fan of turnouts, only the selected route receiving power.

Few layouts, unfortunately, obligingly consist of such a fan of turnouts all, so to speak, facing the same way. The usual way of dealing with those that face 'against the stream' is to provide jumpers as before. I am

Fig. 8. 'Oak' sliding contacts.



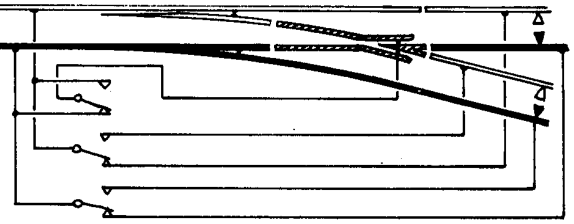


Fig. 2.

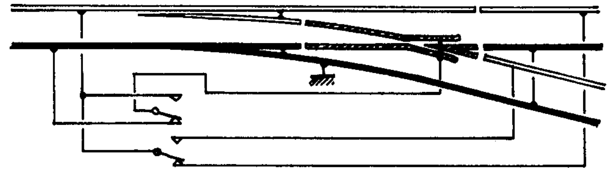


Fig. 3.

surprised how few people seem to have met the circuits of Figs. 2 and 3, which overcome this problem; in Fig. 2, in addition to the contact which switches the crossing feed, two more connect the rails at the toe to one or other pair of those at the heel, while in Fig. 3 one rail is arbitrarily designated the 'neutral' or 'earthy' rail throughout the layout and a second contact switches the 'live' rails as required by the turnout setting.

Both Fig. 3 and the combination of Figs. 1 and 2 are universal; *any* layout can be wired with them. Single and double slips are treated as two turnouts back-to-back (to which they are logically equivalent) and interlaced turnouts are wired just as if they were separate, the only tricky bit being to decide which comes 'upstream' of the other (fig. 4). Diamond crossings without slips present a special problem, but they are pretty rare in both prototype and model practice, and when they do occur it is almost invariably in conjunction with turnouts, so any switching required can be 'slaved' off the appropriate turnout switches. Both systems have their advantages; that of Fig. 3 is easier to understand, since its switching diagram is almost an exact replica of the track layout; but it uses two contacts for every turnout compared with one per 'facing' and three per 'trailing' point for Figs. 1 and 2. The latter usually results in a lower total cost in switches, besides being easier to adapt to reversing loops or triangles; you can even mix them, but beware of 'sneak' circuits which short the power supply when the points are set certain ways.

In a layout based on either of these systems there will almost certainly have to be several feed points, and in most cases there will be optimal positions for these which divide the layout up into convenient areas of operation. If enough operators are available, each can be given a separate controller and responsibility for the area covered by its feed; a solo owner-operator might prefer to use one controller only and switch it to the various feed points as required. A cardinal principle to be borne in mind when designing the electrics of a multi-controller layout is that it should be neither necessary nor possible to pass a train from one controller to another while in motion. Inevitably, if this is attempted, the two controllers will be briefly connected in parallel as the wheels of the loco bridge the section gap; with resistance controllers this results in a momentary halving of the effective resistance and a burst of extra speed as the loco crosses the gap, while more sophisticated transistor controllers can be caused to do peculiar things, if not permanently damaged, by the injection of an external voltage at their output terminals.

Fig. 5 shows a fairly typical station approach in which the turnout switches obviate this problem. Either the circuit of Fig. 3 can be used for all of them, the 'earthy' rail being on the same side throughout the layout, or that of Fig. 1 can be used for all but those two marked 'H' (for heel feed) which are wired to Fig. 2. Three controllers are provided, for Up and Down main lines and Yard, the latter being connected to the headshunt. A Down goods train can be switched over the crossover to the Up line and thence into the yard; as this is done the toe of the yard king-points (from which all the yard tracks are fed) is connected through to the Down Main controller which therefore continues to control the train until it is at a stand in the yard reception road. When the crossovers are restored to normal, the main-line controllers are released for other purposes and the Yard controller takes the train over for any necessary shunting; eventually the light engine or a re-marshalled train can leave by way of the crossover on to the Up line, this time being controlled by the Up Main controller right from the start of the move.

While this is a fairly simple example, and one which would obviously form part of a larger layout if so many controllers were found necessary, it demonstrates the principle well. The kind of complication I am talking about is not really very hard to put into practice; it consists only of the repetition of a few basic modules, and once the action of these is understood the modeller should have no difficulty in applying them to his own situation. If, for example, the two turnouts in the Up line were replaced by a double slip, the operation remains the same and it is only necessary to remember that (just as with a turnout!) the crossing and stock rails are switched by the lever that operates the tongues at the *opposite* end. If a trailing crossover were preferred—as it might well be if the layout formed part of a through station—one could either leave the Up end of the crossover heel-fed, allow it to feed a short section of Up line to the right of the points, and use the Down controller for the backing move; or the left-hand turnout (now in the Down line) could remain heel-fed and feed a short piece of Down line which, for the backing move and the subsequent move into the yard, would come under the Up Main controller. Layouts wired in this way are less demanding but more fun to operate since they remove most of the donkey work and leave you more time to concentrate on the railwaylike aspects of operation; the complicated part—which, at that, isn't really all that complicated—only has to be done once.

Most of us have witnessed, or even been victims of, that embarrassing moment when a train, which has been gathering speed so realistically out of the station, suddenly slams to a halt; any remnants of the fragile illusion are shattered seconds later by the muffled curses and frantic clacking of the overlooked section switches. This, to my mind, is something even a solo layout-owner at home ought not to tolerate; in an exhibition layout it is absolutely inexcusable. Operating at shows is tremendous fun, but the mental strain is quite considerable, and a layout ought not to go on show with its electrics so badly designed that operators suffer under the kind of workload which causes section switches to be overlooked.

A simple means of making such mistakes less likely is to provide the operator with a mimic diagram controlled by the point switches. Light-emitting diode indicators are now so cheap that they compete with an ordinary bulb *in a holder*; their life (barring accidents) is so long that they can be soldered in position and their power consumption is very small. An extra contact on each turnout, wired like the second contact of the Fig. 3 set-up, can feed an LED in each track section, so that the operator can check that his route is properly set up before starting the train.

An attractive innovation is the dual LED, which contains red-and green-emitting diodes in a common housing 'back-to-back', one or the other being lit according to the direction of the current. Better yet, if it is fed with AC the eye combines the two colours into a passable yellow. Thus a single 'dual' LED per section could indicate green for the connection of that section to one controller, red for its connection to the other—the feeds being simulated by half-wave—rectified supplies—and the yellow indication could be made to show either the connection to a third controller or the inadvertent cross-connection of the two.

Route-proving in this way can very usefully be applied to signals. Where several 'homes' protect the convergence of several lines into a single track, or a group of starters control a facing junction, it is possible to use a contact 'tree' to feed the signal actuators, interlocking them with the turnouts. One can either provide a separate lever (i.e. switch) for each signal and arrange the tree so that it can only be set to clear' when the road is set that way, or a single switch will cause to 'clear' whichever signal corresponds to the selected road. The latter method saves switches, but the former is nearer to full-size practice—and if you do make a mistake it saves all that frantic waggling of signals while the operator searches for the right road.

The *use* of signals in this way, rather than just putting them there because they look

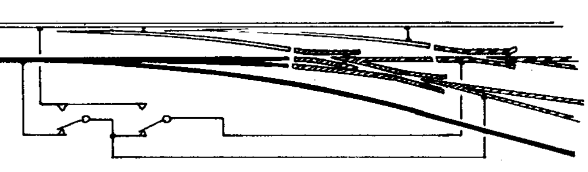


Fig. 4.

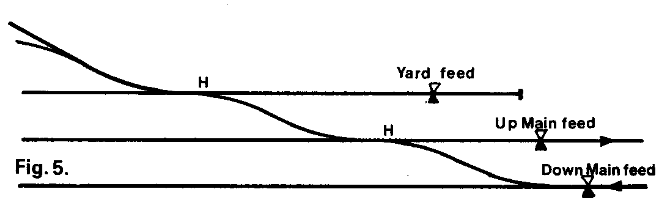


Fig. 5.

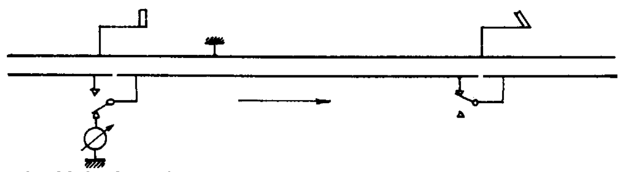


Fig. 6a. Linked section control.

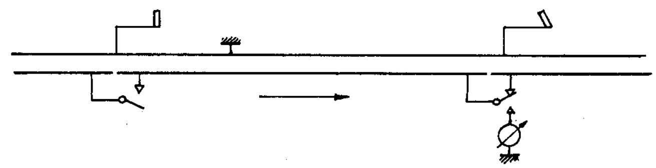


Fig. 6b. Reversed linked section control.

pretty, is the real answer to section-switch errors. Apart from keeping the operators' faces free from egg, it heightens the feeling of running a real railway—and isn't that what the hobby is supposed to be about? One of the greatest breakthroughs in this field was the invention of Linked-Section Control by the late L. E. Carroll, who described it in detail in *Model Railway News* between September 1953 and January 1954. Like most really brilliant ideas, Linked-Section Control is basically very simple. At each Home signal, a change-over contact connects the following section to a local controller if the signal is 'on' or to the section in rear if it is 'off'. Thus, by pulling 'off' all the signals along a selected route, all the sections are connected to the first controller in the sequence, which is then used to drive the train to its next stopping point. Section switches are virtually eliminated; one simply operates the signals. The tremendous flexibility of the system is shown by the fact that Mr. Carroll's own layout, representing the line from Victoria to Reigate, could keep seven operators busy but could be run by one man if necessary.

If LSC has a weakness it is that signals behind a train have to be left at 'clear' until the train has stopped. My own variant—which I call reversed LSC—works the opposite way round, the block leading up to each starter being connected either to the local controller or the block in advance. Now the signals have to be cleared up to the next stopping-point before the train can start—not much of a disadvantage except, perhaps, in a really enormous layout—but they can be restored to 'danger' immediately after the train has passed. Both systems are compatible with almost any railwaylike situation or automatic system you care to name; one could, for example, use relays as signal actuators, let these control the track through RLSC, and provide each one with a push-button and 'hold' contact to set it 'on' and a track-circuit to set it 'off'—and there's a complete automatic signalling system.

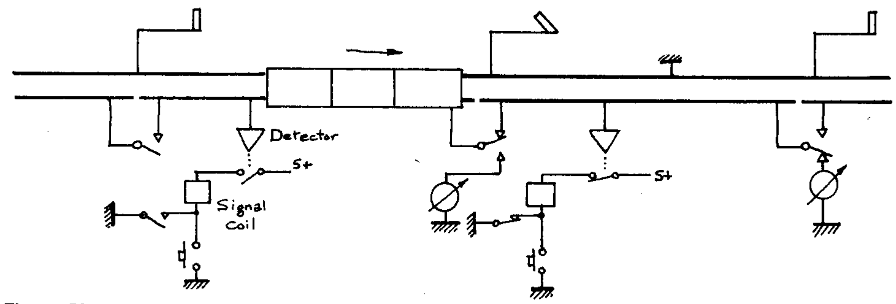
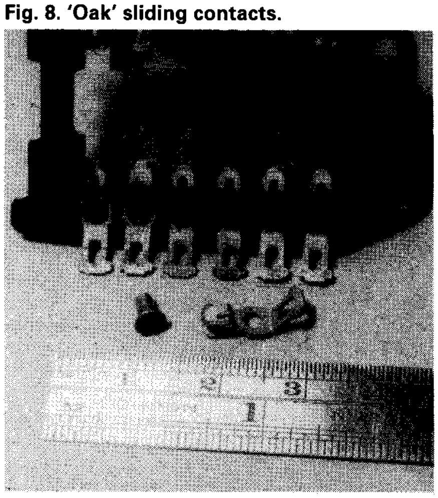


Fig. 7. Simple auto signalling with R.L.S.C.

Mention of signal actuatiors brings us to the matter of hardware; I thought I could hear one of you in the back row muttering about where all those contacts were to come from. This, I agree, is a bit of a problem; no commercially available point motor or signal lever embodies a sensible number of spare contacts. I can remember a time when hardly an issue of MRN appeared without a Heath Robinson design for a multi-pole switch, usually cobbled up from dowel rod, springy brass strip and woodscrews. If our complication is to yield the right degree of simplicity we need a very reliable contact, especially where, e.g. in a fan of sidings, our loco will be receiving current through several contacts in series.

Fig. 8. 'Oak' sliding contacts.



The 'Oak' double-sided wiping contact is a breakthrough, in its field, comparable with LSC. It was introduced in the '30s for radio waveband and similar switching; the contact is a light brass stamping, silver-plated and clenched into a paxolin stator by an eyelet which causes the jaws to come together with a definite 'set' and so to exert a positive pressure on a moving contact slid between them. This contact has been used in thousands of switches, some rotary, some push-button, which have given phenomenal reliability in radios and other electronic devices for decades; even now no-one has come up with anything better. The rotary switches are available in kit form; the slider type, more suitable for ganging to turnouts, are regrettably not, but the contacts and eyelets are available from British NSF (Keighley) who will supply subject to a minimum-order charge which should not greatly embarrass a club or society. It then only remains to make the paxolin parts and the moving contacts (which can be cut from nickel-silver sheet about .015" thick) to make custom-designed slider switches; alternatively wafers like that in the photo are fairly easy to find on the 'surplus' market.

Where only two change-over contacts are required, an ordinary DPDT toggle switch can very conveniently be used as a point lever, an actuating wire being either passed through a hole drilled in the 'dolly' near the root or, better, operated by a reversing crank as shown in Fig. 10. I prefer the latter, as the dolly then points the way the train will go and provides a built-in indication. Such an arrangement is ideal for use in a fiddle-yard, the switches being mounted adjacent to their turnouts.

I can hear another voice asking why we should go to all this trouble when in a year or two it will all be done by 'Chips with Everything' and we shall be back to our two bits of wire. For one thing, I'm sure we shall still have to have switched, live frogs; however it's controlled, a loco must still have a reliable supply of electricity, and I have yet to see how any pulse-coded device can work against the barrage of splats and splutters generated by the average loco's wheel-to-rail contact. Although multiplex systems allow you to operate a turnout or move a selected loco anywhere on the layout, this is in fact their disadvantage; none of the systems at present on offer contains any facility for preventing a wrong or dangerous move.

That isn't to say that the electronic systems couldn't do just that. If, as I suppose, there is a microprocessor in the master control box, it will simply be laughing at the job of controlling two or three locos simultaneously, and it only needs the appropriate memory and input/output capacity to enable it to monitor the position of each train and the status of each turnout and signal on the layout. From this it is a very short step indeed, via a device called a PROM (Programmable Read-Only Memory) to programmes which continuously check that what the trains are being asked to do is in accordance with the signals. All the hardware for this exists already, and there are on the market several 'home computer' kits which someone with a background of computer technology and programmng could couple up to a layout. It's already been done in the USA, and I believe that the Swedish Nyman control system, when it arrives, will have something similar. Once again, this is a form of complication for simplicity's sake—and if it isn't too expensive, and is reliable and straightforward enough for a layman to install, it will probably catch on. It will be interesting to see how things develop.

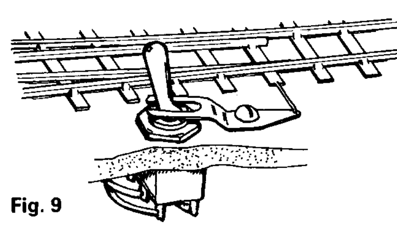


Fig. 9