view to the public safety. Though it did not appear to accomplish much at the time, the formation of this special department was a step in the right direction. By 1844 Mr. Gladstone was much better prepared to deal with the work which confronted him. His experience and understanding of company matters were second to none, and he had made himself master of the intricate workings of the Board of Trade. So on February 5, 1844, he successfully moved a resolution in the House of Commons that a Select Committee be appointed to consider whether any new provisions ought to be introduced in such railway Bills as would come before Parliament during that or any future session. The committee soon got to work. Every conceivable avenue was explored; the powers to be given to the Board of Trade, the practice of some railway companies in issuing loan notes without statutory authority, and the rating of railways came under review. The findings of the committee were published in six reports, which appeared between February 16 and July 22. These reports show that the whole idea embodied in the creation of the Railway Department of the Board of Trade was the desire to maintain a safeguard for the public rather than to grasp at power. The practical monopoly of railway companies had been acquired in the main by " the superior manner in which they had accommodated the traffics of the country," but there were abuses in many directions. It would seem to have been a common practice for companies to raise more capital than that specified in their Acts. They issued loan notes for the purpose of satisfying their creditors. Another common practice, that of withdrawing the companies from Parliamentary control by asking for capital powers greatly in excess of the proposed outlay, was an attractive inducement to widespread speculation. There also appears to have been no sort of uniformity in the fares and rates charged, which were varied more or less arbitrarily. In appendix iv to the book there is a table of fares, purporting to be extracted from Galt's book on Railway Reform which was published in 1865. Its value is entirely discounted by the fact that the figures are throughout wrongly printed. In the case of the South Eastern for instance the first class express average fare a mile should be 2·1d. and not 2s. 1d., and the third class ordinary 0·7d. and not 7d.

The Bill as introduced by Gladstone in 1844 authorised the Board of Trade after a period of fifteen years from the incorporation of any railway (incorporated in 1844 or afterwards), to buy it up on certain terms; or to revise its charges if it had paid 10 per cent. for three successive years, and, after revision, to keep a tight hold on its management. It did not apply, therefore, to railways sanctioned before 1844, *i.e.*, to upwards of 2,000 miles of the most important lines in the country. On the face of it this would imply that Gladstone was in favour of direct State management, but this is at variance with his own statements at other times in favour of private enterprise properly regulated. These purchase and revisory powers were substantially modified by the time that the Bill came up for third reading, when, in deference probably to the wishes of the then Prime Minister (Sir Robert Peel) 21 years were substituted for 15 in the case of the purchase and revisory clauses, the proposed tight hold by the Board of Trade on a " revised " line was dropped, and neither a revision nor a purchase was to take place without a fresh Act of Parliament. The clauses relating to compulsory " Parliamentary " trains were, however, retained. It is suggested that the Bill as originally drafted had intended to give a certain amount of protection to railways against competition in return for a measure of Government control, but the evidence for this is not very definite.

The Belgian All-Metal Coach

WE describe and illustrate on another page this week the new all-metal rolling stock ordered by the Belgian National Railways to replace the wooden passenger vehicles hitherto standard. This drastic revision of policy has already resulted in orders being placed for over a thousand new units, delivery of which is to be completed by May, 1935. By the terms of a convention with the State the expense incurred is carried to the extent of 38 per cent. by the railway renewal funds, and for the remaining 62 per cent. the railway company is authorised to issue a loan of which the interest and sinking fund will be a charge on the State, which receives in compensation non-redeemable participating shares carrying the fixed interest of 2 per cent. and an eventual varying dividend equal to the dividend of the preference shares of the company. In the new carriages artistic reforms have accompanied those of engineering principle. The formula that " function creates form " and the modernist conception that beauty consists in perfect harmony between the two, are exemplified in the scheme of decoration and the appointments. Extreme simplicity and an entire absence of all useless mouldings and similar excrescences characterise the coaches inside and out, yet choice of material and colour has created the atmosphere and actuality of comfort in surroundings which unqualified description may represent as austere. The suppression of ornament, indeed, serves to reveal more fully the rich qualities of the selected woods from the Belgian Congo which have been used for the interior panellings, and the tastefulness of the colour scheme and fittings.

Every effort has been made to take the fullest advantage of the opportunities for comfort and convenience offered by the generous dimensions of the railway carriage as compared with the more restricted road vehicle. Two primary considerations are a comfortable seat and a pleasant outlook. Seating has therefore been the result of extensive study, and the curvature of the backs was only settled after considerable experiment. The field of view is extensive thanks to large windows, which are easily manipulated. Smooth riding is secured by the carefully designed springing of the bogies, and jarring of the coaches when the train comes to a rest is minimised by the type of brake compensator used, which ensures the perfect adjustment and consequent uniformity of the braking throughout. Sound and heat insulation have been studied to good effect, as well as lighting and ventilation, in these new vehicles.

All these facilities, however, are subordinate to the factor of safety, a consideration to which much thought was given in the design of the carriages. The girder type of construction itself imparts great strength to the body. The bottom of the frame has been additionally strengthened to withstand considerable horizontal stress. The principle of assembly is such that the effects of violent impact are evenly distributed throughout the framework and so absorbed without distortion. As being the most vulnerable parts and the first recipients of the shock of collision, the carriage ends are fortified by an anti-telescoping device. This is designed to give way under severe stress, but its collapse progressively weakens and distributes the shock so that by the time it reaches the compartments its destructive force has been reduced to limits well within the resistant capabilities of the main steel framework. Strong safety glass of a type which disintegrates without splintering is fitted in the windows, and the doors are provided with safety locks. Personal experience confirms the great improvement achieved in the construction of this rolling stock, which runs very sweetly and is kept scrupulously clean. For express trains the new carriages are painted in

two shades of green, dark below and light above the waistline, the stock for local trains is all dark green. When all the thousand odd coaches ordered are in use at the end of this year, it will be possible to form all *trains-blocs* and the principal fast trains of safety stock. Fresh orders will have to be placed before the renewal scheme can be carried through in its entirety, and already the Belgian National Railways are having some trial vehicles of all-steel suburban stock built as a preliminary to the next big order.

* * * *

The Signal Inspector

THOSE of our older readers who were in active service in the 'seventies and 'eighties—we fear that they are now few in number—will remember that, in the Traffic Department, there was a very useful officer known as the Signal Inspector. He was much in evidence at Board of Trade inspections and inquiries and at the company's own departmental investigations into accidents. The Signal Inspector was generally the technical adviser of the Traffic Department as to the layout of stations, new and altered signalling, the interpretation of the Rule Book and the issue of the weekly notices relating to permanent way works and changes in signalling. Of such men there were, for instance, Amos Piggott on the Great Northern, Henry Loveday on the Midland, Robert Currer on the Caledonian, and Harry Taylor on the Lancashire & Yorkshire. We put Amos Piggott first, as few men of that day exercised so much influence in securing greater safety through signalling. He was fortunate in working under and being helped in this by so able a Superintendent of the Line as Francis P. Cockshott. Their joint work was perhaps best appreciated by the corresponding officers from other railways, who could hardly fail to be impressed, when visiting or riding over the Great Northern, by the thoroughness of their block and fixed signalling arrangements.

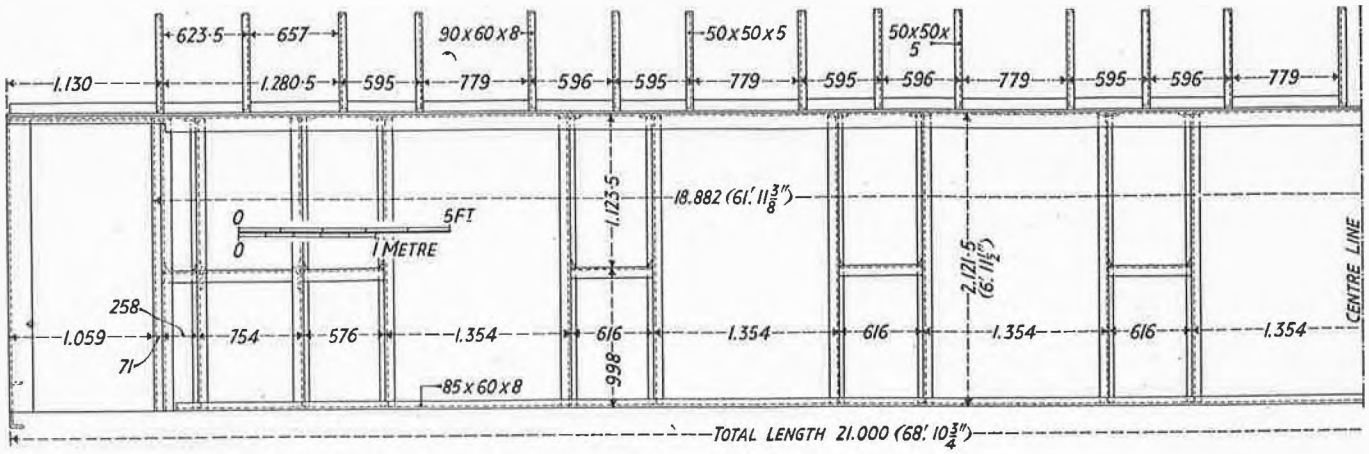
The outstanding feature of the Great Northern signalling was the somersault or centrally-balanced arm, introduced on that line after the Abbott's Ripton collision of January 21, 1876. The Great Northern was, however, very much advanced in other directions, and was the first line to adopt green universally for the "clear" indication at night, ground discs for main line shunting operations in contrast to their use only for leaving sidings, and the detection of facing points by the running signals. The necessity for distinguishing the lights for bay lines, loops and other minor roads from those for the main line was originally met on the Great Northern by having a purple light for the "clear" indication in signals other than those for the main line, though this experiment was not a success, largely because it introduced a fourth colour. Another outstanding feature on the Great Northern was that its standard signal lamp was complete in itself, with no separate outer case, and thus the lenses of the lamp were attended to daily along with the burner and reflector. A small detail that characterised the company's thoroughness was that each signal was numbered and had its own lamp. Correct alignment of the front light, when once adjusted, was thus maintained. Additionally, there was the signalling school at Retford, under the charge of the Signal Inspector, where men were trained as signalmen, and this training was so thorough that there was little occasion for a man to "learn a box" to which he was appointed or transferred.

We are led to make these remarks by the recent retirement of Mr. A. G. Rickett, who, in 1921, succeeded Mr. Hill, who had followed Mr. Amos Piggott as Signal Inspector on the latter's retirement nearly forty years ago. Mr. Rickett, however, was given the more suitable designation of Signal Superintendent, Traffic Department, and soon after the formation of the London & North Eastern Railway, he became the Signal Superintendent of the Western Section of the Southern Area. We thus perform a double duty; we put on record some of the fine pioneer work in the cause of safety in railway travel done by the former Great Northern and also pay tribute to a man of whom Mr. C. J. Selway—who appointed Mr. Rickett in 1921—spoke so eulogistically the other day, as recorded in our Personal columns on page 155. Mr. Rickett's is not only a noble record but one that may be an encouragement to other men to "rise from post to post until they attain the highest position in their own particular sphere and then to hold that position with the goodwill and co-operation of all those with whom they come in contact."

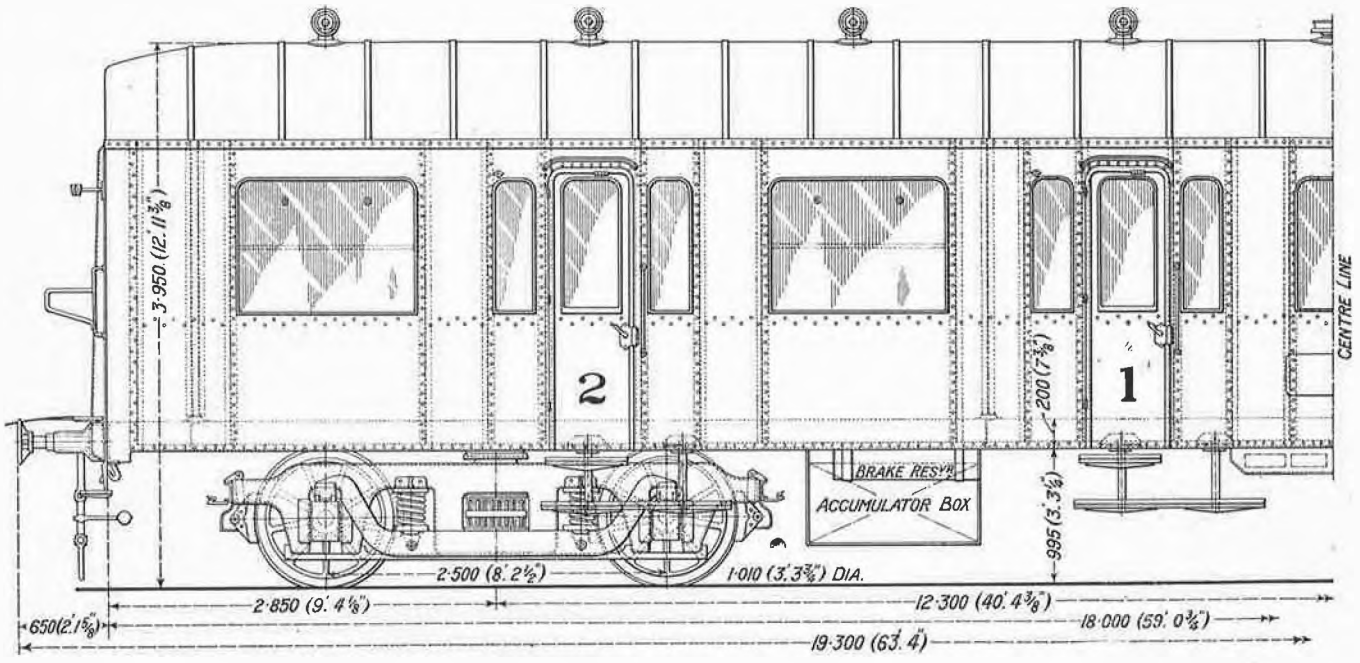
Preventing Water Wastage When Filling Locomotives

CONSIDERABLE leakage often takes place when watering locomotives owing to the difficulty of keeping the hose in the tank. To obviate this firemen sometimes twist the hose round the back of the opening, but this results, with certain types of engines, in the liability of the hose to get burnt by the steam pipe. Another method is to shut the lid down on the hose, but these practices have caused rapid local destruction, giving rise to leaks and premature deterioration of the hose and the necessity for its renewal.

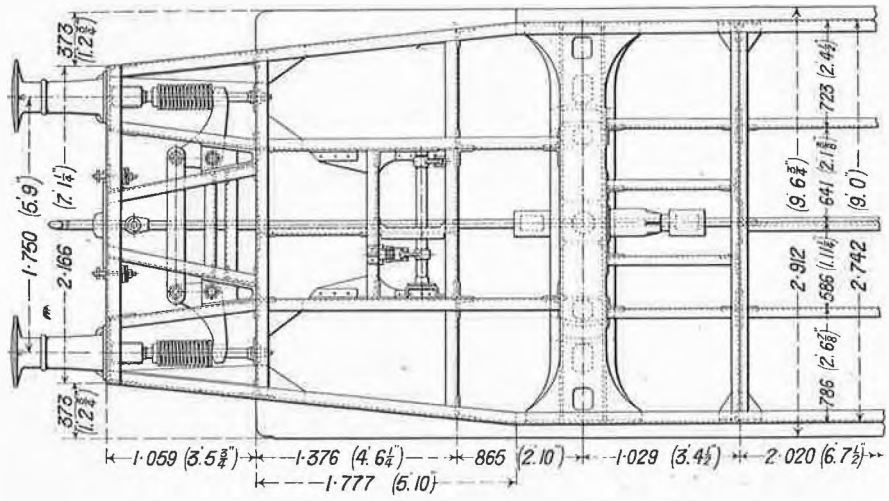
An employee in the Engineer's Department of the London & North Eastern Railway, Scottish Area, Mr. A. Nimmo, has devised the arrangement shown in the accompanying illustrations, and this is stated to be proving very satisfactory in avoiding undue wear when watering engines, and also in saving wastage of water. A rope is attached to the hose in such a manner as to take the strain off the latter when the water is passing through it. This incidentally permits of the use of a shorter hose than was previously considered necessary. The arrangement is, of course, something entirely different from the ordinary chain supplied for swinging the arm of the water crane and lifting the hose.



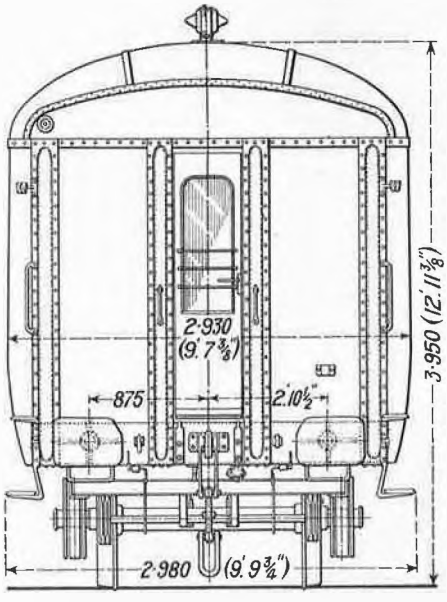
Details of side framing



Part elevation of 18*-metre stock*



Plan showing general arrangement of underframe



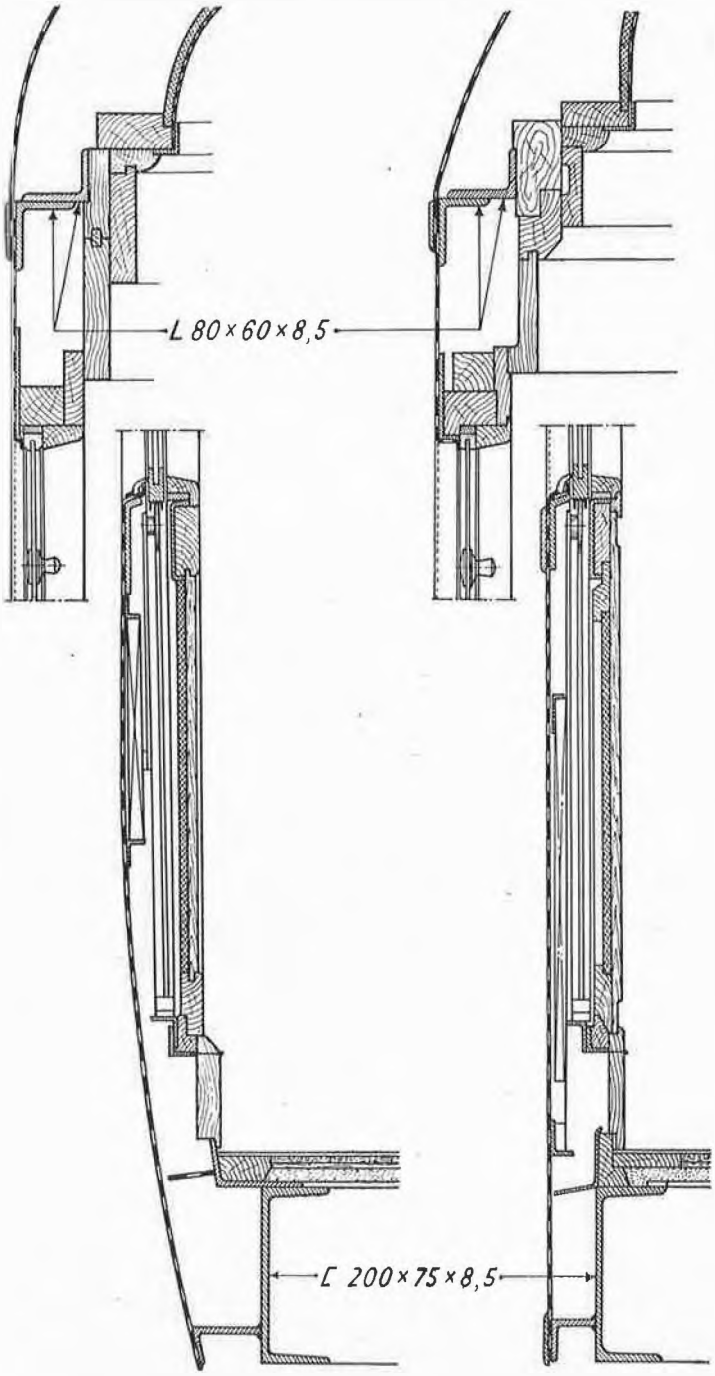
End elevation of 18*-metre stock*

BELGIAN NATIONAL RAILWAYS ALL-STEEL COACHES

NEW ALL-STEEL ROLLING STOCK IN BELGIUM

Over 1,000 all-metal coaches are being built for the Belgian National Railways to replace old wooden stock

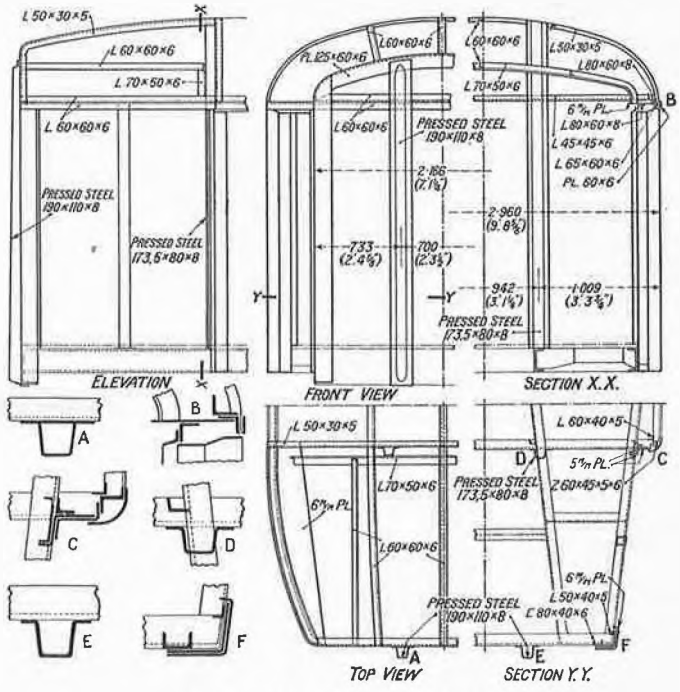
THE Belgian National Railways Company has undertaken the renewal of its passenger rolling stock, introducing all-metal bogie vehicles for every class of service. Up to May 22 this year, orders had been placed for 1,050 coaches, and large numbers have already been delivered. For international expresses, the coaches are of the side-corridor type with separate compartments for all classes, and vestibule connections. Rolling stock for service within the country itself is of two types. A series of 22-metre vehicles has been designed for *trains blocs* or fast trains, in which separate compartments and side corridor are features of the first class alone; second and third are of the open type. These 22-metre vehicles have large end vestibules, with double doors and vestibule connections between the coaches. A series of coaches with similar internal arrangements is designed for the composition of secondary or local trains. These, however, are shorter—measuring 18 metres—and are without vestibule connections. All the coaches are straight sided, except those of the 18-metre series, which have curved sides. The variations of each of the three main series, together with details of weights, dimensions, and seating capacities are shown on the next two pages.



Details illustrating box girder construction. Left, curved sided, 18-metre coaches; right, all others, straight sided

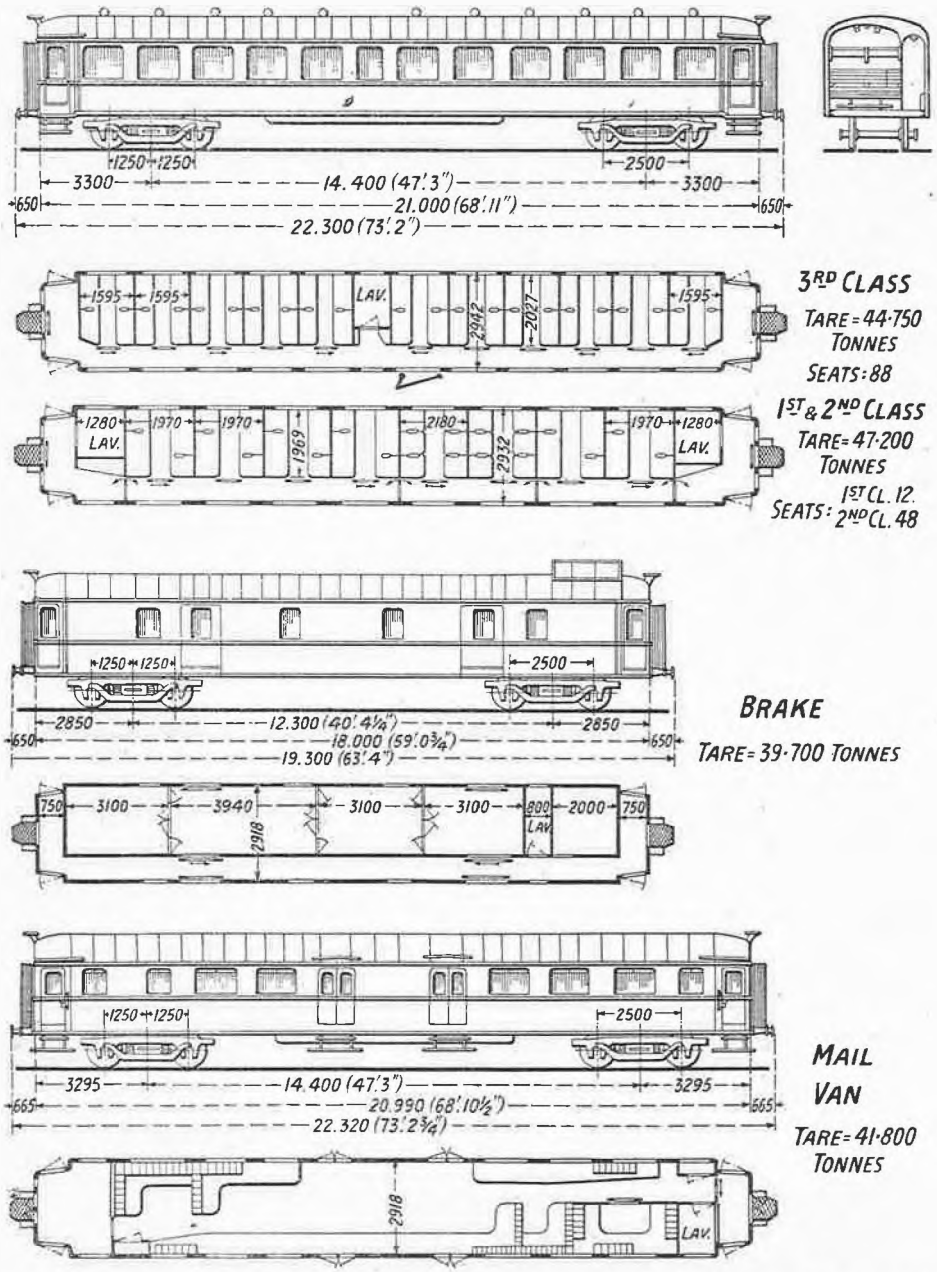
The principle of construction of the coaches is that of a box girder, and is shown in the drawings. Calculations of the strength and dimensions of the body framework were based upon those for the main beam of a bridge carried by two intermediate supports, suitably strengthened to withstand traction and impact stresses.

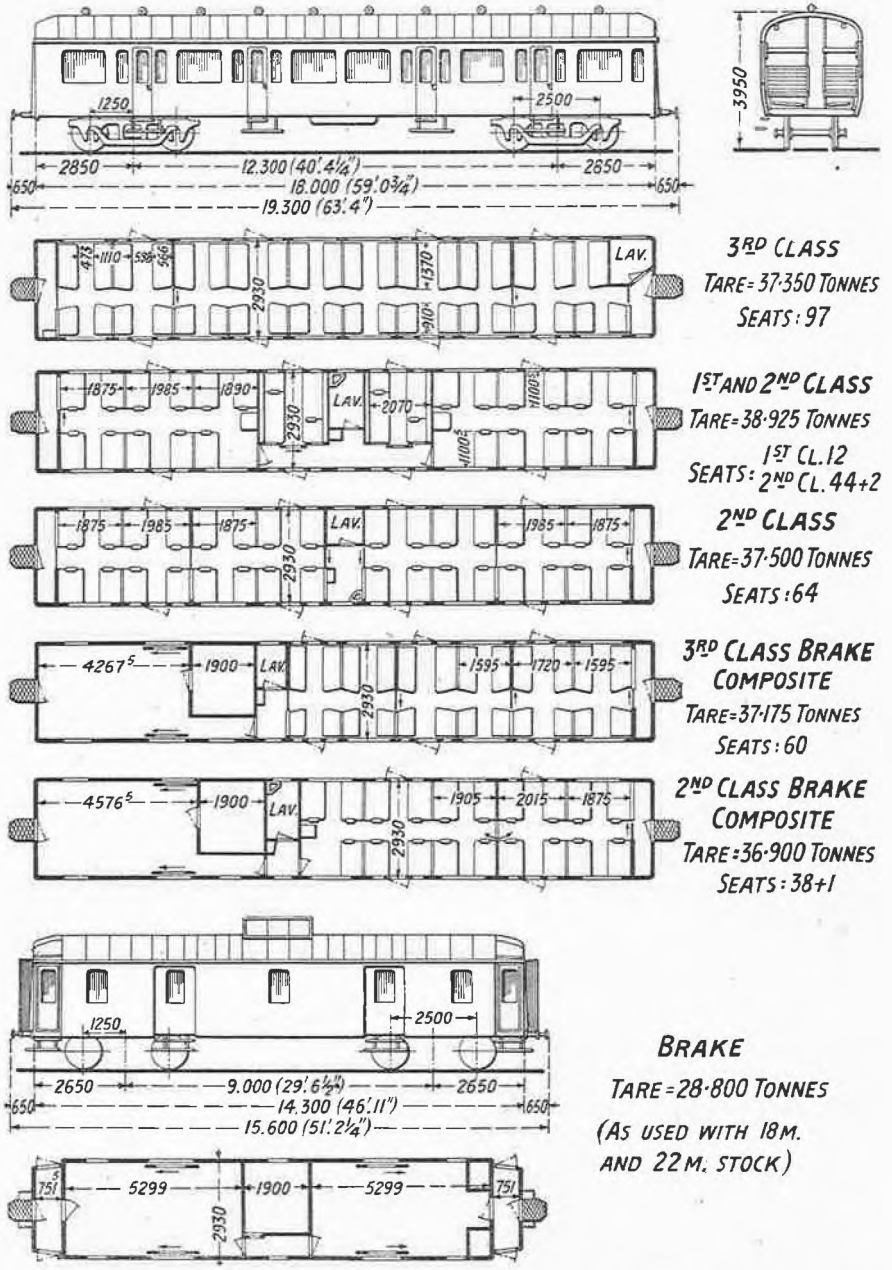
An anti-telescoping arrangement (shown below) in the 22-metre coaches is formed by the corner uprights of the gable end and two intermediate pressed steel supports



Anti-telescoping arrangement

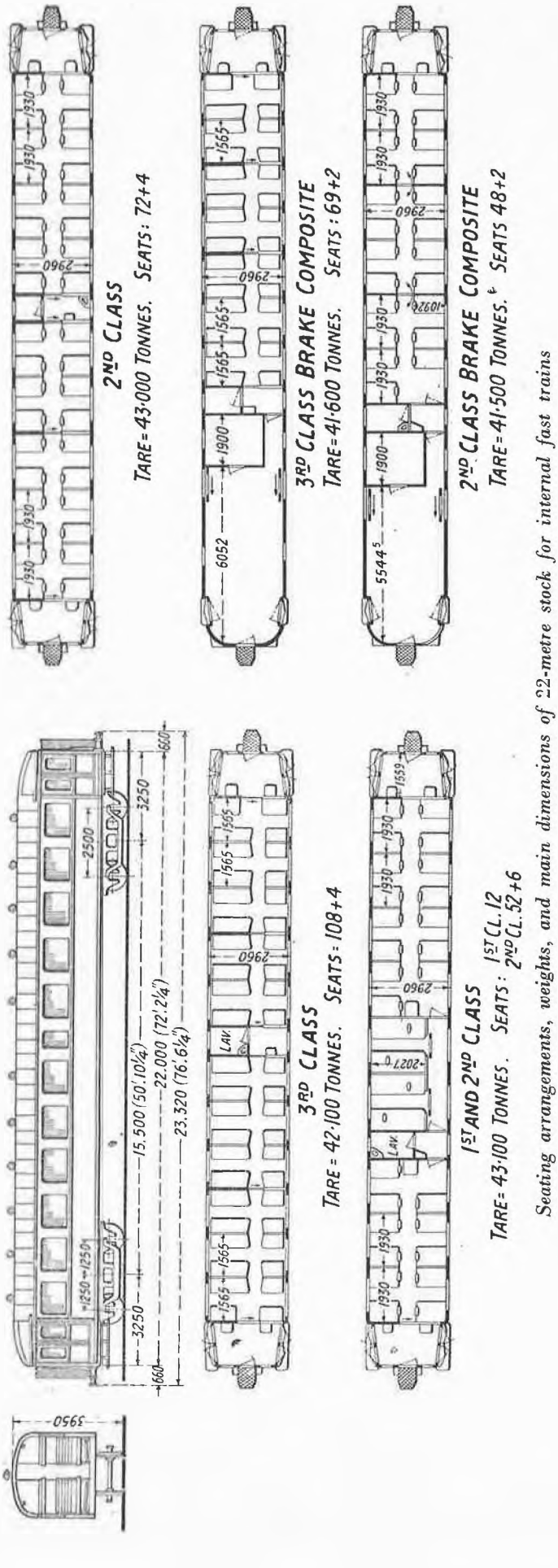
of equal strength. The top ends of these uprights are joined by horizontal steel bars to the four roof supports incorporated in the wall of the end compartments. In the event of a collision, the four outer uprights, which cannot withstand the force of the blow, are designed to give way under the impact, their own distortion causing that of the upper cross-ties. In case the force of the blow is not thus fully absorbed, it is transmitted further to the second bulwark of uprights in the front compartment wall. Similar anti-telescoping arrangements are incorporated in the international and 18-metre coaches. Cast



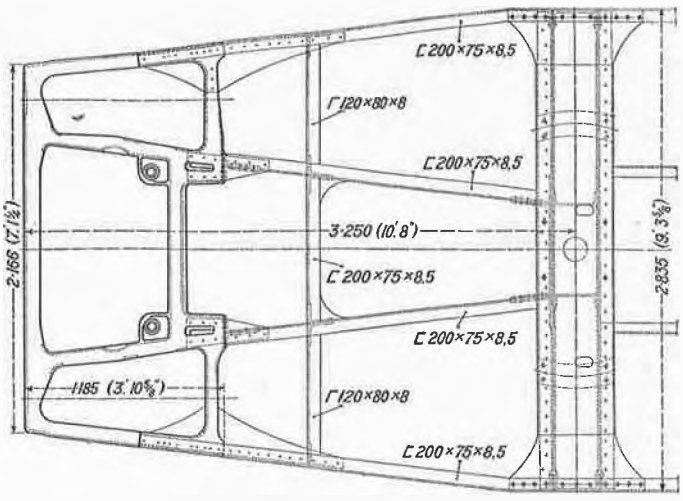


Seating and general arrangements, weights, and main dimensions of stock for international (left) and local internal (right) services

BELGIAN NATIONAL RAILWAYS ALL-STEEL COACHES



Seating arrangements, weights, and main dimensions of 22-metre stock for internal fast trains



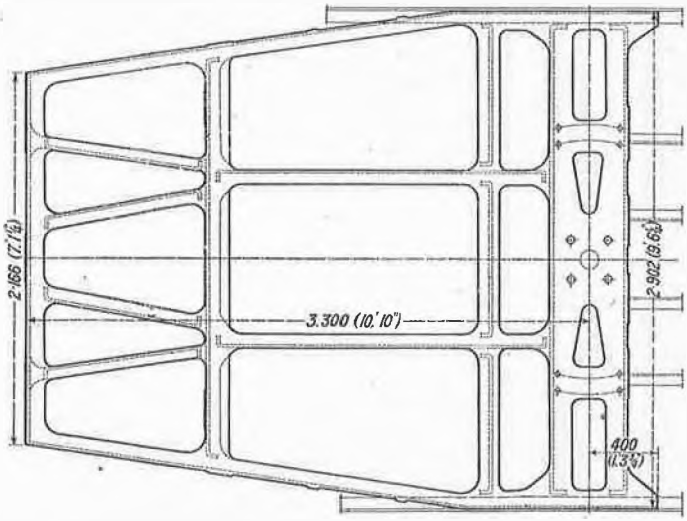
Frame ends strengthened with short steel castings

steel monobloc ends have been incorporated in the frames of about 400 of the coaches (above) in 50 of which it extends far enough to include the bogie pivot cross-tie, as shown in the drawing below.

It had originally been intended to fit bogies of tare weights in proportion to those of the coach bodies. The types under consideration were the Pennsylvanian bogies with 2·5 m. wheelbase for the 22-metre coaches; the Timmis bogie, also of 2·5 m. wheelbase, for the 18-metre stock, and the Leboucher 2 m. wheelbase bogie for the small 14·3 m. vans. A few units of the last two types were ordered when the construction of the first coaches was authorised. The weights of the various bogies are:—

	Kg.
Pennsylvanian built-up	6,250
,, monobloc	6,000
,, monobloc with cast-steel bolsters and various detail reductions in weight ..	5,800
Timmis monobloc (lightened pattern)	5,300
Leboucher	5,000

However, the first coaches fitted with Pennsylvanian bogies gave complete satisfaction as to running, and since the advantage of reduced weight in the Timmis type did not come up to expectations and, moreover, the number of vans to be fitted with the Leboucher bogie formed but a very small percentage of the total vehicles, it was decided in principle to adopt the Pennsylvanian type as



Frame strengthening with steel castings extending back to bogie centre

standard. Lubrication is either by oilbox packing or by the Isothermos, Léonard or Friedman mechanical systems.

Several types of buffer having been tried, the Mohr buffer was adopted for the international vehicles, the Ringfeder type for the 22-metre coaches and an ordinary buffer with Spencer-Moulton washers for the 18-metre stock. The drawgear is of the screw coupling type and the use of safety chains has been discontinued. The vestibule connections are of the Verein pattern with double framing, the flexible part being supported by spring-mounted rods of a type very similar to that illustrated in THE RAILWAY GAZETTE of May 4, 1934, in connection with the new standard corridor stock of the L.M.S.R. The first coaches for internal service were built without vestibule connection, but after a short period of service it became apparent that the provision of this facility for the 22-metre stock was desirable, and it was adopted.

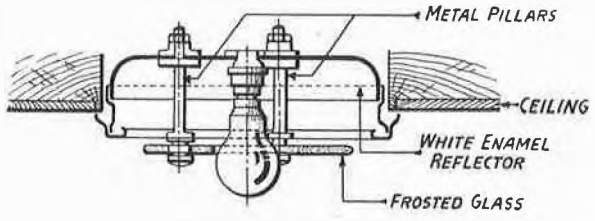
The brake is of the Westinghouse type with the Svenska Aktiebolaget Broms-regulator, which automatically compensates for the wear of the blocks. The S.A.B. compensator enables brake blocks to be kept in service to the end of their useful life without any adjustment of the gear by hand being necessary.

The floors of the coaches are of galvanised corrugated iron riveted to the framework and covered with coloured magnesian cement, except in the brake vans, where wood has been used. In the third class compartments the floor is without covering, but the first and second class coaches have a layer of linoleum over compressed cork, the three materials being glued together. Carpets are provided in addition in the first class carriages.

The decoration of the compartments is extremely simple and devoid of mouldings or other excrescences. The inside panelling is of wood, oak in the third class and selected hard woods from the Belgian Congo in the first and second class compartments. The walls are cork-lined, and the doors lined with Celotex.

The sheet aluminium ceilings and spandrels, which are lined with Celotex, are painted cream colour in the third class, and in the first and second class carriages have a light neutral tinted fabric covering. Fittings are of white metal, Alpax being used in the third class and oxydised german silver in the first and second classes. Severe simplicity of design is also evidenced in the fittings, and every detail without a useful purpose has been eliminated.

The lighting system departs from generally established practice. In the first class carriages the source of light is situated in the axis of the compartments. It is housed



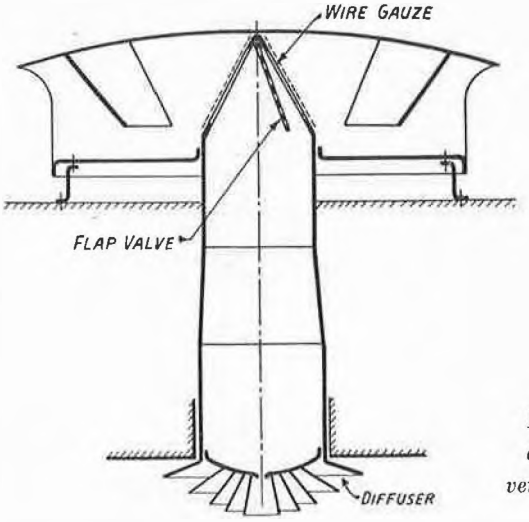
Arrangement of compartment roof light

in a recess in the double ceiling, lined with white enamelled sheet iron which forms a reflector (above). Where the lights are not mounted in the axis of the compartment, as, for example, in the second class centre-corridor coaches, the light source is in a metal holder with ground glass sides which projects from the curve of the roof. The first class carriages also have reading lamps so designed as to screen the light from persons sitting opposite.

Third class compartments have two 25-watt lamps each and second class compartments two of 40 watts. In the first class compartments of the coaches for internal service, and in the first and second classes of the international vehicles, there is one main 40-watt lamp and four 15-watt reading lamps, making a total of 100 watts in each compartment.

Ventilation is by Torpedo suction fans. A few forced draught ventilators of a new type, with Anémostat diffusers (below) have also been tested. Further aids to ventilation are the large adjustable windows, balanced on the Hera system. The windows, which are of Securit safety glass, are provided with blinds of a material treated so as to be completely opaque on both sides, therefore offering a barrier to the sun's rays during hot weather.

Westinghouse Thermostat steam heating is used, with aluminium radiators which have effected a saving in weight of some 1,000 kg. a vehicle. Half the radiators are under



Forced draught ventilators

the passengers' control and half under that of the train staff. Above the radiators under the third class wooden seats, Celotex insulation has been used.

The seats in the first and second class carriages are well sprung and covered with untearable mohair velvet, the Simmons system of upholstery springing having been generally adopted. Beige is the colour for the second class carriages and azure blue for the first class. Small tables are provided in the compartments of every class. Safety locks, which require a double action to release them, are fitted to the outer doors.

The railway company, whose engineers had had experience of the belt system in their own shops, fixed a rate of delivery for the coaches which virtually compelled the contractors to adopt the belt system for the large orders given to them. Very ingenious methods were adopted in order to make use of the existing shops of the various firms. A typical example may be briefly described. The coaches were built up on low bogies which were moved forward after one or more operations necessitating two or more movements but at the same time permitting parts to be laid out or prepared within a minimum space and time. A series of jigs was made for every part of the coach, and the holes were drilled and, so as to eliminate the risk of inaccuracy liable to arise after long continued use, the holes in the jigs were punched with case hardened steel drilled to calibre. This method avoids the necessity for template work and the laborious marking out of each individual part. Further it is more accurate than drilling multiple plates, giving strict interchangeability of parts and reducing subsequent reaming.

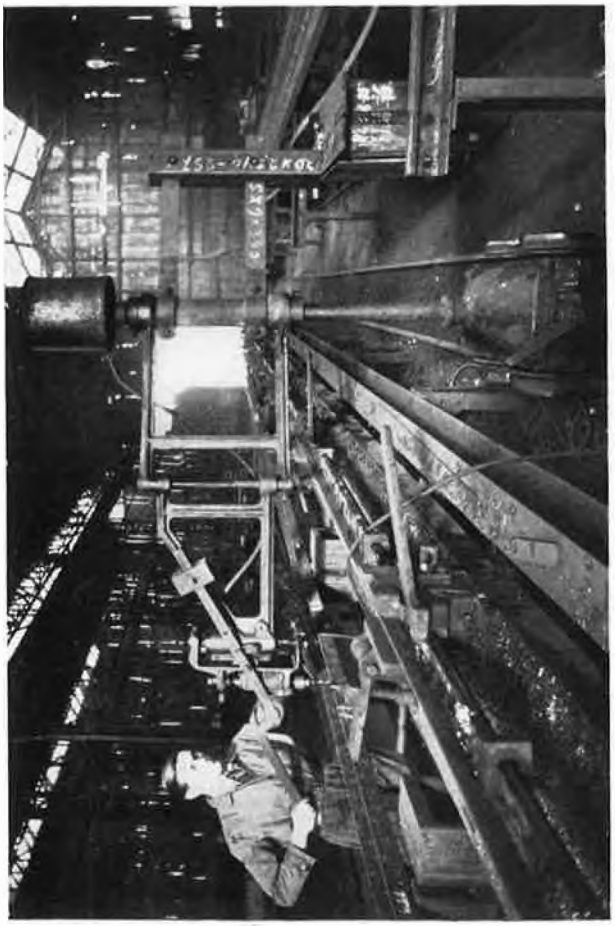
The drill used in these works was the Hicycle, a simple electric tool manufactured by the Consolidated Pneumatic Tool Co. Ltd. It is seen in the first illustration opposite, mounted on a swinging arm and being used for drilling

Coach floor construction

Roof assembly

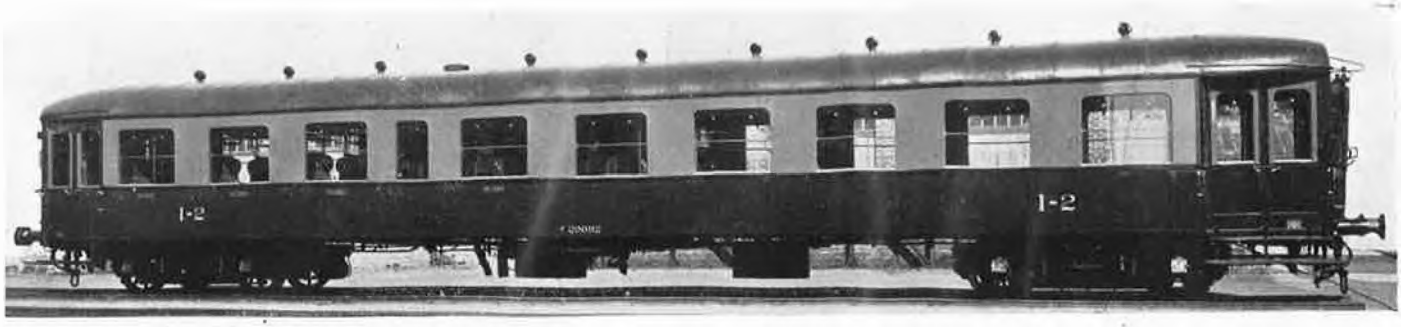
Roof being lowered on to body

BELGIAN NATIONAL RAILWAYS COACHES UNDER CONSTRUCTION

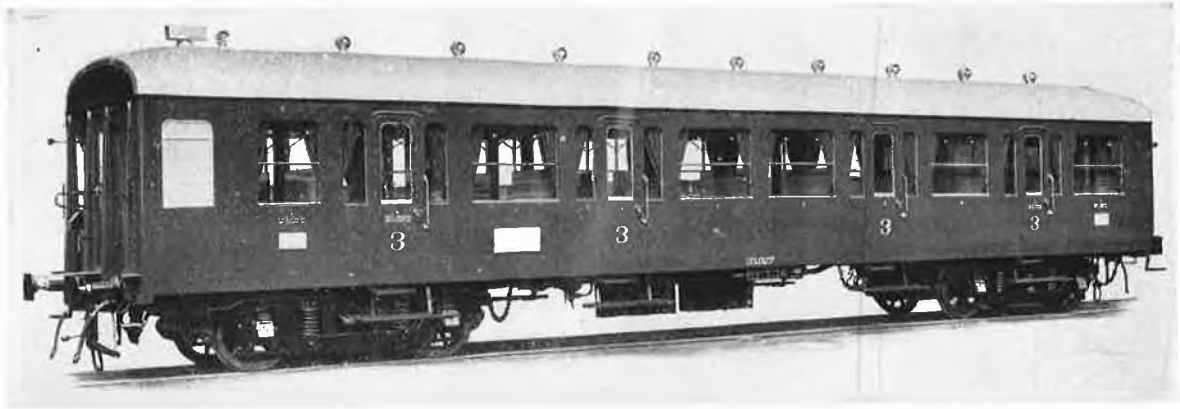


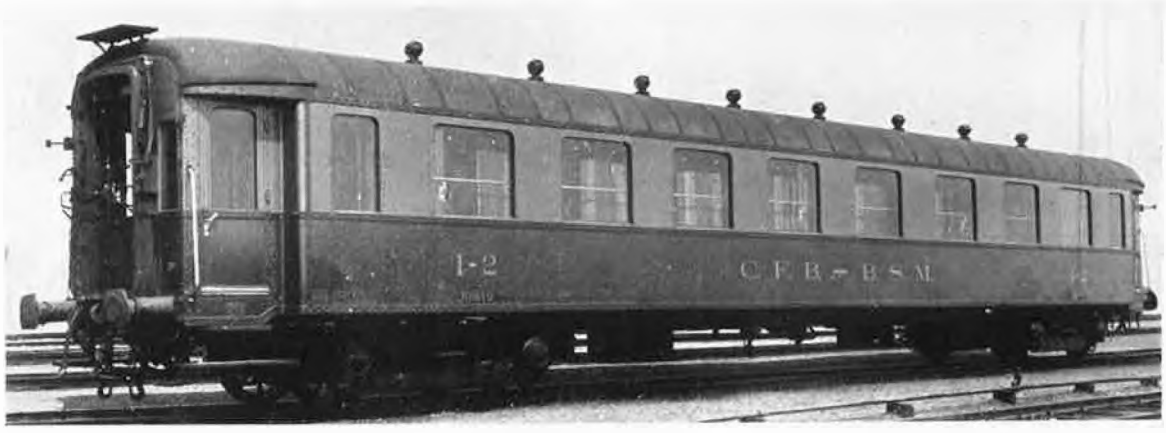
Pneumatic drill, mounted on movable arm, drilling top side rails

General view of works. Sheets of Celotex lining on left



Above: First and second class composite coach for internal express trains. Note large double vestibule end doors





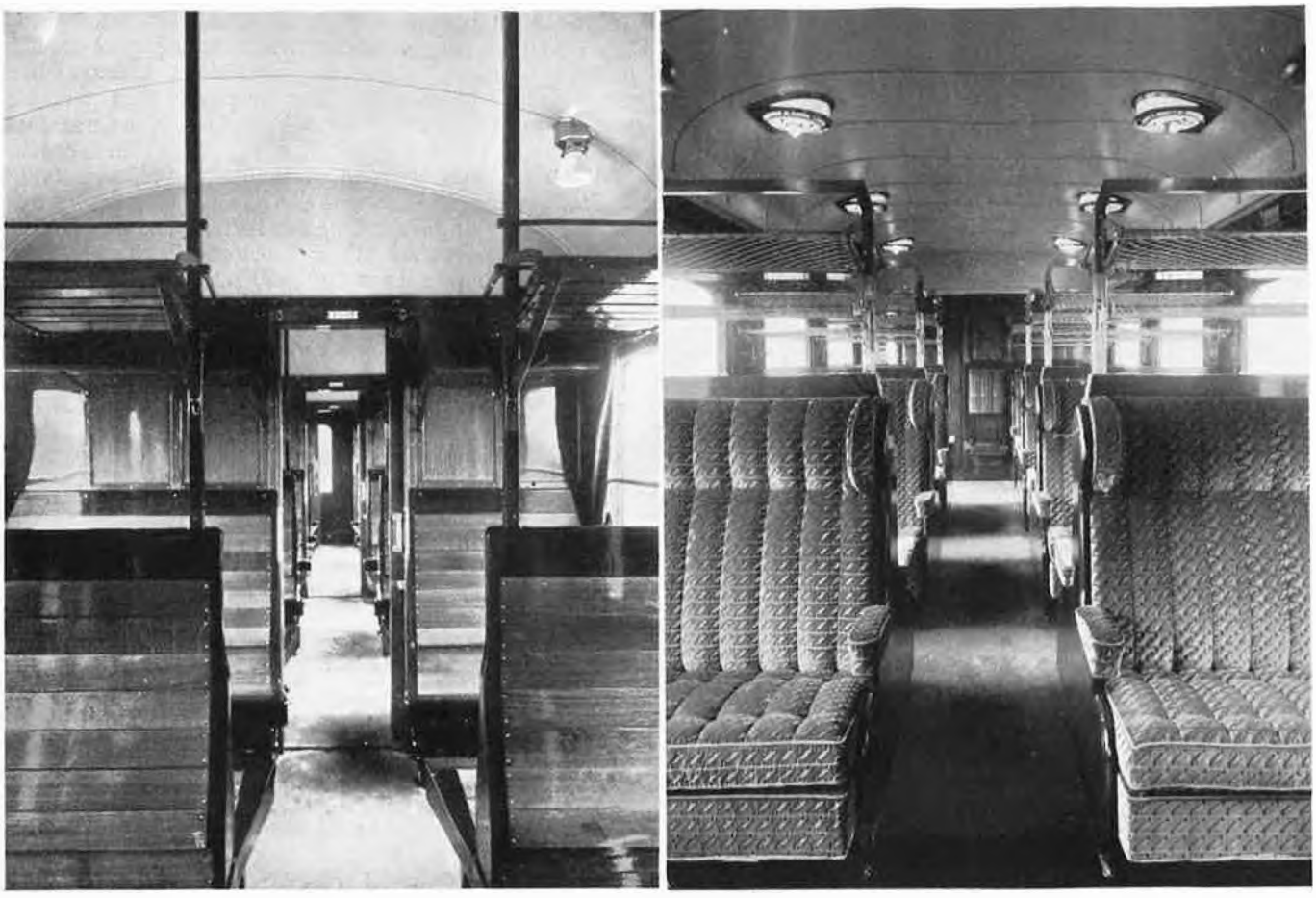
Above: Third class non-vestibuled coach for local stopping services

Above: First and second class composite coach for international services

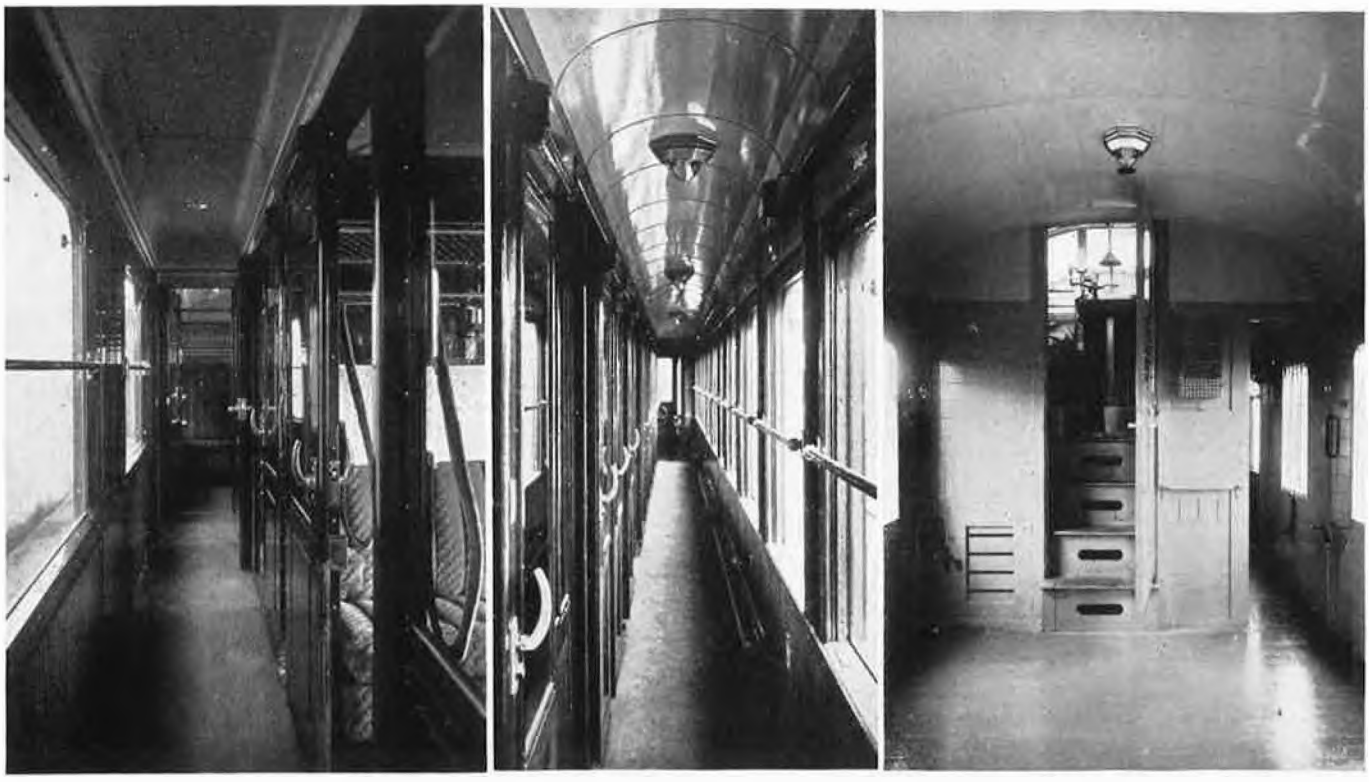
Above: Third class composite brake van for internal express services

Left: Brake van for main line express services

NEW ALL-STEEL ROLLING STOCK,



Third class (left) and second class (right) saloons for internal express trains



Left: Corridor of internal express trains, first class compartments. Centre: Corridor of international coaches. Right: Interior of brake van with roof look-out

BELGIAN NATIONAL RAILWAYS

the top side coach rails. For this purpose the arm is mounted on a column in a movable base mounted on ball bearings so that the operator can advance the tool without effort. It was possible to drill 210 holes an hour in a 22-metre length through $\frac{3}{8}$-in. and $\frac{7}{16}$-in. metal, 90 of the holes being $\frac{1}{2}$-in. and 120 $\frac{5}{16}$-in. diameter. To attach wood panelling, window frames, seats and so on by means of metal screws, $\frac{3}{16}$-in. holes were tapped in $\frac{1}{4}$-in. steel at the rate of 240 an hour.

The same principle as was adopted for drilling the holes in the rails was used in similar operations, specimens of which are shown on page 141. In the case of the body side plates, assembled in a special fixed jig, yoke riveters also were suspended from a travelling drill frame, the operations of drilling and riveting being carried out in the same movement. The riveters were suspended by means of CP balancers.

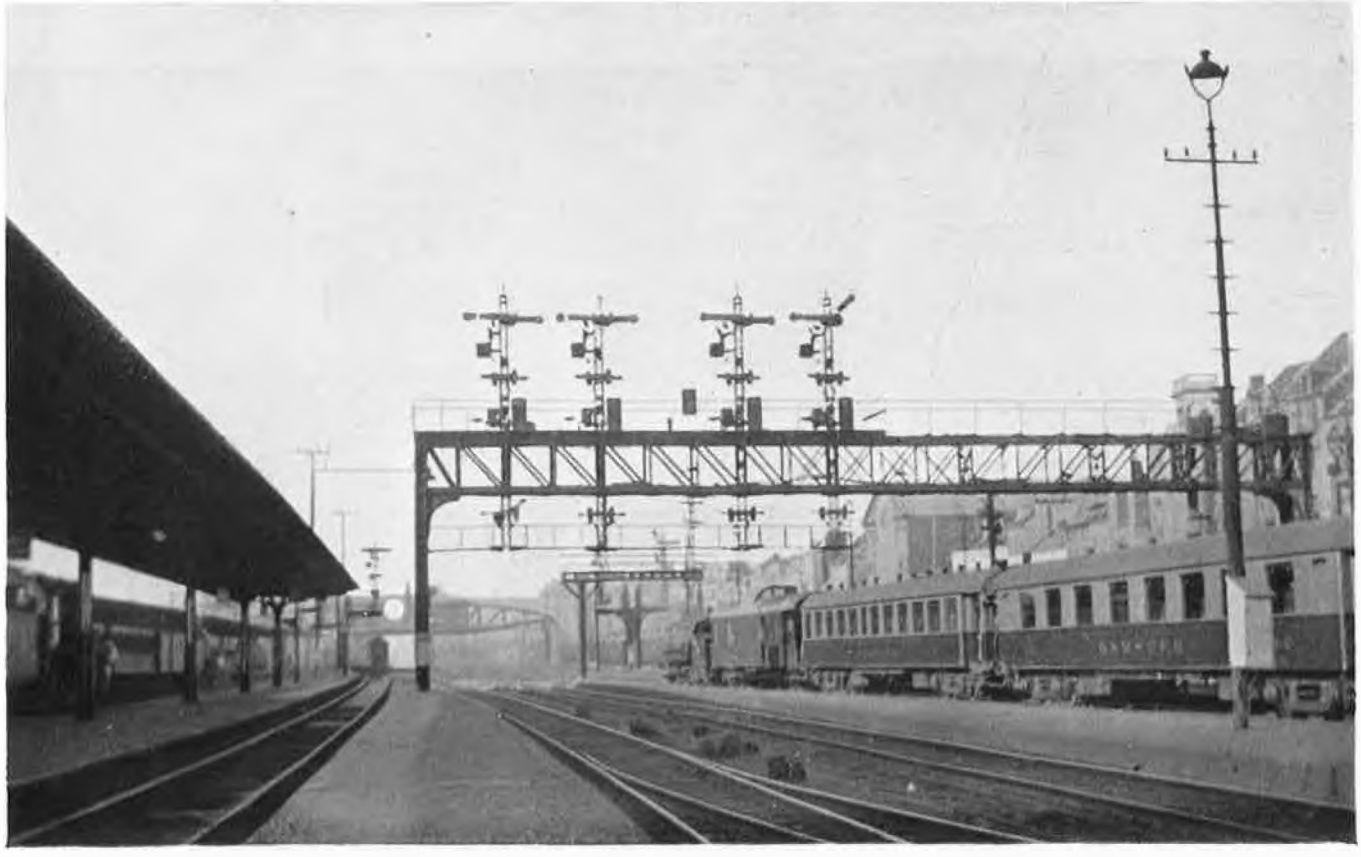
For the roof assembly a special form was prepared on which all the parts were placed and fixed by welded points before any drilling was done. After riveting was completed the roof was picked up on a special jig which permitted its being mounted without distortion.

As many of the assembled members were of small dimensions, a sub-assembly belt was arranged. Most of the sub-assembly jobs were done by C.P. yoke riveters mounted either against a column or suspended by means of C.P. balancers. When the coach was completely assembled it was taken into a sand blast chamber for cleaning, after which the first Government inspection, which was very stringent, took place. On completion of the first inspection the body was painted and then carried out ready for mounting on the bogies, which had been built up on a sub-assembly belt. A special crane was used to lift the body high enough to permit the mounting of accumulators, generators, brake fittings and so on, and the wheeling under of the bogies. The output of this particular works was at the rate of one complete coach in three days.

An editorial article on the characteristics of these coaches and the sweeping revision of rolling stock policy undertaken by the Belgian National Railways in ordering them will be found on page 129 of this issue. The colour of the new steel stock is dark green below and light green above the waist line, except for the local internal coaches which are all dark green.

The contracts for these coaches were distributed amongst the following Belgian firms:—

Les Ateliers Métallurgiques, Nivelles.
La Brugeoise et Nicaise et Delcuve, Bruges.
Les Ateliers de la Dyle, Louvain.
Société Ragheno, Malines.
Compagnie Centrale de Construction, Haine-Saint-Pierre.
Société Baume et Marpent, Haine-Saint-Pierre.
Société Anglo-Franco-Belge de Matériel de Chemins de fer, La Croyère.
Ateliers de Familleureux, Familleureux.
Les Ateliers de Braine-le-Comte.
Société L'Energie, Marcinelle.
Ateliers Germain, Marchienne-au-Pont.
Les Ateliers de Godarville.
Les Ateliers de Seneffe.
Les Ateliers du Roeulx.
Société Métallurgique Enghien Saint Eloi, Manage.
Les Grosses Forges et Usines de la Hestre, Haine-Saint-Pierre.



Old Siemens and Halske power signals at Brussels Nord station. The new signal box with electric frame and the recently-installed power-operated points are illustrated on the opposite page. On the right of the above picture is a train of all-steel coaches as described in the article above