MR. GUY MITCHELL'S "BROOK HOUSE" MODEL RAILWAY.
MR. W. H. JUBB'S NEW "GREYSTONES" MODEL RAILWAY.
MR. B. E. DRURY'S "PEAKLAND" MODEL RAILWAY.

WHEN a "man fra Sheffield" takes up a thing, you may be sure that he will do it well, or not at all—and in model railway building this well-known axiom is exemplified by the excellent work of three gentlemen whose names appear at the head of these few notes. Limited space in this issue will not

FIG. 1.—MR. G. S. MITCHELL'S $3\frac{1}{2}''$ GAUGE RECORD BREAKER.
(3 miles non-stop with passenger; $1\frac{1}{4}$ miles non-stop with one firing.)

permit of the writer dealing with the whole trio of model railways mentioned above, and so the first consideration will be for the largest of the three, Mr. Mitchell's outdoor line, the "Brook House" Model Railway.

Mr. Mitchell's line has practically occupied the whole of the past summer, and judging by the amount of work it has entailed, we are afraid that the builder has had little time to spare for anything else—meals and sleep not excepted.

Our party, which included the owner of the "Greystones" model line, arrived at Mr. Mitchell's charming residence just before dark—in time to get a glimpse of the line, and to prepare ourselves for the good things next day. After dinner, Mr. Mitchell showed us his treasures, model horizontal and vertical engines, locomotives, etc., made at various times. The notable feature of the collection was a ½″ scale N.E.R. type single, which Mr. Mitchell fitted with scale cab fittings, water gauges, combination injectors, etc., etc.

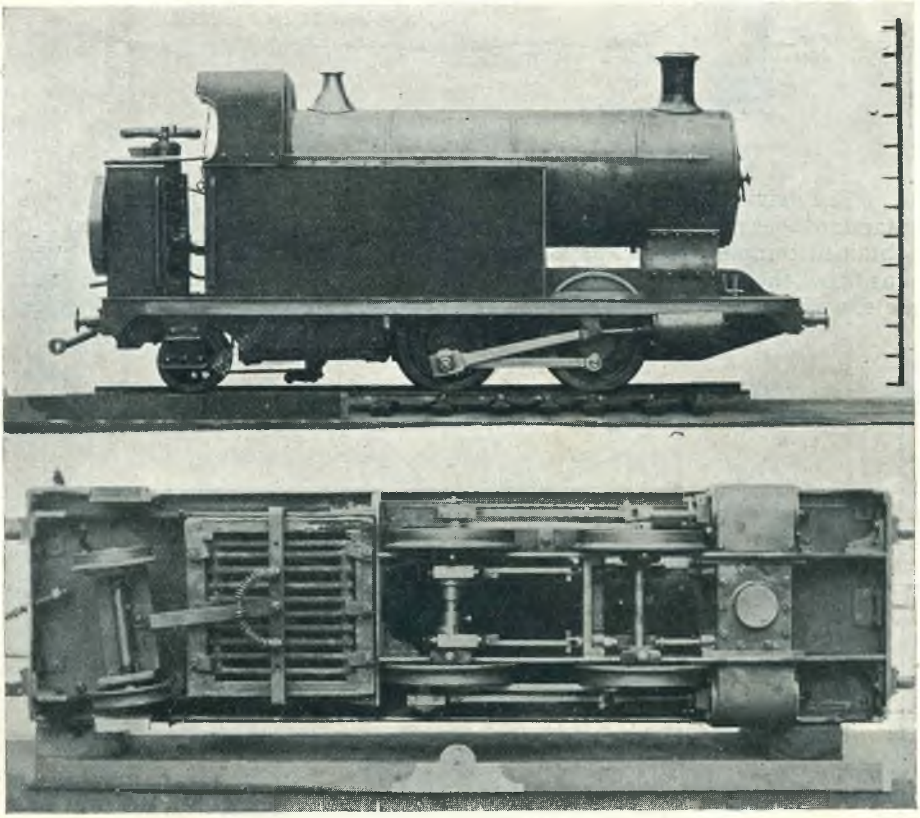

FIG. 8.—SIDE AND UNDERNEATH OF 3½″ GAUGE 0-4-2 TYPE TANK LOCO.

We also examined very carefully the 3½″ gauge tank locomotive designed and made by Mr. Mitchell, shown in the accompanying photographs, and which, as far as the writer knows, is the ultimatum for the 3½″ gauge. This little locomotive will pull an adult passenger indefinitely—not simply haul a big load for a short distance. Its non-stop record is *three miles*, the water supply being replenished by jugs of water handed to the driver as he passed by. The run was only finished by the fact that the "driver-passenger" overbalanced on his narrow perch, otherwise he might have been running still. At our visit it was working all day—always with plenty of steam and always ready for action. As will be seen, this model is an 0-4-2 type tank engine, and was designed simply to do the work required of it. It was a six weeks' job, as Mr. Mitchell put it, and since its completion two years ago it has given no trouble in the least.

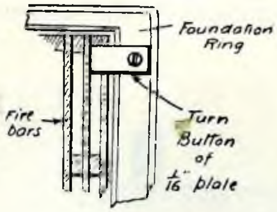

FIG. 9.—SKETCH OF FIREBOX.

The driving wheels are $3\frac{1}{2}''$ diameter, and the cylinders are the writer's standard design (as used for the well-known $3\frac{1}{2}''$ gauge G.N.R. model), obtained complete from Messrs. Stuart Turner, Ltd. Mr. Mitchell, however, has fitted the pistons with brass piston rings as supplied to the No. 7 Stuart sets, with most excellent results. The cylinders are $1''$ bore $\times$ $1\frac{1}{2}''$ stroke.

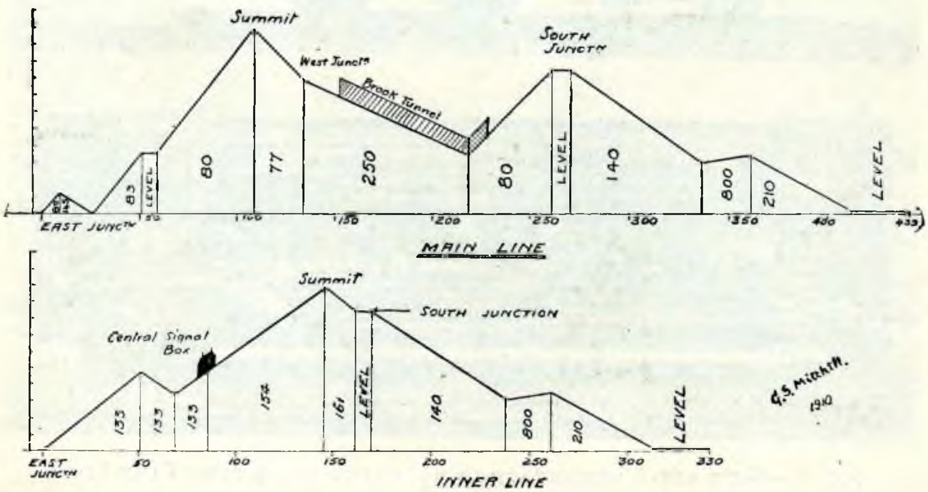

FIG. 10.—DIAGRAM OF GRADIENTS, "BROOK HOUSE" MODEL RAILWAY.

The boiler is of the loco type, with a straight side firebox made as deep as possible. The firebox is $5\frac{1}{4}''$ long $\times$ $4\frac{3}{4}''$ wide outside, and is $6\frac{3}{4}''$ deep inside. It is fitted with eight field tubes $\frac{1}{2}''$ diameter, and has an exceptionally large fire hole. Eighteen fire tubes $\frac{1}{2}''$ diameter pass through the barrel which, by the way, is $4\frac{3}{4}''$ diameter and $9''$ long.

There are several small points worthy of notice, all of which go to make the locomotive so successful. The water-feeding arrangements consist of a large hand-pump, which with a few strokes quickly replenishes the boiler.

For service conditions a steam donkey pump is employed. This has a cylinder $\frac{3}{8}'' \times \frac{5}{8}''$ stroke and a $\frac{1}{4}''$ diameter plunger. Considerable trouble was

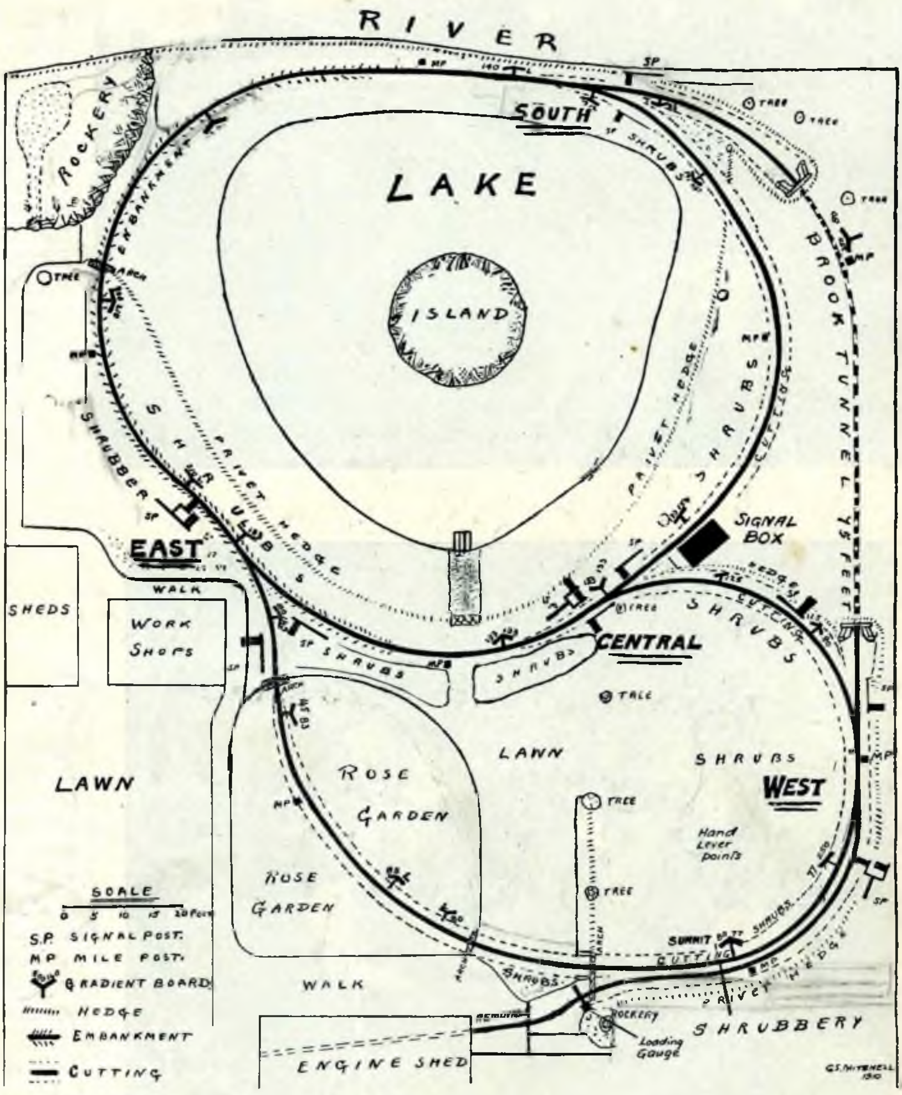

FIG. 11.—PLAN OF BROOK HOUSE MODEL RAILWAY.

experienced with this pump until a small by-pass pipe was fitted to the delivery pipe. To start the pump, the cock on this pipe is opened, and when the jet of water is fairly constant it may be turned off with the full knowledge that the pump is doing its duty. The trailing wheel is placed clear of the firebox, and is mounted on a pony truck.

The firegrate is built up of wrought iron bars, and is affixed in a very neat manner, as shown in our sketch. These metal buttons can be easily knocked aside when it is desired to drop the bars.

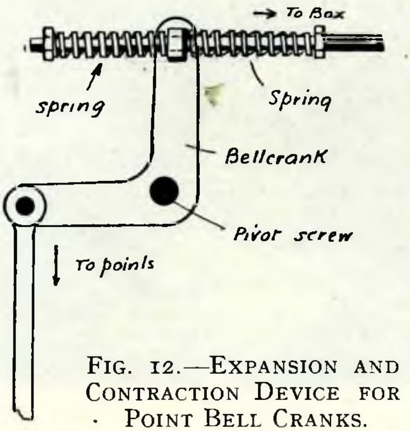

FIG. 12.—EXPANSION AND CONTRACTION DEVICE FOR POINT BELL CRANKS.

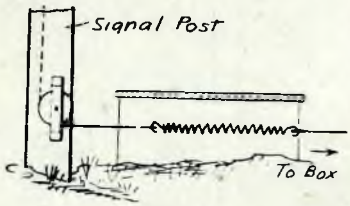

FIG. 13.—SIMILAR DEVICE FOR SIGNAL WIRES.

The working pressure of the boiler is usually 75lbs., but the engine ran quite well, during our visit, with a passenger, with a maximum pressure of 63lbs., which was the pressure at which the "Pop" valve temporarily fitted happened to be set to blow off. The boiler is built up of tube and castings for the end plates, and the joints are secured by screws—not rivets.

As the engine has to run on the $1\frac{1}{2}''$ scale permanent way, it has large flanges. These are essential for any vehicle working out-of-doors and on the ground. One feature of the design is the use of slip eccentric reversing gear, a stop collar being provided for the pin in the eccentric to work against.

The following are the leading dimensions of the Model :—

MR. G. S. MITCHELL'S MODEL $3\frac{1}{2}''$ GAUGE TANK ENGINE.

Driving wheels $3\frac{1}{2}''$.
Trailing wheels $2\frac{1}{8}''$ on radial truck.
Axles $\frac{3}{8}''$ silver steel.
Fixed wheelbase, $5\frac{1}{4}''$
Total wheelbase, 14″.
Boiler barrel length, 9″.
Boiler barrel, $4\frac{3}{4}''$ diam., solid drawn tube.
Smokebox, 5″ diam., 3″ long.
Firebox, $5\frac{1}{4}''$ long, $4\frac{3}{4}''$ wide, depth $6\frac{3}{4}''$.
Grate, $4'' \times 4\frac{1}{2}''$.
Area of grate, 18 sq. in.
Boiler centre $7\frac{1}{2}''$ above rail.
Firehole diam., $1\frac{3}{4}''$ round tube.
Eighteen $\frac{1}{2}''$ tubes, brass.
Eight field tubes, $\frac{1}{2}''$.
Heating surface of boiler 430 sq. in. (excluding superheater).
Drawbar pull at 75lbs. pressure =32lbs. With 25 lbs. pressure it will pull an adult.
Total length over buffer beams, 24″
Width over footplates, $6\frac{3}{4}''$.
Thickness of frame, $\frac{1}{8}''$ steel.
Between frames, $2\frac{3}{4}''$.
Between flanges, $3\frac{5}{16}''$.
Weight in working order, 75lbs.

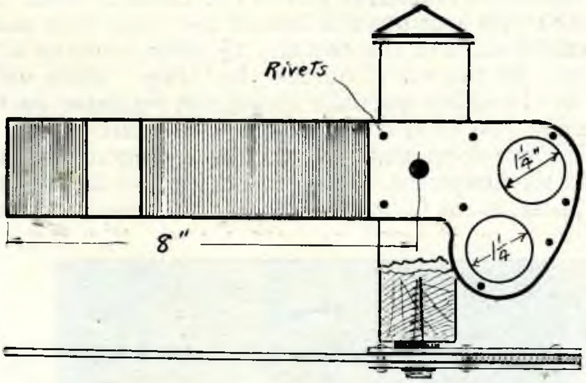

FIG. 14.—SIGNAL ARM.

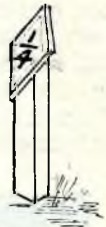

FIG. 18.—MILE POSTS.

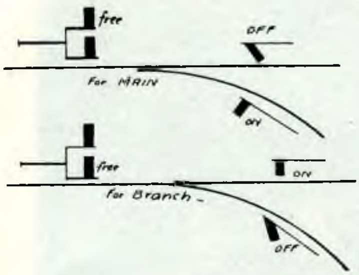

FIG. 16.—DIAGRAM OF SIGNALLING POINTS IN TRAILING DIRECTION.

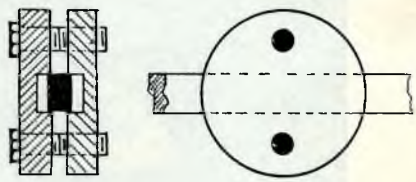

FIG. 15.—SIGNAL WEIGHT.

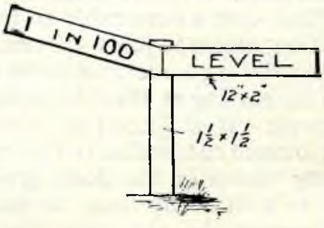

FIG. 17.—GRADIENT POSTS.

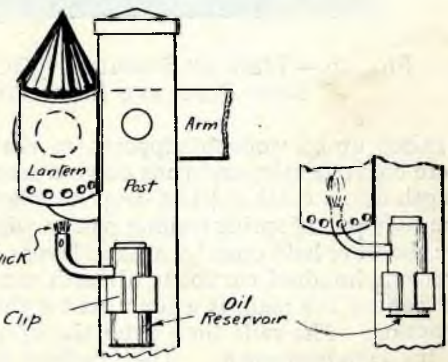

FIG. 19.—SIGNAL LAMP.

photograph Fig. 20 brings us to East Junction, where the inner line, with its dual gauge track, leaves the main to the left. The main line then rises—except for one little dip of 1 in 145—with an average gradient of 1 in 80 to the summit, at which the engine shed road runs alongside, and the loading gauge is fixed.

The Inner circle runs completely round, and from East Junction to the summit between South Junction and the signal box is rising all the way, except for a little piece of 1 in 133 down.

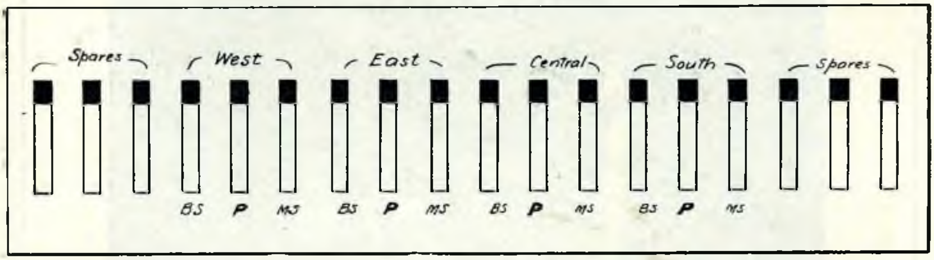

FIG. 22.—DIAGRAM OF SIGNALBOX LEVER FRAME.

The following particulars give full details of the permanent way :—

RAILS.—$1\frac{1}{4}'' \times \frac{3}{8}''$ Bulb iron.

CHAIRS.—Cast-iron with oak keys.

SLEEPERS.—Oak, creasoted : $14'' \times 2'' \times 1''$ for $7\frac{1}{4}''$ gauge ; $18'' \times 2'' \times 1''$ for dual gauge. Laid 11″ centres.

FISHPLATES, $4'' \times '' \frac{5}{8} \times \frac{1}{8}''$ steel strip, with four $\frac{1}{4}''$ bolts.

BOTTOM BALLAST.—Crushed ashplate. About 40 tons was used, this material being to hand in another part of grounds.

TOP BALLAST.—Limestone chips—about 8 tons used.

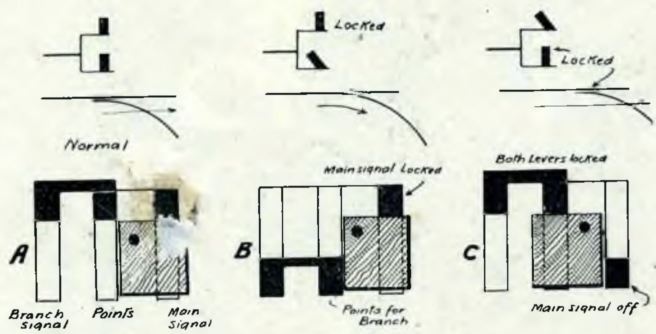

FIG. 23.—SKETCH SHOWING MR. MITCHELL'S INGENIOUS SIGNAL INTERLOCKING DEVICE.

The leading engineering feature of the line is, however, the 25-yard tunnel. This structure is built of brick throughout on proper drums (wooden centreing), with 14″ side walls and arch bricks for roof. The height above the rail level is 4′, and width inside 3′. Concrete slabs are employed for the copings on the wing walls outside the tunnel. The whole of the earth—about 200 tons—on top of the tunnel was put there after it was built. The tunnel is drained by 4" land drain pipes passing through the tunnel and cutting underneath the centre of the track.

Five sets of points are employed, four of which are controlled from the box, and the remaining one to the engine shed being worked by a hand lever. The points are connected to the box by $\frac{1}{4}$" rods of hard steel, which

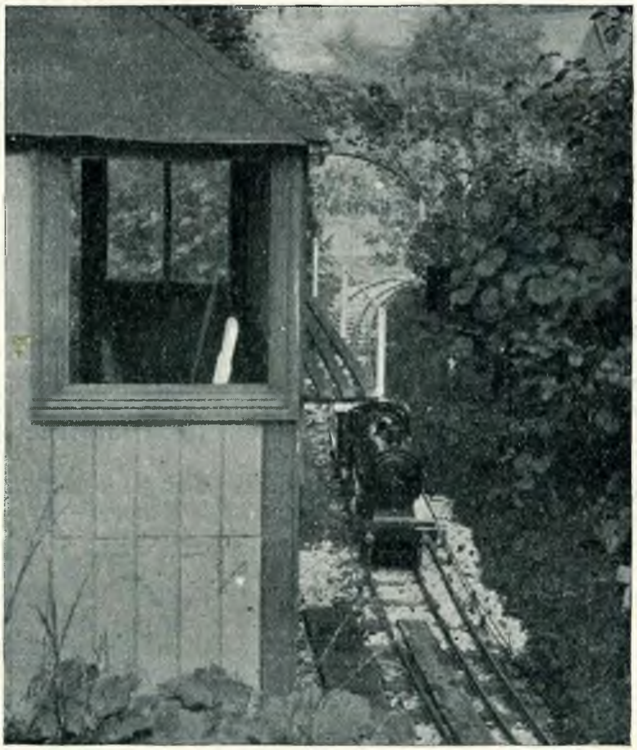

FIG. 24.—VIEW OF SIGNALBOX, LOOKING TOWARDS CENTRAL JUNCTION.

will stand treading on without developing kinks. They are nutted together in eight-feet lengths, and run through upright $1\frac{1}{4}$" pulleys fastened to the ends of the sleepers. The effects of expansion and contraction, which, as some of the points are over 100 feet from the signalbox, is considerable, is absorbed by springs, as shown in Fig. 12. These springs also prevent any damage to the points should a train run through trailing points against the signal—which sometimes occurs when visiting enginemen take charge The signals are connected to the box with $\frac{1}{16}$" (No. 16 S.W.G.) galvanized wire, running round 3" pulleys and through brass screw eyes. The East points and signals are about 120 feet from the box.

The signals are fitted with long springs to compensate for expansion and contraction. These are horizontal, and are covered by a wooden casing, as shown in our diagram. It will be seen that the first portion of the movement of the lever in the box extends the spring, and when so extended to a point of certain tension, the counterweight on the signal is overpowered, and the signal comes " off." To simplify the system of signalling—a perfect necessary thing in model work, however much may be said to the contrary—all signals which govern trains entering points in a *trailing* direction are worked by the points. Therefore, one signal is always up and the other down, according to the state of the points. The facing signals are worked from the box, and the levers are interlocked in the lever frame in a manner which will be described later.

Sixteen signals are used in all—four bracket signals with two arms for junctions and eight single-arm signals. The posts are $1\frac{1}{2}''$ square and are made of red deal, with L.N.W.R. type caps. The arms are of $\frac{1}{16}''$ zinc plate, $8\frac{1}{2}''$ long from the pivot screw and $1\frac{5}{8}''$ wide. The spectacles are formed by placing two sheets of proper shape on either of the arms with the glasses sandwiched in between, and secured by small rivets. Our sketch shows the idea more clearly. The openings are $1\frac{1}{4}''$ diameter. The counterweights at the bottom of the post consist of two iron castings grooved for the lever. These castings are $3\frac{1}{4}''$ diam. $\times$ $\frac{5}{8}''$, and are screwed to the rod by bolts, as shown in the sketch Fig. 15. The pivots for arms, cranks and point cranks, are $\frac{3}{8}''$ coach screws, those on the ground being fixed to oak posts driven firmly in the ground. The signals are painted white with red arms at front and white at back, with the usual white and black bands. All metal-work, including the rails, point rods, etc., are painted with two coats of oxide paint.

The signals are all lighted at night, the lamps being cheap " bull's-eye " lanterns with a separate container for paraffin. This container is clipped on the back of the post, and has a projecting wick tube. The reservoir slides up and down in the clip, and can be lighted in the position shown in our diagram, and then pushed up into the lantern. Mr. Mitchell informed the writer that he tried nightlights, but without success. The gradient boards are $12''$ long by $2''$ wide, of $\frac{3}{8}''$ wood, and are fixed on to $1\frac{1}{2}''$ square posts.

However interesting all these details are, nothing surpasses the signalbox and its internal arrangements. By obeying the ordinary laws of signalling and by codes of hand flag-signals (red and green lamps at night), and engine whistles, there is no need for the driver and signalman to say a word to each other to enable the latter to safely control trains in any desired direction, within the capabilities of the line. At our visit we performed all kinds of evolutions, and at one time had the $\frac{3}{4}''$ scale tank engine and the large $1\frac{1}{2}''$ scale loco working together, and, except when one of the visiting engine drivers ran past a signal, no danger of a disastrous collision occurred. We recorded this event in a photograph and suspended the driver.

The arrangement of the eighteen signal levers in the box is shown in the accompanying diagram. They are in four groups (with two spare sets in addition) controlling West, East, Central, and South Junctions, respectively. The levers are of wood, $1\frac{1}{2}''+\frac{3}{4}''$ section, with a built-up bell-cranked lower end. They are $3'\ 3''$ long, spaced $3\frac{1}{2}''$ between, the length of the frame being $5'\ 7''$. The signal levers are red, and points blue, the spares being painted white. Small brass barrel bolts are employed to hold them in position.

The signalbox is $7'\ 6''$ long $+$ $4'$ wide outside, and is $6'$ high to the eaves. It has a platform in front for flowers and is lit by a paraffin lamp at night. The box has proper sliding windows, and is equipped with red and green flags and a guard's lamp for night work. Each group of signals is interlocked in itself. The method employed is simple in the extreme, but although it only took a few minutes to make and fix, it cost Mr. Mitchell much thought before he arrived at so satisfactory a solution of the difficulty. It consists of a square piece of $\frac{3}{4}''$ hard wood, pivoted as shown to the lever frame, and with the commonly fitted bracket piece on the back of the branch signal lever, this describes the whole apparatus. It will be seen from the diagram in Fig. 23 that at A the point lever or the main signal lever is free. If the points are pulled as at B, the branch signal, which is governed by the bracket on the back of the lever embracing the back of the point lever, so butts against the piece of pivoted wood that the main line signal lever cannot be pulled. In diagram C the main line signal has been pulled. This turns the pivoted wood into such a position that the points cannot be pulled over for the branch while the main signal is "off," the bracket piece on the back of the branch signal lever also locking this lever. Could anything be simpler or more effective? Of all the interesting things Mr. Mitchell's handiwork provides, this piece of apparatus has pleased the writer most, and he congratulates the "engineer-manager" of the "Brook House" Model Railway on his ingenuity.

A few other useful particulars of the B.H.M.R. may be gleaned from the following tabulated statement, kindly supplied by Mr. Mitchell :—

LOCOMOTIVES.—$3\frac{1}{2}''$ gauge tank engine, designed and made by Mr. Mitchell. $3\frac{1}{2}''$ gauge G.N.R. 251, from designs by the writer. Built from Stuart Turner's castings; fired by coal, and pulls 25 stones easily. $7\frac{1}{4}''$ gauge "Precursor," designed by the writer, and described in *Model Railways* of April last; purchased from Bassett-Lowke Ltd., Northampton.

COACHING STOCK.—$7\frac{1}{4}''$ gauge double bogie wagon, purchased from Mr. Gerhartz; spring suspension altered to suit the specially sharp curves. $7\frac{1}{4}''$ gauge ballast truck, made by Mr. Mitchell. $3\frac{1}{2}''$ gauge driving truck for tank engine, with water and coal space (Mr. Mitchell's design and make).

FUEL for all engines, 3-parts coke and 1-part anthracite coal.

SUPERELEVATION.—On 40′ radius curves, $\frac{3}{4}''$. On 25′ radius curves, 1″.

LENGTHS OF LINE.—Main line, 439 feet; inner line, 330 feet; connecting line, 62 feet; engine shed line, 110 feet.

SPEEDS.—$3\frac{1}{2}''$ gauge tank engine, up to 7 miles per hour. $7\frac{1}{4}''$ gauge "Precursor," up to 12 miles per hour.

In both $1\frac{1}{2}''$ and $\frac{3}{4}''$ scale models, steam-raising is done in the engine house by means of a 3″ chimney, 20′ high, running through the roof of the engine shed. This pipe has a removable bottom piece, which drops over the engine chimney. The pipe is warmed first by a Bunsen gas burner placed in the smokebox through the opened door, and when thoroughly warmed, the door is shut, and fire started with wood. It will then draw quite well until sufficient steam is raised to work the blower. At his visit, the writer found that steam could be raised in the $1\frac{1}{2}''$ scale engine by simply projecting the Bunsen in the fire door, after, of course, the preliminary warming of the chimney flue.

The mile posts are illustrated in Fig. 18. They have $1\frac{1}{2}''$ square posts with a 4″ square board fixed on the top as shown. They are fixed at *scale* distances of $\frac{1}{8}''$ of a mile, *i.e.*, $\frac{1}{8}$ of $\frac{1}{8}$ of a mile apart, viz., 82 feet apart.

This the writer thinks fully describes the construction of the B.H.M.R., which has occupied the whole of Mr. Mitchell's available time for the past six or seven months, and had only been completed a few weeks before Mr. Jubb and the writer were invited to inspect it. Needless to say, we enjoyed ourselves immensely, and the writer feels sure that our readers will join him in thanking Mr. Mitchell for the trouble he has taken in providing most of the photographs and dimensions for this article.

(*To be continued.*)