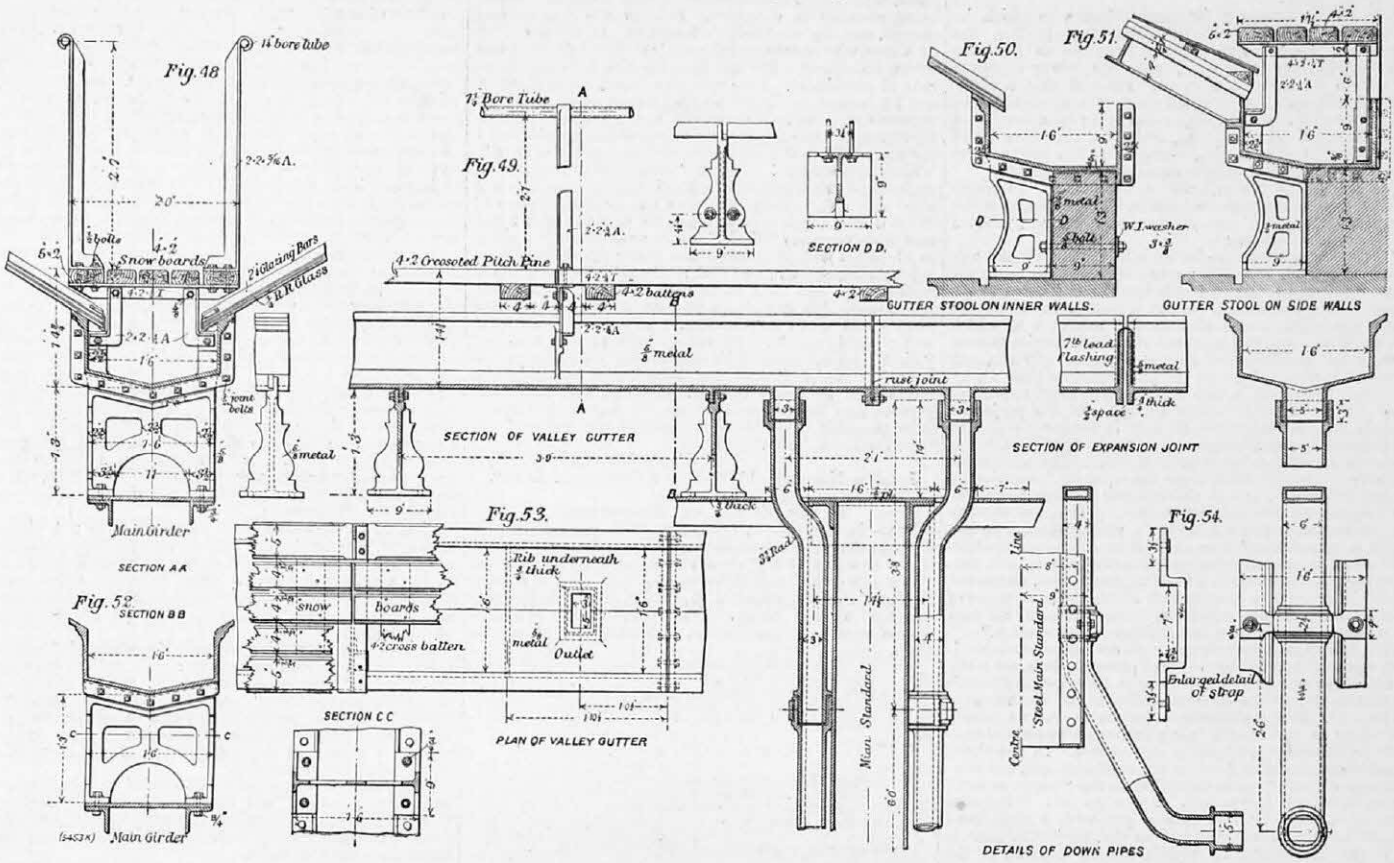
THE VICTORIA STATION AT NOTTINGHAM.

MR. EDWARD PARRY, M. INST. C.E., LONDON AND NOTTINGHAM, ENGINEER.

(*For Description, see Page 672.*)



FIGS. 48 TO 54. DETAILS OF GUTTER AND ROOF DRAINAGE.

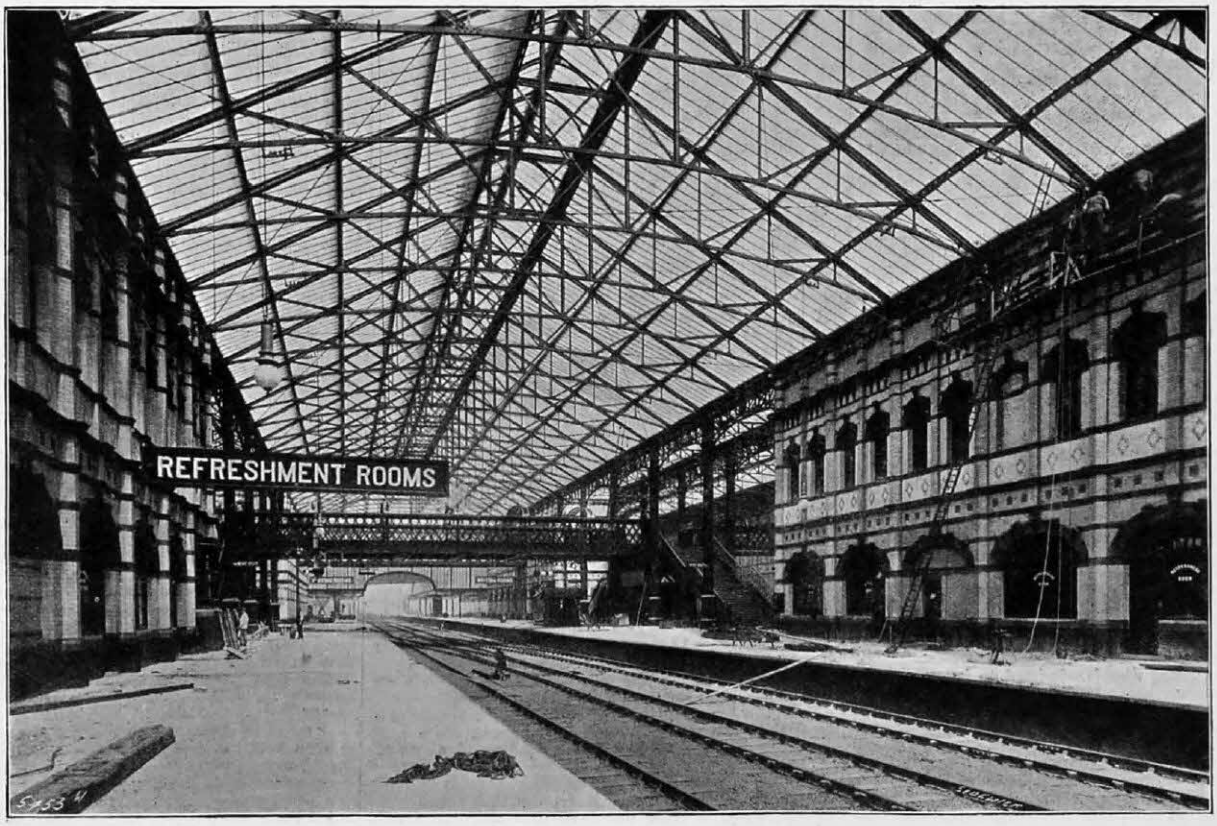


FIG. 55. VIEW OF INTERIOR OF STATION SHOWING MAIN SPAN.

THE NEW VICTORIA STATION AT NOTTINGHAM.

(*Continued from page* 674).

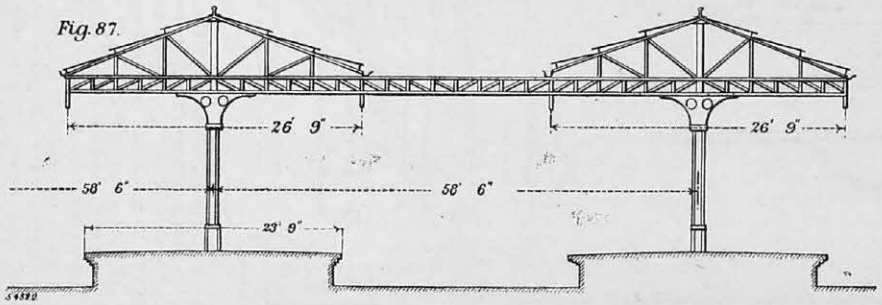
HAVING described the general arrangement of the station—the joint property of the Great Central and Great Northern Railway Companies—we now come to that important item in the structure—the wind screen at each end of the several spans of the main roof. Here again we may confine ourselves to the central screen, which is, of course, typical. The total area of this screen is 3000 square feet, it is 53 ft. deep in the centre, and some idea of its importance may be suggested by the fact that 28 tons of steel have been worked into it. It presents a handsome appearance, while at the same time being workmanlike. Detailed

drawings of it are reproduced this week on our two-page plate (Figs. 56 to 86).

The main structure or support consists of a line of girders built 20 ft. from the bottom of the screen (Figs. 60 to 67), and to this the whole frame is suspended, while at the top there is an apex girder of the plate type, 2 ft. 5 in. deep, with ½-in. web, and 3-in. by 3-in. by ½-in. angles at top and bottom, to give a finished appearance and to afford a means of securing the ends of the purlins (Fig. 68), while along the bottom edge there is a simple lattice girder 15 in. deep (Fig. 85), which follows the line of the arch formed in the centre to assist in improving the general effect. The cross-section of the screen shows these several members, and indicates also that the main girder in the centre of the depth, although of lattice construction, represents a rectangular or box section, 6 ft. 10¼ in. deep, the front and back members being 6 ft. 9½ in. apart, with horizontal and diagonal lattice bracing at top and bottom.

The supporting of this girder was a somewhat difficult matter, and for the purpose the columns at the ends of the platform buildings, where the screen is built, had to be greatly reinforced. The columns at this part are 43 ft. 4 in. in height and their section was increased to 14 in. by 12 in., being made of two plates 14 in. by ½ in., two plates 12 in. by ½ in. secured together in a rectangle by four angles 3½ in. by 3½ in. by ½ in. It was decided to make not only a strong column at the outer corners of the buildings, but also

Fig. 87.



to utilise the next column within the wall of the building for assisting to resist the wind pressure, and this was accomplished by substituting for the ordinary longitudinal joist connecting all columns within the building walls, a double lattice girder 2 ft. 8 in. deep, the front and back members being 2 ft. 6 in. apart and braced at top and bottom. This girder, which corresponds to a box section about 2 ft. 8 in. square, is firmly bolted to the two end columns; and while the outer member of the main (86 ft. 11 in.) girder of the screen is carried by the outer columns, the inner member rests on, but is not secured to, the top of this 2-ft. 8-in. girder, as is shown in Fig. 57.

The cross-section of the wind screen shows its relation to this girder for stiffening the columns. Carried on the top of the main screen girder of box section are struts placed at 9-ft. intervals along its length, the width of the struts at bottom corresponding with the width of the girder (6 ft. 6 in.). They taper to meet the apex girder, as shown on the dotted lines on the section. These struts, of lattice section, as shown in Figs. 69 to 72, are composed of T-iron 6 in. by 3 in. by ½ in., with double cross bracing of angles, and they support not only the apex girder at the top, but carry the glazing bars. On the under side of the main girder there are corresponding struts, the only difference being that the narrow end is downwards, and they do not vary to the same extent in length (Figs. 73 to 75). They carry the horizontal girder at the bottom of the screen and also the glazing bars. These are on Mellowes's system, of $\frac{3}{16}$-in. glass, attached to horizontal angles. The elevation is relieved by mouldings of pitch pine, and at the apex there is a cast-iron ornamental crest.

Including the wind screen, all girders, columns, &c., the main roof required 987 tons of steel, and it is almost unnecessary to state that there is a complete system of wind ties. These are 1¼ in. in diameter, and are provided with screw couplings throughout. Galvanised ladders, too, are provided for cleaning purposes.

We come now to the awning roofs, which cover the platforms north and south of the main roof for a length in each direction of 235 ft.; but under York-street bridge it was not necessary to build such a roof. The height from platform level to the top of the awing roof is about 20 ft. 6 in. The platforms are on varying curves, and the roof follows the curves and narrows to suit the decreasing width. The awning roofs do not cover the bays or docks at the ends of the platforms. They are built in pairs, one on each side of the bays, but a lattice girder stretches right across the bay at the same intervals as the columns, and thus binds the whole structure over each platform together (Fig. 87). The columns, along with their foundations and brackets and the drainage arrangements, are illustrated on page 738 (Figs. 88 to 103). These columns are spaced along the platforms at 30-ft. centres. The height of each at the north end is 16 ft. ⅛ in., and at the south end 17 ft. 2½ in. The roof is horizontal: this was necessary owing to its connection with the wind screens. The difference in height of columns is due to the gradient of 1 in 528, at which the rails are laid through the station. The platforms follow this gradient, but for facility in construction it was decided to make the columns at the north all alike in height and those at the south equal with each other. The difference is made up by sinking the foundations further into the ground according to the gradient. The columns (Fig. 94) are built of two plates, 8¾ in. by ⅜ in., and four angles 3½ in. by 2½ in. by ⅜ in., braced diagonally with bars 2½ in. by ⅜ in. The base-plate is 3 ft. by 2 ft. by ⅝ in., and the connection with the stem is strengthened by ⅜-in. gussets. There are riveted to the columns at their tops curved brackets of steel, ⅜ in. thick and 8 ft. in length, to carry the girders which stretch across the bay, and also extend as cantilevers to the front edge of the outside platform, to carry the front screen, &c., as shown on Fig. 87. The edges of the brackets are stiffened by T-irons 6 in. by 2½ in. by ⅝ in., firmly riveted to 3-in. by 3-in. by ⅜-in. angles on the cross girders already mentioned (Fig. 89). The base of each column is protected by a cast-iron plinth surrounding it (Figs. 98 to 100), while there are cast-iron mouldings on top with neck below to enhance the appearance (Figs. 96 and 97). There is a surface-drainage pipe in the interior of the column (Figs 95 and 101 to 103). The awning-roofs, with their supporting girders, are illustrated on page 739 (Figs. 104 to 110).

The girders, which extend across the bays as well as across the platforms, are of the lattice type, 1 ft. 3 in. deep, of double section, the width being 1 ft. 2¾ in. (Figs. 105, 109, and 110), and the two parts are thoroughly braced together. These girders are carried on the tops of the columns, and are riveted to the brackets on either side. The brackets are 8 ft. long and the maximum overhang of the girders and roof is 13 ft. 4½ in., lessening towards the ends of the platform. The total length of these tie or cross girders is 70 ft. 6½ in. over the angles, and this also decreases towards the end owing to the narrowing of the platforms. These tie girders and the columns are at 30-ft. centres, and in line with the platforms there run longitudinal girders, also of the lattice type and 5 ft. deep. These longitudinals carry three principals intermediate between those supported by the columns. The principals over the columns are double, the others single, and the interval between each is 7 ft. 6 in. The single principals are shown by Fig. 104, and the double principals by Fig. 106. They are built up of angles and flat bars, and the two are 10¾ in. apart, the gutter being carried between them from the eaves to the tops of the columns. The purlins are of Z-bars, with Mellowes's glazing. The valance boarding is carried by a light lattice girder connecting the ends of the principals, as shown in Figs. 107 and 108. It is 1 ft. 3 in. deep. This also carries the cast-iron moulded gutter.

The ends of the awning roofs at the ends of the station are hipped. This part, which extends for a distance of about 13 ft., is suspended from the ends of the longitudinal girders in the form of two half-principals, splayed at an angle, and connected to the end valance girder at distances of 8 ft. 4 in. apart. The adoption of two half-principals instead of one was to increase the rigidity of the structure against wind pressure.

The awning roof is returned at the inner end, where it joins the main roof at the wind screen. The half-principals in this case are attached to the lower girders of the main wind screen, as is also the valance girder. Some of them, against the end of the buildings, rest on pad-stones built into brickwork.

York-street bridge cuts through the awning roof at an angle (Fig. 1, page 678 *ante*), and special principals had to be provided to suit the skew of the bridge. The connection between the principals and the columns of the bridge is made by tap bolts. A glazed screen is carried by angles on the under side of the outer main girders of the bridge, and is connected to the special skew principals.

The total area of the awning roof is 49,248 square feet, and it is entirely glazed. The iron and steel in the awning roofs are supplied by Messrs. Handyside and Co., Derby.

(To be continued.)

THE NEW SUBWAY IN NEW YORK CITY.

By Charles Prelini, C.E., New York.

(Continued from page 700.)

The second part of the fifth section of the subway, known as Section 5 B, extends for nearly three-quarters of a mile along Broadway from 47th-street to 60th-street. It presents several interesting engineering features, such as the work to be done under the Elevated Road at 53rd-street, and the underpinning of the Columbus Monument at the Circle, 59th-street. The section is being built by Messrs. Naughton and Co., the sub-contractors, with the aid of Mr. G. W. Wilson as engineer-in-charge.

The soil through which the work is being done is chiefly hard rock, a pocket of loose soil being encountered at 47th-street, and extending a distance of 400 ft. This soil consists of reddish clay, rendered somewhat plastic by an underground stream. The clay is followed by a mass of soft rock of the usual mica-schist composition, but very friable and full of seams. In some places it is quite disintegrated. For the length of only two streets —viz., from 56th-street to 58th-street—is the rock sufficiently solid and compact to allow of its being used in building the walls of the subway. After this, soft rock is again met, which dips down nearly to the edge of the Circle at 59th-street, where sand and gravel are encountered up to the end of the section at 60th-street.

Two methods of construction have been employed on this section, viz., the open cut and the two side-trenches, both being greatly modified to meet local conditions. Along Broadway the four-track standard section, which is 55 ft. wide, takes up nearly the whole width of the street, extending in some places even under the sidewalks. In order not to interfere excessively with traffic and the trolley-cars, only one side trench was dug at a time along Broadway. It was worked down to the foundations of the subway, and well strutted whenever it passed through loose soil. The water-pipes, gas-pipes, and electric conduits which were met with were held in position by means of chains suspended from timbers placed across the trench.

Under the car-tracks, at distances of 12 ft. apart, narrow headings 5 ft. wide were driven across the street, and needles inserted composed of beams 10 in. by 12 in. The needles are held up by a vertical beam, 12 in. by 12 in., resting on the floor of the trench, and by shorter timbers resting on the bottom of the headings. The earth or rock between and under the needles is removed, and new uprights put in position, so as to secure the sub-structure of the car-tracks at the surface, and in such a way that when the men have finished excavating, the needles remain supported by four uprights, two under each car-track. In the space which has been cleared the foundation-bed is laid, and three panels of the steel bents of the standard

THE VICTORIA RAILWAY STATION AT NOTTINGHAM; DETAILS OF COLUMNS FOR AWNING ROOF.

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(For Description, see Page 736.)