This article carried some incorrect type references for ‘Plastruct’ extrusions. The following letter which quotes the correct material reference was sent to MRJ but was never published, probably being lost during a change of editor. It is included here, before the article, in the hope of saving any reader from buying incorrect sizes, should they decide to copy the idea.
Dave Booth , March 2004

My article about the TOU has encouraged quite a few modellers to try them, but has thrown up an error which is very peculiar. I purchased Plastruct square tube in styrene, coloured white, in two different sizes: AFS6 & AFS10 - or rather that's what I thought I purchased and I'm sure that's what I paid for. At least two others I know to have done the same but at different shops or exhibitions. However the material I used could not possibly have been AFS6 & AFS10 because AFS6 is not a sliding fit in AFS10.
It took much surfing but I eventually worked out how to use _ HYPERLINK "http://www.plastruct.com" _www.plastruct.com_, and that's why I am now certain of the error. It’s a big site but worth a look, and what a range! I am now convinced that the tube I used was ABS, not styrene, and its colour is described as ‘light grey’ not white. The angle I used was coloured black (or is it dark grey?) and the bloke in the shop told me that the black was ABS. He had no angle in styrene, which he claimed was white.
The real difference as far as this application is concerned is that ABS tube has a larger wall thickness than does the styrene, and I thank Allan Sibley for that information, which started deeper searching. The thicker wall means that the internal dimensions of ABS tube are smaller than the same size of styrene tube. It would appear that the styrene range will telescope at adjacent sizes, meaning that AFS6 telescopes into AFS8 (not AFS10; AFS8 will telescope into that) but the wall thickness of AFS6 would not really allow tapping for a screw thread. For the ABS range it seems that the telescoping feature is a two-size step and the generic ref. for ABS is ‘TSxx'.
This all means that the references for the tube I used must be TS6 & TS10. For what it’s worth, styrene is coloured white and ABS is coloured light grey, but what the black or dark grey is, I'm afraid I didn't find out - it's a complicated site, but what the whole episode has shown up is that the Plastruct display carousels at shows and model shops are open to error and some traders don't necessarily know the product as well as we might expect.
Dave Booth,
Holmfirth,
West Yorkshire
January 2003

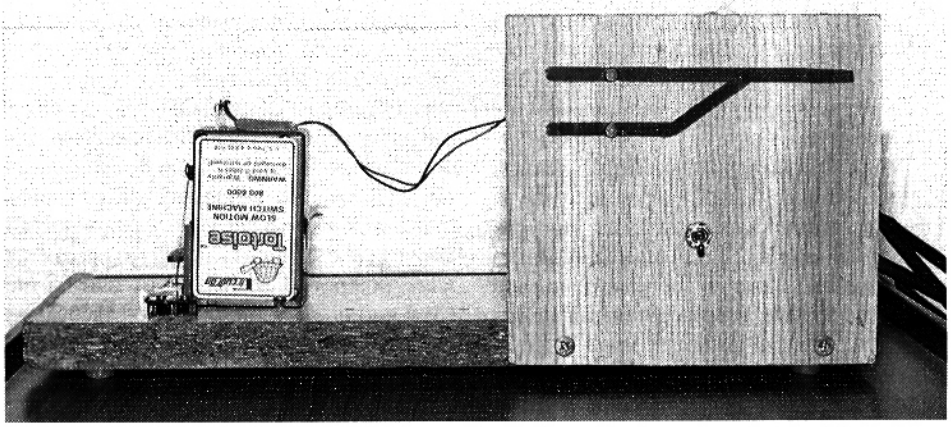
TURNOUT OPERATING UNITS

from readily available materials

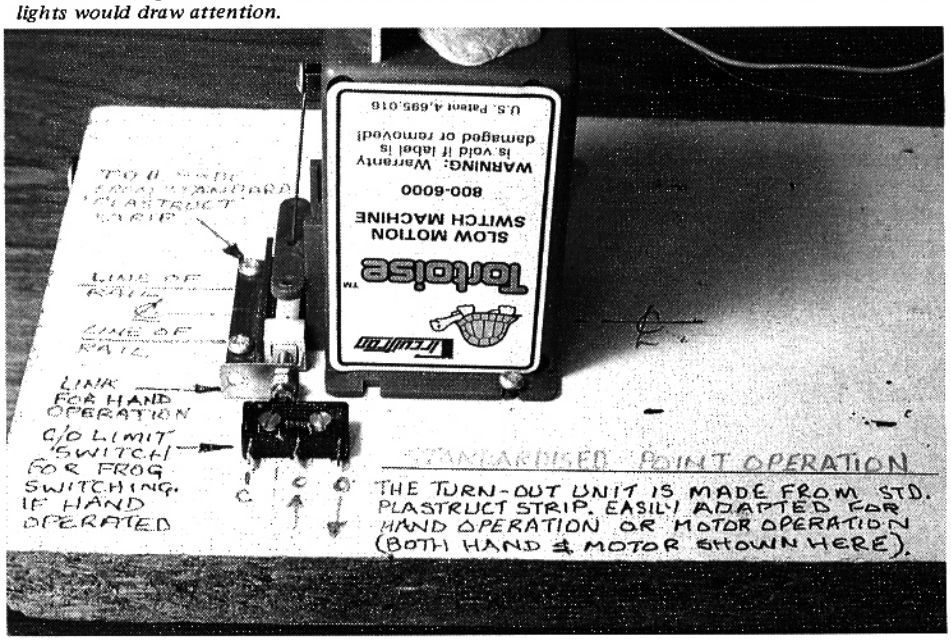
by DAVE BOOTH

The development of this little unit was caused by an unusual sequence of events, but it has resulted in a simple design of TOU that can be adopted for either hand or motor operation and which is constructed from readily available materials. First, let me tell you why I decided to write this article and then relate the story of how it all happened:

Manchester Model Railway Society is one of England's oldest, and various traditions have developed over the years such as the annual exhibition just before Christmas, but recently distanced a little further from Christmas. One custom is to have a demonstration stand manned by volunteer members who demonstrate anything of their choice related to railway modelling. This article came about because of the tremendous interest shown when one small part of my demonstration unit caused so much interest at Manchester's 2001 exhibition. I was genuinely surprised that so many people seemed to think my design of TOU was an excellent idea, and surprised too that so many left me saying they would be adopting it. I therefore thought the information ought to be published.



The mimic diagram demonstration unit which 'fired' this article; it was intended that the flashing lights would draw attention.



A closer look at the demo unit, showing the physical relationship of all the parts. Of course, I would neither fit the link for hand operation nor the frog switch if using a point motor.

Beginnings

Why had I decided to demonstrate point operation? Over the weeks just before the show, I had been doing a fair bit of research into this because the track of my new layout was now down, and operating the points was the next step. I eventually came to the conclusion that the American-made 'Tortoise' slow-acting point motor was the best machine to meet my needs.

Now one of the merits of the Tortoise motor is that it lends itself very easily to the production of an illuminated mimic diagram of the track plan. It was the idea of moving lights in a demonstration which caused me to prepare the unit which I was to use at the Manchester exhibition. The surprise was that it was my little TOU rather than the flashing lights which seem to have caught the imagination. Unfortunately, the Tortoise is designed to drive the turn-out blades via a 'sliding sleeper' i.e. a tie bar which takes the place of a sleeper. Along with most other finescale modellers I dropped that unsightly system many years ago. I have used the 'Swish curtain rail' system which was, I think, introduced in the manual produced for Proto-four Society members some time in the early 1970s. It provides the basis of a TOU which is below baseboard, driving the blades above with virtually nothing seen at track level. However, I ordered the required number of Tortoises, knowing about this problem related to 'sliding sleepers', but confident that such a problem could be overcome.

Let's go back in time a few weeks to when I was wondering how to operate the turnouts on my new layout. Strangely, it was the demonstration stand at the EM Gauge Society show at Slaithwaite that started my experiments and enquiries about point operation. There was a demonstration showing uses of 'Shape Memory Wire'. This caused me to purchase one of the C&L memory wire kits and to set off working to produce a point operator which was smaller than the 4in × 2in 'footprint' units which have been written up in our magazines and which have been fairly widely demonstrated.

My new layout does not have much room for point motors and I don't want the complication of motors remote from the points, which involve long mechanical linkages. So my first steps were towards

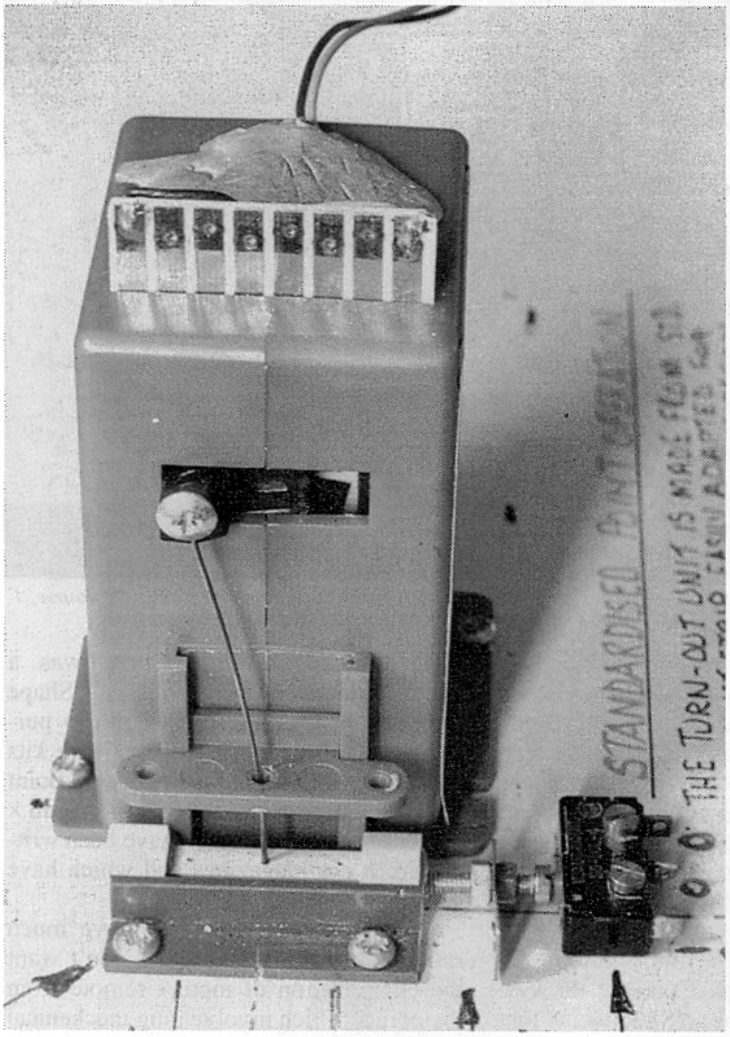
miniaturisation. It was not long before I dropped the idea of using memory wire! Too many unknowns related to current, spring tension, heat loss and ambient temperature and too complicated to manipulate the required length of 'shape memory wire' into the space I could allow. However, in trying to miniaturise my memory wire unit, I had reduced the size of the turnout operating unit. This had been achieved due to another strange quirk of fate.

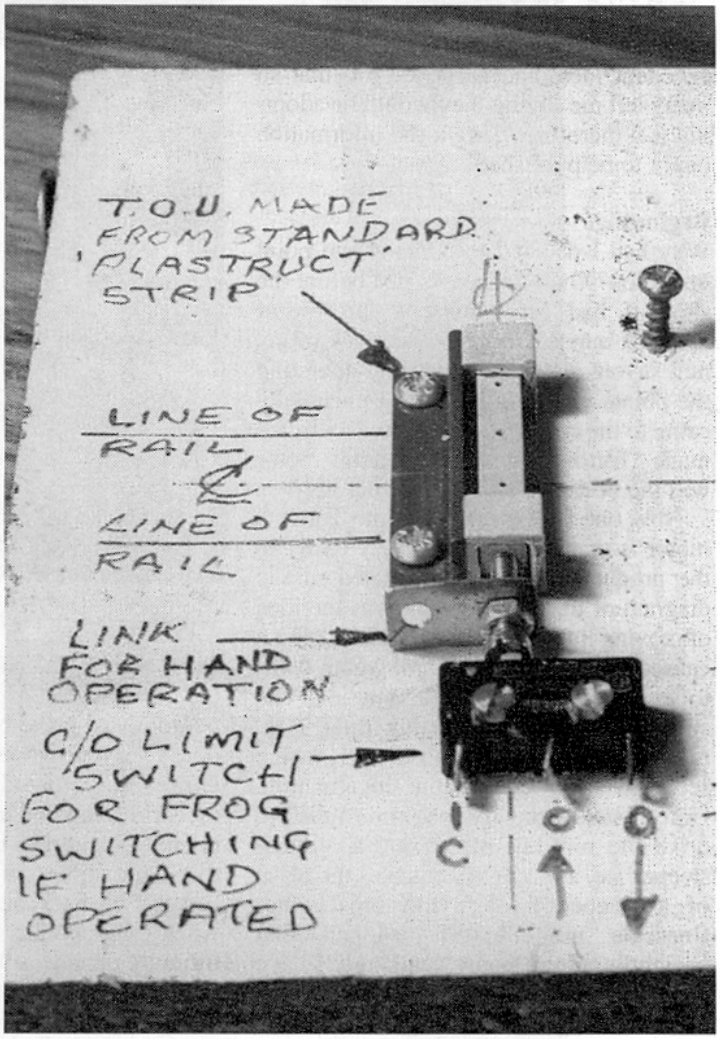
While visiting Wakefield Model Railway Centre, I had taken some time to inspect what was available in the 'Plastruct' display. This material is something which I have in the past dismissed as too expensive a replacement for things I can make from Plastikard! I was inspecting a length of square tube, wondering what purpose people found for such plastic extrusions. My next thought was whether these square tubes 'telescoped' like brass tubes do. I tried a smaller tube inside the larger and found my answer – they do so beautifully with no slop and an oily-smooth slide of one inside the other. I was so impressed that I left the shop with a length of each, knowing that I could use this telescoping feature but not knowing how.

Readers of experience will already have guessed that the Plastruct tubes became the replacement for the Swish curtain rail part of my TOU. Mk. 1 helped me reduce the memory wire baseplate size down to about 2.5in × 2.5in but as I could not achieve the reliability of operation that I was aiming for (for reasons quoted above), the memory wire experiments were postponed in favour of one of the slow-acting point motors. The Mk. 1 TOU and indeed the Mk. 2 version need not be described here, for while they had influence on the final design, they did not meet the criteria that I eventually set myself.

Something which I find irritating in some articles is when the author describes what he has done but his design is based on materials not readily available. If he describes something based on equipment purchased from an Army surplus shop in 1950, then the rest of us can't use his idea! The criteria I set myself for my TOU were:

1. Repeatability.
2. Adaptable for either hand operation of any kind, or for operation by point motors of any kind.
3. Related to 2, it must be capable of driving a change-over switch for frog polarity switching.
4. Virtually undetectable from the viewing side.
5. Reduce the stresses at the blades by having a degree of twist, allowing the toe of the blade to move through an arc and not trying to make that arc a straight line.
6. The ability to remove either the track or the TOU without one disturbing the other.
7. Allow the fitting of cosmetic tie-bars.
8. Built-in adjustment so as to remove any need for very accurate fitting.
9. Capable of being made with normal modelling tools and skills.
10. It should hold the blade so that the running surface of the blade matches the running surface of the stock rail.





Left: *This shows how a 'Tortoise' can drive the slider. Also shown are the TOU fixing screws and the locknuts for a hand-operating link.* Right: *A closer look, without the 'Tortoise'. Note the markings showing the centre lines for locating the fixing position; the fixing slots allow for slight adjustment.*

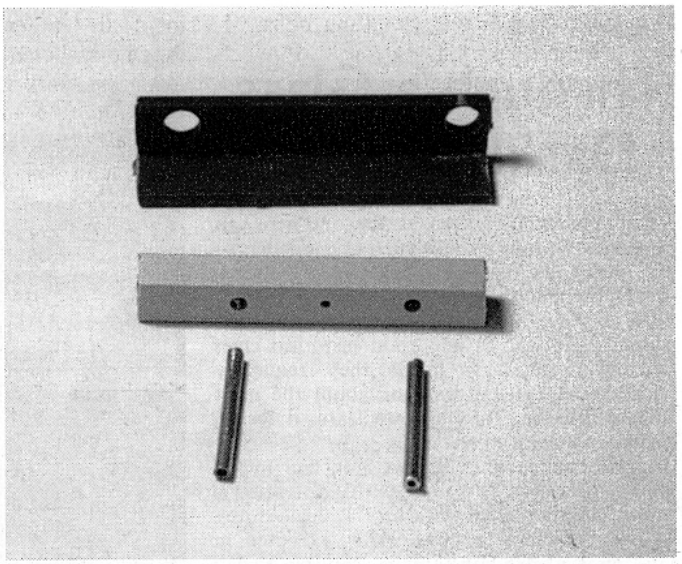
A final aim, but not so important as the above ten, was that it should be adaptable for all the smaller gauges. Items 4, 5 & 6 were met by the Swish curtain rail idea, tubes being carried by the slider going through smallish holes in the baseboard and pins soldered to the turn-out blades entering these tubes from above. The problem was the selection of compatible tube and pin! The Central London Area Group (CLAG) of the Scalefour Society has a web page describing their TOU and this had some influence on my thinking. They use bits of hypodermic tube here, and '... some electrical tags from some old electronic components ...' E-mail enquiries about these parts produced insufficient information to allow me to directly copy (lack of 'repeatability'!) but my thoughts led me to brass tube.

For a long time I have used 1/16in diameter tube as material for crank pins. It seems to have an internal diameter of 0.85mm which is a nice tapping size for 14BA, and it will accept 0.8mm rod or wire as a smooth sliding fit. I am now going to relate a silly tale which will allow you a laugh at my expense: I tried bending a piece of 0.8 rod through 90°, only for it to crack at the bend. I tried again three times; it always cracked or broke. I had started to curse 'Eileen' for having sold me some rubbish when good sense returned and I remembered such wire must be 'hard drawn'. Annealing with a match flame was sufficient to allow a nice clean bend and having done so, I realised that a sharp tap with a hammer would forge the bent, round section to a flat section and hopefully work-harden it. Success! I had found my source of blade tubes and blade rods.

Construction

We have at long last reached the nitty-gritty. You can set to and make one or more of these units in an evening. The materials you need are all available from any good model shop with the exception of the frog switch which is an international standard 'sub miniature "V4" limit switch' (Maplins order reference is FP41 U, but identical units are readily available elsewhere.) Here then is your shopping list and the quantities are likely to be the minimum you can purchase but which are sufficient to make about eight units to 4mm scale dimensions:

1. One length Plastruct angle (ref. AFS10) for the mounting bracket
2. One length Plastruct square tube (ref. STSF10) for the guides.
3. One length Plastruct square tube (ref. STSF6) for the slider.
4. One length 1/16in outside diameter brass tube for the blade tubes.
5. One length 0.8mm diameter brass rod for the blade rods.
6. One V4 limit switch as described above (not required if frog switch is part of point motor).



Top: *The mounting bracket; the fixing holes have not yet been slotted.* Middle: *the slider, showing 1/16in holes for tubes and a 0.8mm for 'Tortoise'.* Bottom: *The blade tubes of 1/16in outside diameter brass.*

Now you've done the shopping, let's measure and cut! Please remember that any quoted dimension is based on 4mm scale, 18.83mm gauge, and for a simple, single turnout. If you operate to a different scale or gauge, or if your TOU is for a more complex turnout, the following dimensions may not apply. Some dimensions are also governed by trackbed thickness.

Mounting bracket

One is required; 35mm length of plastic angle with two fixing slots, each 3.5mm dia × 5mm long, one at each end of one web of angle. These slots will suit No.4 woodscrews and allow longitudinal adjustment when fixed to the baseboard. The slider guides are welded to the other web of the angle.

Guides

Two are required; each is a 7mm long piece of the larger square tube (STSF10). Weld these to the mounting bracket, on the outside of that web of the angle which is without holes; one at each end. (see pictures for clarification).

Slider

One is required: 35mm length of the smaller square tube (STSF6). This requires at least two holes (for the blade tubes, 1/16in dia.), three if you use Tortoise motor (0.8mm dia.) This last hole is drilled on the junction of transverse and longitudinal centre lines; the other two are equi-spaced around the transverse centre line to suit your track standards (17mm works for S4 or P4; 16mm probably OK for EM and about 13.5mm perhaps for 'oo', but you must decide!). If you require your TOU to drive a limit switch, then tap a 6BA thread into the relevant end of the slider. (The hole in the Plastruct is tapping size for 6BA; you may get away with making a 6BA screw self-tap.) If you need to attach a mechanical linkage to your TOU then run your linkage bracket between two locknuts onto a 3/4in cheese-head 6BA screw and screw this into the tapped hole.

Blade tubes

Two are required; their length is dependent upon the thickness of your track bed and ballast but they need to end about 1mm below the top of your ballast. Mine are 16mm long for a track bed, plus ballast thickness of 11mm so if you add 5mm to your track bed/ballast dimension, then

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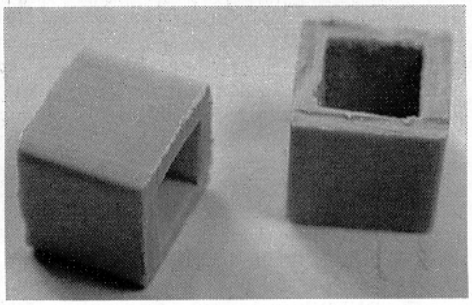
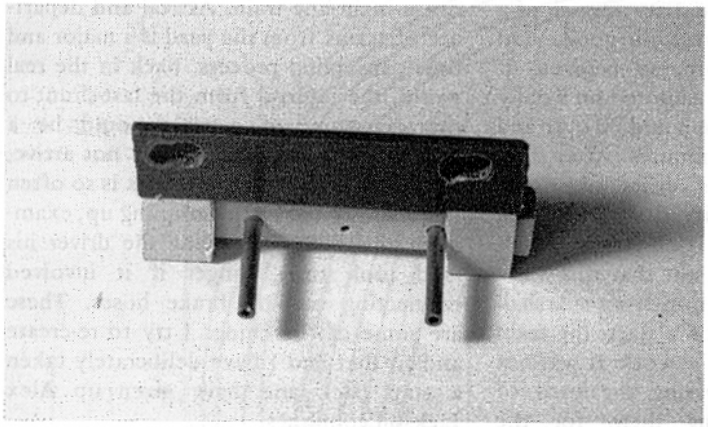
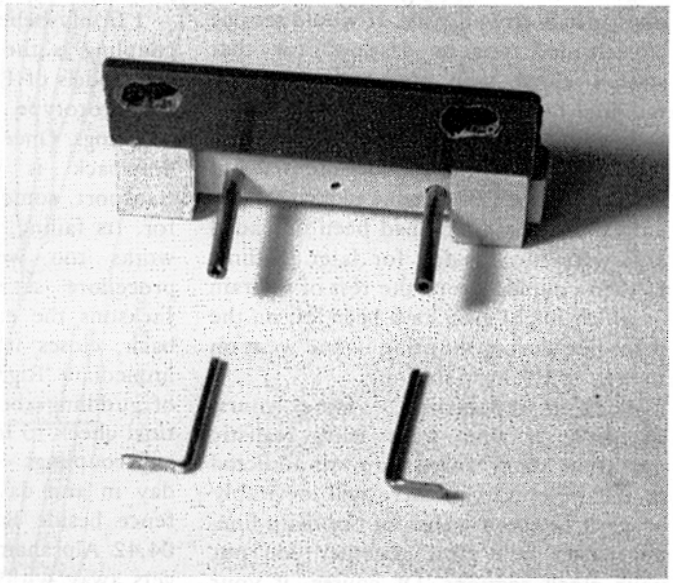


A much enlarged shot of the guides. (Yes!, they still need cleaning up with a fine file.)

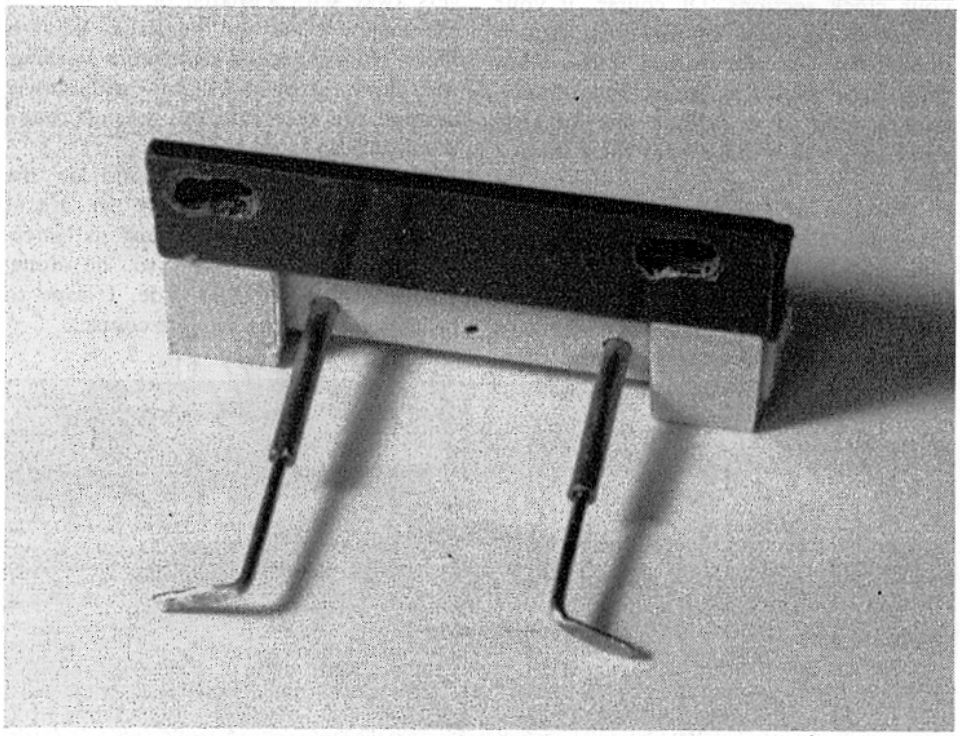
Continued from page 299



The assembled sub-baseboard section. (Again Bill's close camera work shows up my tatty attempt at hole slotting.)

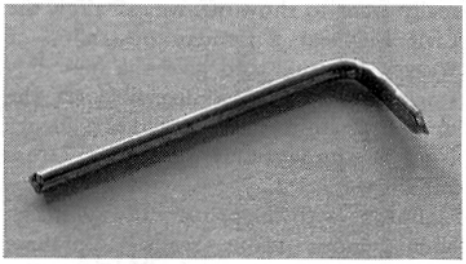


The blade rods slip into the blade tubes from above baseboard and remain loose in the tubes. They are then soldered to the point blades.



This shows the complete TOU with all the parts in position.

that should work for you. Remember that the slider must be mounted in its guides before the blade tubes are fitted to it. They are a push-fit into the 1/64in holes in the slider, with their bottom ends flush with the underside of the slider. I add a touch of cyano to ensure that they stay in position.



A 0.8mm brass rod, annealed, bent through 90 degrees and the short end forged to a flat section, becomes a blade rod; but don't forget the annealing!

Blade rods

Two are required and they are the same length as the tubes, though this is not critical. Anneal one end (a match or cigarette lighter will supply sufficient heat), and bend 5mm of this end through 90°. Give this short length a smart tap with your smallest hammer against an anvil-like surface, to achieve a flat section. Tidy up with a Swiss file.

Assembly

Hopefully, inspection of the series of photographs, added to the comments in preceding paragraphs, tell you how the various parts relate to each other. I don't intend using a limit switch but if you are, I recommend that you make up the full unit on its own baseplate, and also remember that the thickness of your baseplate needs to be added to the length of the blade tubes and rods.

Fitting

The majority of you reading this article may be modellers of some experience and it seems improbable that you need me to explain how to fit a TOU! However, one or two notes about my methods may be useful to someone.

I would never attempt to fix the TOU until the point is fixed and ballasted. I then draw on the underside of the baseboard the centre line of the track and the centre line of the slider. This is aided by drilling pilot holes 1/16in for the blade rods and tubes, later opening these to 1/4in from below (*very carefully* because there are some fragile track sections above!) At completion, these holes are covered over

by paper coated with ballast, and all visual evidence of our means of point movement is removed.

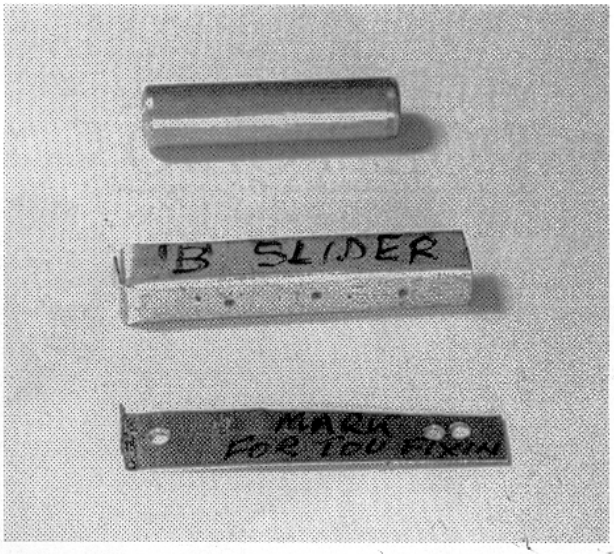
The unit is now fixed to the baseboard (I use ½in No.4 wood screws) around the drawn centre lines, aiming for strict accuracy, but the built-in adjustments allow some leeway. Next I thread the blade rods, from above, into the blade tubes and wedge them with cocktail sticks held by Blu-tak, such that the horizontal flat section is hard up to the underside of the stock rail. The blade is now soldered to the rod. This has, in the past, been the point where things went wrong and strong language became profuse as everything insisted on being soldered up solid. Now I prepare and solder with a higher degree of care. Firstly, the blade rod is tinned but by using solder mask, that section which will travel under the stock rail is left clear of tinning. Also this non-tinned section is treated to a thin coat of silicone grease, not only to aid smooth operation, but to help keep the solder from that area where we don't want any! In this type of situation I would no longer use a liquid flux; the slightest touch of 'Powerflux' helps to keep solder where we want it.

Conclusion

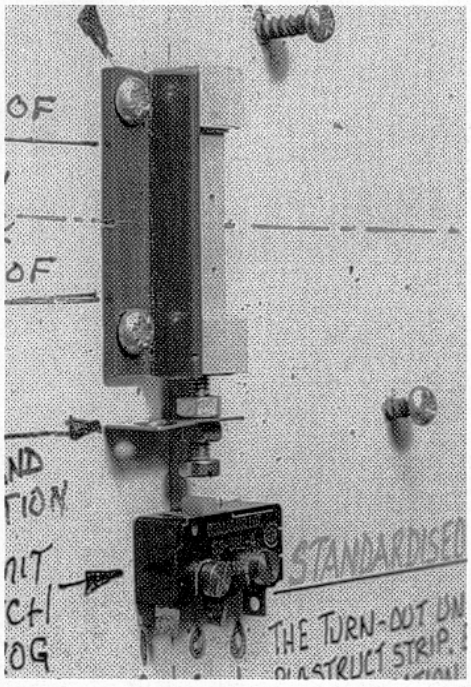
The TOU is in place and the blades move freely when the slider is moved. It only remains to link your TOU to your means of operation via the adjustable linkage bracket on the 6BA screw. First, if you need to use a frog switch, fix this so that its actuator is touching the screw head. When fixed, adjust the screw position so that the switch operates within the movement of the slider. There should still be sufficient thread of the 6BA screw showing, to allow adjustment of the position of the linkage bracket and your whole mechanical linkage.

None of this is necessary if you are using 'Tortoise' motors. Fix these exactly as the manufacturer instructs but fit the toggle spring wire into the 0.8mm central hole in the slider, ensuring that you trim the wire length short enough to clear the underside of the baseboard.

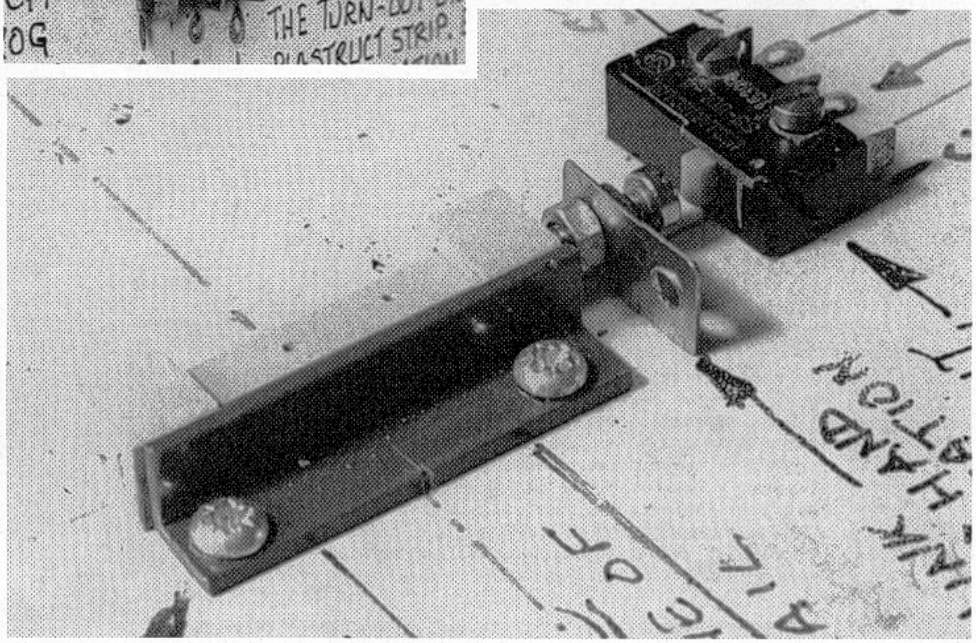
That's it, except to give the usual comment about having no connection, other than as a customer, with any traders mentioned. If I was to offer thanks, then because so many have been involved over so many years, I would be bound to offend by forgetting someone, so thanks anyway, but no names.



Because I was making 13 units, I made some marking-out and drilling aids. Top: *Blade tube and rod length cutting aid.* Middle: *Slider cutting and drilling aid.* Bottom: *Mounting bracket cutting and drilling aid.*



Visualise your hand-operated rodding connected to the link bracket and this is all that is needed below your track. Tidy fitting will result in nothing being apparent at track level.



This view is included to show the simple link bracket; a piece of 0.015in scrap brass and two 6BA holes.