Technical Meeting of the Institution

held at

The Institution of Electrical Engineers

Thursday, December 17th, 1953

The President (Mr. T. AUSTIN) in the chair

After the minutes of the Technical Meeting held on November 18th, 1953, had been read and confirmed, the **President** welcomed Messrs. W. A. Gunn, J. B. Simpson, A. E. Brookes and W. J. Foster, who were present for the first time since their election to membership.

The **President** then called upon Mr. F. Horler to read his paper on the " Layout of Signal Cabins."

Layout of Signal Cabins

By FRANK HORLER (Past President)

Diagrams—Inset Sheet No. 15

"What's in a Name?"

One of the unfortunate terms in the railway signalling vocabulary is " Signal Box," yet with its smacking of ultra-utilitarianism it seems to have described very well the thing itself at the time when the name was given. Even when, instead, charitably minded people say " Signal Cabin " there is still the taint of frugality and meanness remaining. The Americans chose a very different name, but though " tower " might be fitting to some of their erections it does not apply suitably over here. The French " poste " is much more apposite.

The poverty-stricken appellation " signal box " is not likely to provoke any great professional interest in the architect, much less fire his inspiration if he were to be asked to plan and design one. A Box ! The word stands for a shape of four sides, a bottom and a top.

Yet a box need not be an ugly thing. There is much evidence to the contrary for the same word equally describes a container made of cardboard or plain deal and one of scented sandalwood, or carved ivory or wrought silver.

The name box is with us then, established by usage and destined to remain. Our wise plan will be to envelope the term with a finer aura, suggestive of something well designed, that is, not to degrade the building to the level of its name but to raise the meaning of the name to a building of character.

To be quite fair in this matter it must be stated that a conscientious break-away from tradition has taken place in recent years arising from three probable causes. The modern acceptance of a certain standard in the amenities to be made available to the employee—in this case the signalman ; then the requirement to provide accommodation for more, and at the same time, more delicate equipment, and thirdly a more determined venture with aesthetics. Be these things as they may, there can be no doubt that a modern box is a better one than the old notwithstanding the disappearance of the fine facias and finials.

Now consider, superficially, the economic factor in design. Beyond all question the old boxes have served their purpose well and if better buildings are desirable for any reason, that reason must be the justification for an increase in cost if that is what improvement involves. All such reasons are likely to be matters of substance affording their own justification, with the one exception of the aesthetic. Beauty in its application here earns no dividends. In consequence we must be content to find a sufficient degree of loveliness in simple fitness and suitability for its purpose, but to achieve this a diligent study of the subject will be required.

Where does this preamble lead us ? Surely to a point of considering what are the essentials of signal box design. Not exactly to draft a specification, but to make an inventory of the features and ideas from which a specification could be drawn. If this can be done with a touch of idealism mellowing the plain necessities, perhaps the architect might get a desire to see what his experience and skill can make of it.

It is to be emphasised here that whereas the service requirements more or less determine the size and shape and arrangement of the rooms, the whole outward appearance is strictly a matter

for the trained architect and therefore the planning should be in his hands.

The matters of detail to be considered in connections with signal box design are quite imposing and well worth setting down briefly before we deal with them individually.

1—Choosing the site
2—Accommodation of the control machine
3—Accommodation for relays, batteries, standby plant
4—Amenities
    (*a*) Sanitation and toilet
    (*b*) Cooking and feeding
5—Heating and ventilation
6—Lighting
7—Window vision
8—Cable ducts, or mechanical leadout
9—Stairway
10—Fire prevention
11—Fitters' accommodation
12—Interior decoration
13—Furniture
14—Architectural features

1—Choosing the site

One of the practical obstacles to good design is often the insufficiency of the building site itself. With all their acreages the railways seldom leave space in their layouts for a signal box of adequate dimensions in its rightful place. In consequence we often find erections with strangulated lower storeys in unaccommodating spaces between lines or mounted aloft on girders because there is no ground space at all.

Blind signal boxes are feasible if an adequate illuminated track diagram is provided, nevertheless it is much more desirable to maintain where possible an open vision, and this is one of the first considerations in deciding on a suitable site. If a mechanical box is contemplated the distance from points to be operated becomes a definite factor. If level crossings are involved the choice of position is much narrowed down. If a power box is to be built the economical layout and balance of cable is important. If the box is to have any part in single line token working the means of exchanging must be taken into account.

When these things have been borne in mind and the ideal location settled with good reasons, it will be a pity if the space is just a tight squeeze.

2—The Control Room

When the sighting has been done and a position fixed, it is of course the control room of the signal box which has been pinpointed. Whatever other rooms are requisite must take second place. Almost invariably this control room will be an upper storey.

We must assume the control machine to have been decided upon and its shape, size, weight and structure settled, so that the design of the room can be begun. It may be asking for what in many cases it is impossible to afford, but it is in every way desirable to keep a liberal space around the control machine. Of what space there is available the major consideration must be given to provide freedom of movement for the signalman himself. When the importance of the work requires additional staff the space must be arranged to accommodate them.

The advantages of the improved outlook obtained by the tendency nowadays to arrange the levers or panel so that the signalman operating them has his back to the line, were discovered incidentally when an occasion arose to put in a new replacement frame at the back of a box ready for a changeover whilst the old old frame was still in use. However the improvement is now generally accepted and no one regrets the supersession of the old method in which the block shelf and instruments and cabin diagram formed an effective screen to the signalman's outlook, so that in some busy boxes with very long frames a few central levers were omitted to make a gangway to the front windows.

The position of the control machine may then be settled without difficulty, but the architect must know not only the shape and size of the control machine but its weight and the manner in which it is to be supported, that is whether directly on the floor of the control room or whether and how it may extend through the floor to some form of support below. Some lever frames though supported on a lower floor need longitudinal beams in the control room floor to steady them back and front. Into these beams probably floor joists can be trimmed. If the floor is to be concrete a slot must be left to serve the same purpose and in this case it is

well to consider whether the slot should be longer than the machine to cover future extension contingencies, the gaps being temporarily filled in.

Passages for wires across, along or through the floor may be needed. The dimensions and direction of these should be determined so as to be embodied in the constructional details. If an illuminated diagram is to be suspended from the ceiling, preparations should be made to take it.

A rather attractive scheme for an illuminated diagram is to set it in flush with the back wall, arranging access to a recess behind it for wiring and maintenance purposes unless there is a room behind from which the maintenance can be carried out. This is not mentioned so much as a particular recommendation as a suggestion to exemplify the developments that may be possible when all the requirements are carefully scheduled and planned in advance.

3—Relay and Battery Rooms, etc.

Accommodation for relays is required in almost all cases whether the installation of signalling is to be manually or power operated, but, of course, to a different extent. The practice of planning the relay room to be immediately below the control room or adjoining it on the same floor is convenient and it assists in keeping control wires between the two rooms to a minimum length which is desirable for both service and cost.

There is much scope for ingenuity in this room, but it must first be known what type of rack or shelf is to be used. There is much difference between arranging a rack which is to be accessible back and front and one which needs be approached on one side only. This much is certain, it will be better to lay out the relay room to suit a known design of relay rack than to have to plot to accommodate racks when the room is completed unsuitably. Crowding is to be deprecated for it is detrimental to tidiness and consequently to maintenance.

The directions of cable runs must be settled and all necessary ducts and wall-openings be set in their proper places to give passage to the control room—not forgetting the illuminated diagram—the battery room, the standby plant room and of course the outside cableways.

The position of terminal and fuse racks must be related in some way to the main cable inlets and to the method of potheading if any.

Relay racks are not easily arranged for daytime lighting unless a lantern roof is practicable. It may be most convenient therefore to make no attempt to introduce windows in any of the walls, and to rely entirely on artificial light.

If the scheme includes train describer cabinets an appropriate space must be allocated to them either in the main relay room or in a room separately.

The method to be employed for fire protection here should be decided before the relay room design is completed, so that it can be taken into proper consideration in the general layout.

There are two preferences—not essentials—in locating the battery room, viz., an outside door and close proximity to the main switch board to keep power leads as short as possible. Ventilation is important as it is necessary to clear away the gases from the batteries. Lighting by daylight is not very material, and a compromise might be made by using a glazed door.

The best layout for the battery is one by which the cells are accessible on both sides rather than set on shelves against the walls, but this implies having a larger space available.

If any prime mover for standby generation purposes or for air compression is to be housed within the same building, steps should be taken to keep down vibration and noise in the other rooms to the lowest possible limit. The requirements vary so much according to size that nothing can usefully be added here about foundations, ducts, lifting beams, etc., but there should always be direct entrance by an outer door sufficiently wide to allow all apparatus to pass through and sufficiently high to include apparatus, runway and hoisting tackle.

4—Amenities

All signal boxes require certain accommodation apart from the control room itself to provide simple amenities for the signalman. The style in which this is done may be of two sorts, one to cater for boxes where only one signalman at a time is on duty, and the other to cover more than one man.

When more than one man is on duty a retiring room should be provided with sanitary, lavatory, cooking and feeding facilities.

Where only one signalman is on duty and he must remain within hearing of the block bells, a recess appropriately fitted is more desirable.

All fittings and plumbing should be chosen to conduce to cleanliness, and for the walls a tiled dado is desirable.

5—Heating and Ventilation

About the general type of heating to be adopted no general rule can be laid down because the availability of means will vary with the district, but at least it might be said that as far as is possible the system should be automatic and thermostatically controlled. This rule strictly applied would ban the coal fire, but would admit electrical, oil or gas methods of heating. Where coal fires have been used experience seems to indicate that they are generally so fiercely stoked that the boxes are greatly overheated.

The position of radiators and heating pipes, in addition to being kept sufficiently clear of the floor to permit easy cleaning must also be fixed in relation to wire ducts so as to avoid undue and non-uniform heating of the conductor insulations.

Relay rooms, especially where there is a large quantity of apparatus, because of the energy consumed in operation, will not require in temperate climates much extra heating to keep the apparatus in good condition and the air moisture-free.

To treat a relay room properly it should be completely air-conditioned and care taken in this respect will be amply repaid by the behaviour of the apparatus. The exclusion of dust and moisture gets rid of the chief enemies of dependable operation.

The ventilation of the battery room should be such as to extract the gases given off by the accumulators and allow clean air to replace them.

6—Lighting

About the lighting of the control room there can be varied ideas and different opinions, and also requirements will alter with the type of control equipment being used. For instance where there are to be many lamp-lit indications under regular observation the lighting arrangements must avoid flooding and so destroying the effect of them. To state the obvious, there must

be no unscreened light visible to the signalman as he faces his frame or panel or desk.

A concentration of light is required where booking and registration take place, but otherwise a subdued but not gloomy effect is generally preferable, as, for instance, is obtained by indirect lighting. The interior colour of walls and ceilings have their reactions on the lighting and the two matters should have consideration in relation each to each.

In the relay room a clear shadowless light should be provided to reach all apparatus and fluorescent lighting seems to offer some advantages on this count.

Stairway lighting needs particular and careful attention.

7—Window Vision

If the site chosen for the signal box is such as to command a view of the field of control, the windows in the control room must conform to the fullest possible extent with this purpose. Consequently there will usually be a wide expanse of glass and low window sills. The experiment of sloping the windows upwards and outwards has been tried for the purpose of minimising reflections, but it is doubtful if there is any advantage in this sufficient to outweigh the awkwardness of the construction.

Linked with window vision is what we might call window communications, which are necessary at times between the signalman and shunters or engine drivers. This is said in particular reference to service conditions today. The development of telephone and loudspeakers for communication between signal box and shunting ground will give this facility less importance in the future, but the window communication enabling the display of a signal flag or lamp or the giving of a megaphone call is very well worth while for emergency reasons.

There is another and entirely separate consideration to influence the use of opening windows. To make it possible to clean both sides of the windows from within the box, rather than to provide stages and handrails outside is something well worth while. Certain developments for private houses in this respect have been forthcoming but in these cases the windows usually open outwards, and this may not serve always with signal boxes. The sliding window has proved very useful over the years and a little attention to design might produce a combination of a

sliding window for normal use with a hinge or pivot for cleaning purposes.

Of course climate is another factor in the design of windows and in hot countries the gracious and welcome shade of walls may have to reduce the area of glass.

When considering the artificial lighting of the control room it was observed that too much light was detrimental to reading of indications of the light type. This equally applies to daylight. We ask for big windows for outward viewing, but we want incoming rays screened from our illuminated diagram, signal and point indicators, etc., and this may involve the construction of awnings. Such awnings have a double value in tropical parts, and can in effect be very pleasing outwardly.

8—**Cable Ducts** or Mechanical Leadouts

Mechanical leadouts present no difficulty but the requirements need to be stated, especially if they are necessary at the back or ends of the signal box. In construction they should be as free from intermediate supports as the design of the box permits in order to have perfect freedom when fitting cranks and rods.

For the power box the preparation for cables is not confined to the relay room by any means. It begins with the entry of mains and control cables from the outside, then their distribution within, the leads from relay room to control room, supply routes from battery room and standby plant. All the runs whether at floor or ceiling level, vertical or horizontal must be planned in advance to make the after-work satisfactory. Some of the work may be of such scale that a mezzanine floor may prove the most satisfactory accommodation for distributing the cable, and certainly this method has the merit of disencumbering the relay room.

Cable runways whether in the form of ducts or open supports must be adequate in size and arranged to take account of the material character of the cable itself. For instance all junctions and changes of direction must be rounded to a radius sufficient to avoid damage in bending the cable. Where cables have to be pulled through ducts, pipes or walls, sufficient space must be left for the men who have to handle the cable to operate.

9—Stairways

Outdoor steps are not without an element of risk under certain weather conditions, and so far as we have known them they are rather unsightly, but they save indoor space and are therefore probably cheaper to provide. An indoor stairway can be so contrived that the spaces under the stairs are utilised for stores or heating chamber, and a winding staircase may save space, but it must not be spiral for this kind of stair has never been welcomed. Any stairway which leads down directly to the running track should be provided with a guard rail or barrier.

10—Fire Prevention

The choice of correct materials for all purposes and in all parts of the signal box will constitute 99% of the safeguards against fire, but there will remain the remote chance of fire arising in some unexpected way. So it becomes wise to have available appropriate appliances for fire extinguishing and by either manual or automatic operation. These are proprietary articles and it is not proposed to discuss their merits or demerits. Where the running of pipe line feeders is part of the scheme this pipe line should be planned with the cable runs and heating pipes, so that they all have their allotted places.

11—Maintenance Fitters' Accommodation

If the installation is sufficiently large or important, some accommodation for the lineman on duty is requisite. This involves a bench where occasional repairs and cleaning of apparatus can be done ; shelves or cupboards where small emergency stores can be kept tidy and amenities comparable with those for the signalmen already described. These quarters should have their own outside entrance, with an inner door leading to the relay room.

12—Interior Decoration

To what extent is it necessary to take any pains to get a particular effect in the treatment of the interior of the control room ? How much of the discussion on the psychology of decoration and colour is science and how much fancy ? There is no need to develop the argument here because there is a very practical

approach to the subject which should save us from becoming involved and confused.

If we speak of decoration there is an implication of something more than we intend. One would not consider the inside treatment of the signal box on a level with a dwelling house where pattern and ornamentation may be necessary to display the furnishing, but the basic requirements are similar, the uppermost being the contribution to cleanliness wherein the colour and substance of wall, ceiling and floor finishes are concerned. Thus wall tiles for example have much to recommend them, for though expensive, they are easily cleaned and are durable. One could not advocate cold white tiling in a control room but then very reasonable alternatives in colour are available.

When walls are painted, the quality of the paint used should ensure that it is washable and lasting. The choice of colour is an individual matter, about which no laws can be laid down, but it is nevertheless most desirable to use those which are serviceable and pleasing.

If plywood, plastic or hardboard panelling for wall lining is used, dark staining is best avoided because of the absorption of light especially if the surface is unvarnished.

For floor surfacing it should be reckoned an essential to use a non-dusting material—that is a material which in wear does not create its own dust as concrete does. This is particularly so where electrical equipment is to be used. Under this heading may be included polished hardwood strips or blocks, rubber or plastic tiles and certain proprietary compositions. It is to be understood that floor cleaning may involve washing, sweeping, vacuum suction and polishing, or a selection of these. Some preference must be made and the material chosen accordingly. The reason for this is that heating pipes, radiators and suchlike fixtures must be kept sufficiently high above the floor to give accessibility for cleaning right up to the skirting board everywhere whatever the system of cleaning in use. A fillet to break the corner angle at the junction of the floor and skirting board is also useful for easy cleaning and avoiding the collection of dirt in corners.

The remarks made about the decoration of the control room apply in a large measure to the relay room, but there, large wall surfaces may not exist and the floor will be much divided by relay racks and other fixtures. The room is likely to be resolved

into a number of alleyways where some sort of strip treatment can be used on the floors.

13—Furniture

With fire risks in mind the utilisation of steel furniture—cupboards, lockers, desks, tables and stools—would offer a practical choice. This sort of construction, supplemented by laminated plastics where necessary, has reached a satisfactory stage of development and if cellulose and stove enamel finishes are used, provides a durable form of furniture which can be coloured to suit our general scheme.

14—Ensemble

So far we have looked upon the various rooms of the signal box in a detached way without stressing in any particular way the essential relation of each to each.

The location of the control room is of most importance, its position being determined by the view of the line it commands and the other rooms are related to it in their positions according to the attendant advantage.

Thus the relay room, which is likely to cover the largest area of the building must be considered next and should be as close to the control room as conditions allow either beside it or below it.

Subordinate to the effect on cable ducts and outside window lighting, the various other rooms can be added according to the ingenuity of the architect and his success will appear when the general elevation of the building is drawn out. So we come to a consideration of

15—Exterior Architectural Features

We have discussed those aspects of signal box construction which should, for the most part, be influenced by the signal engineer's specification, but when we come to comment on the style of the building we must take care not to encroach on the professional architect's province. Therefore there must be no laying down here of strictures, nor even the formulation of preferences, but perhaps there would be no harm done in going over some of the practical possibilities in the light of buildings already in use.

Narrow based boxes, and boxes on gantries we look upon as enormities which need special and discreet handling and as such cannot fall under our generalisation.

Sometimes it is necessary to incorporate the signal box in the general station buildings so that it loses its individuality. These also must be excluded from our observations.

The earliest considerations must be concerned with the space available, the nature of the ground whether on the level or on cutting or embankment, the subsoil and the environment. Choice of material will follow and after that there can be ample play for imagination and good taste. Even so it seems that the horizontal line will be the predominant one and affords the key to the style of the modern box with comparatively few exceptions. This style can be emphasised by banding, by shape and grouping of windows, sills and copings or modified by buttresses and panels; but whatever the treatment the architect adopts, the requirements are almost certainly for a long, low block with the control room perched above at some appropriate part of the length, except where space limits necessitates the use of three floors.

A signal box can wear many differing sort of dressings as other buildings do; bricks of all facings and colours, stone, concrete perhaps steel or aluminium panelling, but it is well to debar timber because of fire risk. As the building is to have a distinct purpose to fulfil no doubt the architect will evolve a style that is directly in keeping with the purpose. This is most likely to lead to the result of producing simple, pleasing and satisfying lines.

It is not unlikely, since the control room may be situated above a much larger relay room, and one end at least may need a special support, that the architect may have to include in the structure steel uprights and girders or reinforced concrete equivalents. If it is so it needs to be ensured that these do not interfere with any cable runs.

The tiled or slated roof is by no means an unsightly construction, but the flat concrete roof has not only utilitarian values but it can readily be adapted to the formation of balconies and awnings both of which might be of influence on the general architectural effect.

As for the outer appearance of the control room the decisions reached about window vision will have a dominant effect, but there will always be more ways than one of interpreting the decisions.

Because natural daylight may be largely if not wholly excluded from the relay room, whereas windows will be necessary in some of the smaller rooms, there may be some difficulty in getting the windows placed in true symmetry.

The name of the box whether displayed at the ends or in the front or both, should be part of the whole design quite as much as the doors and windows, and use should be made of letters eminently readable.

A few illustrations of signal boxes are given after very careful selection by way of examples of widely different treatment. The drawings themselves are intended primarily to emphasise the main feature lines of the buildings and it may be that in following this purpose certain contrasts of masses, especially as regards shadows and window effects, may be missing and so some of the architect's intentions may be lost. However, let us make a superficial observation on their characteristics.

1—*B.R. Cardiff West*

The use of three floors saves a great deal of space in the ground plan but does not avoid the stress of the horizontal line in the elevation, which is in fact emphasised by the banding above the three lengths of windows, but there is some relief due to the projection of the centre section of the top storey. The windows are interesting and purposeful.

2—*B.R. Thirsk*

This well proportioned and symmetrical design was one of the first satisfactory breakaways from tradition. The control room with its cutaway corners is excellent for outlook and yet is somewhat shaded by the extended roof. The illustration unfortunately misses one of the chief charms of the signal box which is its brickwork.

3—*B.R. Wimbledon*

There is something reminiscent of a battleship in the lines of this signal box with its curvilinear deck and superstructure, as viewed from the bows.

Note how the name panel breaking as it does the continuity of the broad upper band becomes an essential unit in the design.

4—*N.S.W. Gov. Rlys. Typical*

A tiled or slated roof can be a pleasing feature as this example shows, and its extension to cover the verandahs at each end adds something to its dignity.

The buttresses not only serve to break up the flatness of the lower walls but give an appearance of substance and durability.

5—*S.N.C.F. Les Laumes*

There is something about this three-storied signal box which marks it as not British. The design is clean and direct. If it suggests something built up from a child's box of bricks it is a tribute to its simplicity. The great area of blank concrete wall could not have been broken up more satisfactorily than by the well-spaced vertical and horizontal lines except by the use of features more elaborate and more expensive. The roof awning is an excellent crowning touch.

16—Conclusion

We set out to give the term signal box a better implication than the obvious one. We had to find a happy mean between a soap box and a jewelled casket. It may be objected to many of our arguments herein that no standards have been set as to costs. It is true that cost has not been brought directly into the scope of this discussion, but after all the way to economy is only reached by careful thought and planning based on a true conception of essentials and non-essentials.

So we visualise the well-planned box completed. Nothing in its setting among neighbouring buildings puts it to shame nor does it look odd and inappropriate.

As the signalman comes to take duty when his shift is due he will feel the freshness and purposefulness of the place. This may be subconscious but so far as external influences can do so, he should be aided in the performing of his tasks. He can work in a clean atmosphere—this means he breathes clean air. His body is comfortably warmed or cooled according to season and his mind is not distracted from his responsibilities.

DISCUSSION

Mr. J. H. Fraser said that the paper was really a complete specification of the requirements for a signal box, and that there was very little that had not been included.

In considering the question of fire protection devices, one had to take into account also the matter of exits and with certain gas appliances it might be necessary for an extra exit to be provided for emergency purposes.

It had been mentioned that cement and concrete floors were not good because of dust due to wear; anything that wears produces dust, whether it be rubber dust, concrete dust, or iron dust. Quarry tiles, which did not wear, were therefore, ideal in this respect.

The question of light in signal boxes was an important one, particularly in modern boxes where there were panel illuminated diagrams on which indications were given by lights, some of which were not very brilliant. London Transport Executive had designed a type of signal box in which the windows were in the corner and comparatively small, which enabled a clear view to be obtained of the illuminated diagram. Mr. Fraser said that he had personal knowledge of Thirsk signal box, where the sun came in all round and prevented the panel from being seen so well as would be the case if there were less glass.

He suggested that when designing signal boxes, if it were possible for the terminal panel wiring to be related to the lever frame, the wiring of the new frame could be pre-formed in the locking shop, tested, taken to the signal cabin and installed straightaway, which would save a good deal of time on the actual changeover.

He recalled the case of a box at Colchester which controlled a level crossing in a street of half-timbered, medieval style houses. It was considered that the signal box would be an eyesore if not in keeping with the street, so it had to be half-timbered, provided with an oriel window to enable the signalman to look up the street when working the gates, and have a specially designed roof because of ancient lights.

Mr. J. E. Mott said that one of the important points made by the author was the need for air conditioning in modern signal boxes, in order to keep the intricate equipment clean. If this were done, instead of having to service apparatus every three or

four years, the period could no doubt be lengthened. Proper air conditioning would so provide a good economic return.

In designing signal boxes, it was desirable to have adequate space for bringing in equipment. He remembered the case of a signal box which was to contain a lever frame; it was built up to the level of the frame flooring, without walls or ceiling, and a ramp was built from the edge of this to the platform. The lever frame had to be pushed up the ramp on to the box, after which the walls were finished and the roof added.

Good ventilation in battery rooms had been mentioned by the author, and was very desirable, particularly with the open type of cell. Mr. Mott had seen some installations in North America where sealed type cells were in the same room as signal equipment, relays and the like. He thought that would be considered undesirable, but said he would be interested to hear further comments on it. He also enquired if it were desirable to give any special protection in the case of nickel iron cells.

Regarding fire protection, he mentioned the South African Railways' practice of segregating incoming cables and cable terminals from the relay room. The cables were brought on to the terminal racks and the internal connections were taken from those racks, the cables themselves being sealed in a cable room. The relay room and cable room were separated by a sealed door.

In order to avoid some of the mistakes of the past, he suggested that designers of new cabins might make some provision for alterations and extensions, as in that way they might prevent the cramped conditions which occurred in some cabins at the present time.

Mr. E. G. Brentnall said that in the case of signal boxes constructed solely or partially of timber, it was a good practice to support the lever frame entirely separately from the structure, as this would be beneficial in the case of fire. If supported separately it was surprising what the frame would stand, and once the fire was out, it would be possible to use the frame and get it repaired before the structure was built up.

In mechanical boxes, it was a great advantage to have the frame so that the signalman had his back to the line and could see the line through the window, to ensure that nothing was overlooked. The windows could be taken down to the floor level, but he thought that a minimum height of 2-ft. above the floor was desirable. Even then, it would be necessary to have a bar

across them, so that if the signalman went to the window in a hurry there would be no possibility of him tripping and falling through. The cleaning of windows was a vital matter and efforts should be made to facilitate it. The question of pivoted windows was an important one, and he had known of cases where, with windows hinged vertically, a driver had seen the reflection from lights in the cabin and had mistaken it for a signal. The London Midland Region had recently built some signal boxes where the pivoted windows were kept locked except when cleaning was being carried out. He emphasised that the signalman should have a good view and it was undesirable to put any obstruction in the way of it.

On the question of the type of signal box, he agreed that a fine structure was desirable, but unfortunately, economy came into it. In speaking of an expensive box, he meant a brick or stone one with full amenities. It was possible to design a less expensive one, either in concrete with a brick face, or even a timber box, with architectural merit. Unfortunately, they did have to face the need for them sometimes. In the case of a timber box, it was possible to build it in sections, which could be used again. Furthermore, in the case of fire, they could be replaced quickly.

Mr. C. F. Challis stated that the concrete floor was standard on the Southern Region. He agreed that there could be a lot of dust from concrete, but there was a dustproof treatment which was employed and the floors nearly all had coverings ; so they did not experience trouble from this cause in the modern signal boxes.

There was a fair degree of standardisation with modern brick signal boxes and good co-operation between the signal engineer and the civil engineer. He thought that there should be only one form of heating, namely, central heating.

Referring to window reflections, he suggested that use might be made of an acid etched glass similar to that used on some illuminated diagrams, which cut out a good deal of reflection.

Mr. P. A. Langley considered that the outward appearance of a signal box might be the architect's concern, but a close check should be kept on the design by the signal engineer to ensure that adequate protection was given to signalling equipment. He, also, had known cases of a reflection in the signal box being mistaken

by a driver for a signal, and in one case the window had to be sloped to overcome the difficulty.

He considered that the height of the working floor above rail level should be at least 10-ft. to enable the signalman to see the tail lamp of a train on a remote line whilst there was a train standing on the nearest line.

In addition to the fourteen items mentioned in the paper, he suggested the provision of accommodation for public address equipment and possibly a separate annexe for the announcer; coal and ash pans for signal boxes in outlying districts where the cost of central heating was not justified; and a lamp room where semaphore oil-lit signals were employed.

In mechanical installations, it was usual to provide some regulators in the control room for signal wire, but he questioned if this were the best arrangement, as there was the liability of the apertures being covered by furniture and the signalman tended to ignore them.

In his opinion, the best way to treat the illuminated diagram was to have it on the instrument shelf, and if power were available, the question of luminous block indicators might be considered or the provision of some indicators on a panel rather than a number of different types of indicator of varying sizes.

It was preferable to provide timber floors where mechanical frames were concerned, as they were much more suitable for additions and future developments.

Mr. A. Moss said he was entirely in favour of consideration being given to air conditioning of relay rooms, which would greatly assist in maintaining correct operation of the intricate equipment. Regarding relay room floors, the quarry tiles mentioned by Mr. Fraser were excellent, but hard to get. Plastic tiles wore fairly well, but he did not think that concrete was at all suitable, as whatever protection was applied to it, with the constant passage over it, it wore off, and sweeping raised clouds of dust.

The author's statement that "blind" signal boxes were feasible, if an adequate illuminated diagram was provided, was true to a point, but he did not think that the operating department would agree to it, as it was desirable that the signalman should be able to see all the traffic that was running.

Mr. B. F. Wagenrieder was very pleased to hear that quite a number of signal engineers inclined to the view that the signal-

man should be able to see the traffic. This was very desirable as the signalman could see the trains, identify them by special headlights or the like, and know for a certainty what trains had passed. If he had to set them on a describer, he could do so.

Regarding the position of signal boxes, he remembered, many years ago, a signal engineer putting up four mechanical signal boxes on one side of the line and two on the other. At the time, it was criticised very severely, as it was thought that signal boxes should be on alternate sides of the line. He noticed that nothing had been mentioned in the paper about the standardisation of signal boxes, a subject which was very much to the forefront before he retired from railway service. It had been found that architect designed signal boxes were very expensive.

Mr. F. W. Young (*in a written communication*) said that although the term " signal box " is widely employed, it is probable that the majority of railway staff use the name " signal cabin." In regard to the question of nomenclature, he wondered if the author was inviting comment by using the expression " control room " to describe the signalman's working area. Mr. Young suggested that " operating room " or " operating floor " would be preferable, as "control room" is widely used in railway working in another sense. As to the choice of site for a signal box. in other than complete power signalling schemes, the necessity for the signalman to have a clear view of tail lamps is important, and undoubtedly this consideration has been the reason why some boxes are not in structurally ideal positions. The height of the operating floor above rail level is also determined between certain limits, by the position of the signal box. The paper included the main features for consideration in the design of relay and battery rooms, but Mr. Young thought that in the majority of signal boxes, the amount of electrical apparatus did not warrant separate buildings. In these circumstances provision had to be made for battery accommodation on the ground floor of the signal box, taking care that there was no interference with the mechanical equipment, that there was satisfactory lighting and ready access. Where the number of relays is small, they can be accommodated in specially designed cupboards either on the ground floor or the operating floor. He suggested that the operating floor is preferable, providing that the cupboards do not impede the signalmen in their movements nor restrict their view. This problem is best considered at the design stage and not when

the signal box is built. In regard to heating, there seemed little doubt that in the smaller signal boxes coal burning stoves would continue to be used, but the use of modern types with reasonable regulation would probably overcome many difficulties experienced in the past.

Mr. Young favoured the provision of sliding windows between two fixed windows of equal size, allowing the windows to be cleaned from the inside of the signal box. He thought that pivoted windows should be avoided owing to the danger of reflected lights.

After considering the question of awnings on signal boxes in the United Kingdom, he thought that it is doubtful if they are warranted, as they can serve little purpose in eliminating light against a rising or lowering sun.

In regard to stairways, he thought that the outdoor steps had one particular advantage by giving ready and obvious access to train crews and others who had cause to enter a signal box hurriedly. Careful design could reduce to a minimum the risk on this type of stairway under adverse weather conditions. In regard to timber signal boxes and the risk of fire, he did not think that the incidence of fires in the past was sufficient to cause undue concern, and thought that there may still be cases where medium or small signal boxes might with advantage be of timber construction on concrete and brick foundations. Among the advantages he mentioned were, speed of erection, ease of extension, removable for use elsewhere if taken out of use, easy to prop and lift when subsidence occurs in mining areas, and that it is capable of being produced and stocked in standard units.

The **Author**, in reply, said that quite a number of remarks made were supplementary to the paper and did not require answers. Generally he accepted them, but added that there were a few that perhaps needed some further comment.

Mr. J. H. Fraser had mentioned that certain types of fire appliances might make additional exits necessary; that was so and was a matter that had to be taken into account when considering the type of fire appliance to be used. The theory that dust must be produced from floors if any wear took place certainly seemed unanswerable in itself. On a properly polished floor, however, the wear that took place did not cause dust to fly and settle on apparatus, the point was in having a floor that could be kept polished, and that could not be done with a concrete floor.

In reply to *Mr. J. E. Mott,* he agreed that sealed type batteries did not require quite the same treatment as open type batteries. When consideration was being given to accommodation for batteries, whoever had the matter in hand must know what type of battery was to be housed, and decide how it was to be housed.

In reply to *Mr. E. G. Brentnall.* He had seen interlocking frames in signal boxes supported on timber uprights or timber beams, and on the question of protection from fire, he did not think that such separate supports made much improvement. There were other ways of supporting frames, but that was more a matter of signal apparatus design than the design of the cabin itself.

In reply to *Mr. C. F. Challis.* He agreed that the use of etched glass helped to eliminate reflections, and when used on signalling apparatus, such as cabin diagrams and the like, did not, of course, come within the scope of signal box design.

In reply to *Mr. P. A. Langley.* If public address equipment had to be housed in the signal box, accommodation must be found for it ; but it was not commonly agreed that it should.

Referring to " blind " signal boxes he mentioned that York was an outstanding example.

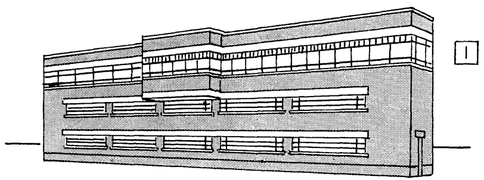
The height of the floor above rail level was not a fixed measurement and could only be determined on site.

In reply to *Mr. F. W. Young.* He agreed that it was not always economical to have a separate relay room but he had known cases of very unsatisfactory relay housing and emphasised the importance of providing good accommodation for apparatus. He also thought that coal fires would remain for many years, but wherever possible these should be replaced by something better.

Although it had not been proved that fire risk had been very high in timber boxes, it was always there, and he thought the time had come when some alternative light construction could be provided, either in the form of metal work, with metal panels, or some other modern form such as plastic.

A very cordial vote of thanks was proposed by the **President** to Mr. Horler for his excellent paper, and this was carried with acclamation.

The **President** then announced that the next Technical Meeting would be held on January 12th, 1954, when Mr. J. P. Loosemore would give his paper on " Level Crossing Protection."



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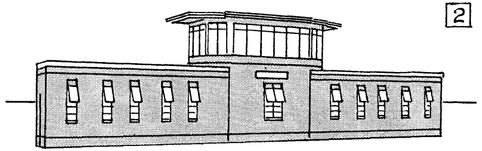

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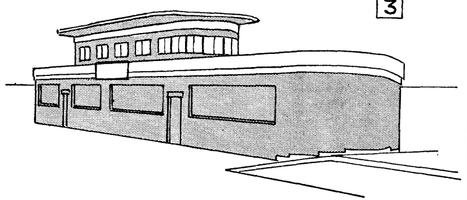

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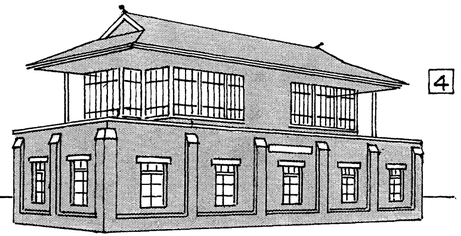

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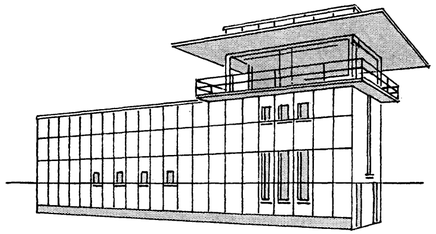

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1 B.R. CARDIFF.
2 B.R. THIRSK.
3 B.R. WIMBLEDON.
4 N.S.W. TYPICAL (POWER).
5 S.N.C.F. LES LAUMES ALESIA.

MODERN SIGNAL BOXES.

F.H. 1953.