

The Danville plant was designed by the firm of Albright & Mebus, of Philadelphia, for whom Mr. W. D. Gernet was assistant engineer-in-charge. The contract was awarded to the Pitt Construction Company, of Pittsburg. The siphon and nozzles were supplied by the Pacific Flush Tank Company, of New York.

A HEAVY FLOOR FOR A DOUBLE-TRACK BRIDGE.

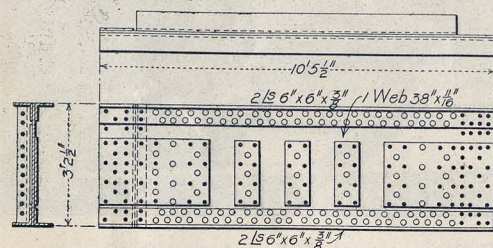
Two tracks of the Delaware, Lackawanna & Western Railroad are carried over the Erie Railroad tracks at the west end of the Bergen Tunnel, Jersey City, N. J., by a riveted truss bridge with a single span of 136 ft. 6 in. The trusses conform in most essentials to regular high-grade practice and are very heavy to provide for two 167-ton locomotives and a very heavy high-speed traffic. They are 30 ft. deep and 29½ ft. apart on centers, with 8-in. pin bearings in massive shoes.

The 26-ft. 3-in. end panels and 21-ft. intermediate bottom chord panels are subdivided by subverticals to the intersections of the diagonal members of the trusses, and the bottom chords are made with pairs of built channels 26 in. deep, with their 4 x 4-in. flange angles latticed top and bottom. Both the vertical and subvertical posts are field-riveted between the chord webs and project about 3 ft. 3 in. below the lower flanges to receive the main longitudinal floor girders. The chord splices are made with web and flange cover plates and flange angles and are located adjacent to the subvertical connections.

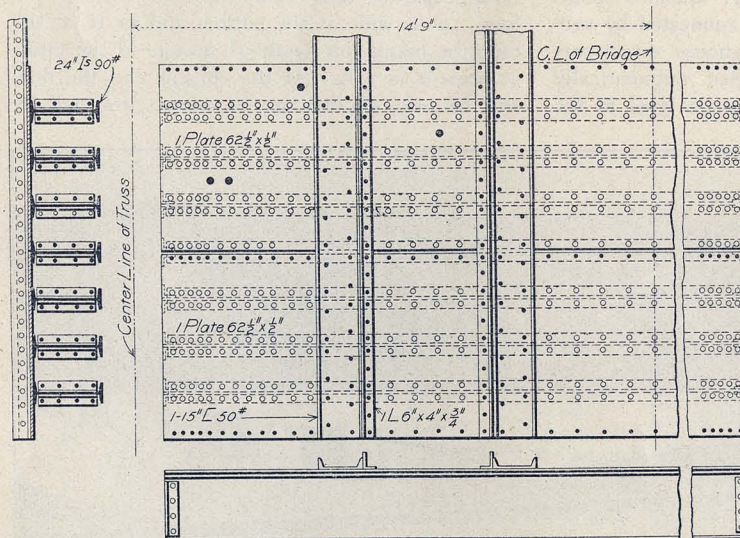
The end floorbeams are field-riveted directly to the shoes, and the latter are made unusually heavy to receive them and the lateral stresses, together

bed plate and is field-riveted to the end floor-beam webs. The expansion end shoes are seated on nests of rollers, which, like the bases of the fixed shoes, are supported on grillages of 15-in. I-

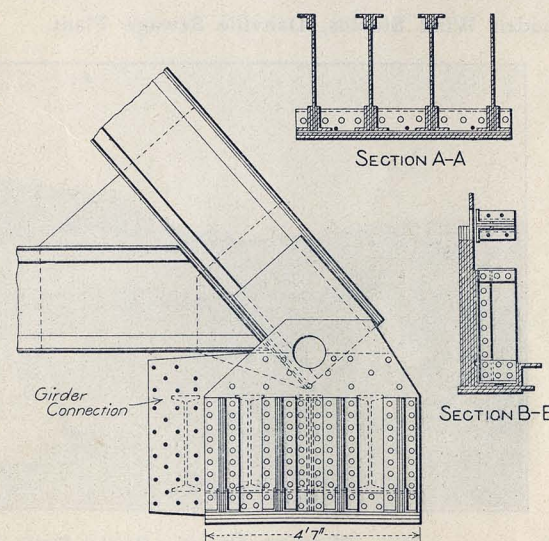
through the inner flange of each end post. The kneebraces, 6 ft. deep, are made with solid plate webs with pairs of 6 x 4 x ½-in. inclined flange angles. The length of the portal strut, about 36



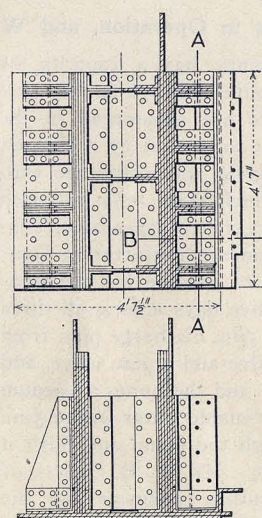
Longitudinal Girder G.



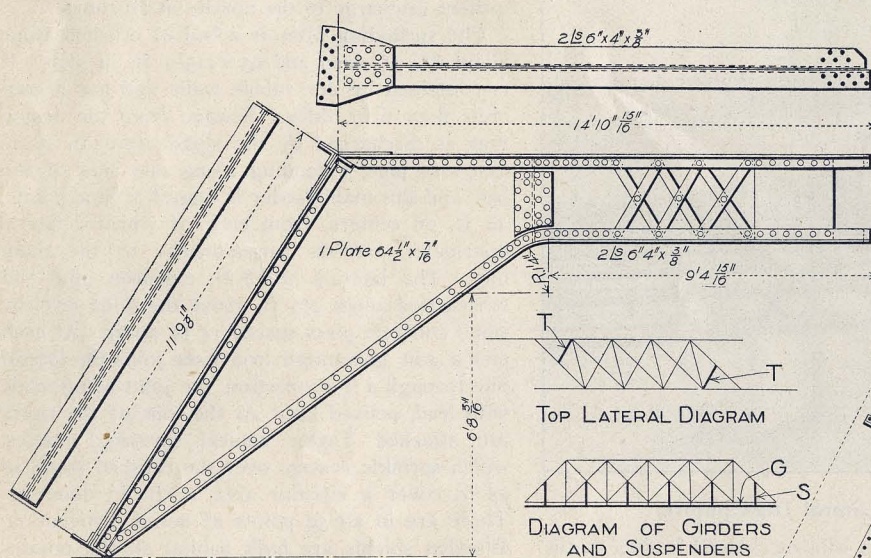
Floor Section.



Main Bearings.



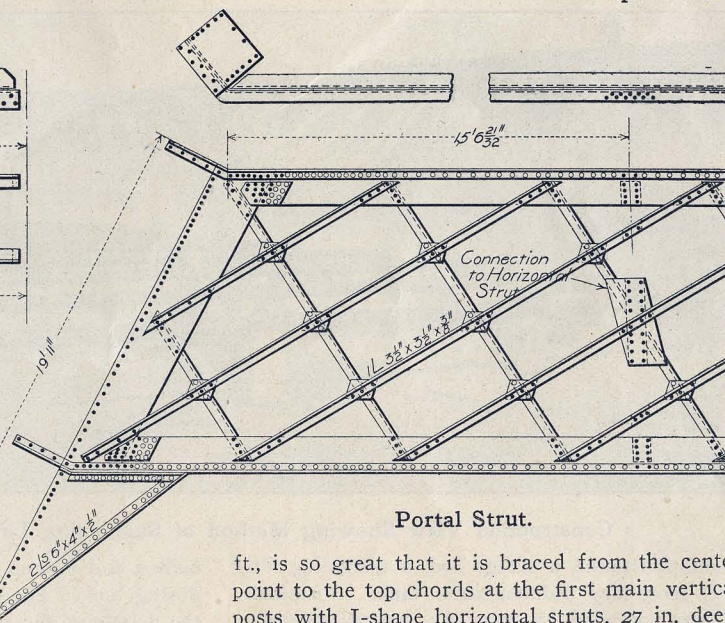
Suspender S.



Top Lateral Strut T.

TOP LATERAL DIAGRAM

DIAGRAM OF GIRDERS AND SUSPENDERS



Portal Strut.

with the heavy impact which is provided for in the structure. They have base plates 4 ft. 7 in. square and 1¾ in. thick, made with two 7/8-in. plates riveted together, and have two longitudinal webs, each made with five thicknesses of vertical plates, giving 3½-in. pin bearings and connected by three center vertical transverse diaphragms. The outer faces are also each stiffened by four exterior vertical transverse diaphragms serving as kneebraces, one of which projects beyond the

beams countersunk riveted to top and bottom plates and provided with cast-iron separators.

The portals, skewed about 46 deg. to the axis of the bridge, are lattice girders, 11 ft. 9 in. deep, with top and bottom flanges each made with a 16 x ½-in. vertical web plate and two 6 x 4-in. flange angles. The web members are single 3½ x 3½-in. diagonal angles, and the portal is field-riveted to the inclined end post with full-length 24 x ½-bent plates, having one continuous row of rivets

ft., is so great that it is braced from the center point to the top chords at the first main vertical posts with I-shape horizontal struts, 27 in. deep, made with two pairs of angles latticed. The horizontal legs of the flange angles are field-riveted between the top lateral connection plates on the top chords, and at the other end the strut is connected to the portal girder by a 64½ x 7/16-in. inclined solid-web kneebrace plate about 11 ft. long, with the inclined lower edge stiffened by the bent continuation of the bottom flange angles of the strut.

The top lateral system consists of I-shape X-braces and transverse struts intermediate between

the portals, all having the same depth as the top chords and each made with two pairs of angles back-to-back latticed and field-riveted at the ends between horizontal connection plates on top and bottom flanges of the top chords. In each panel one of the X-brace struts is made continuous, and the other is cut to clear it and spliced across it with $13 \times \frac{1}{2}$ -in. top and bottom flange plates, shop-riveted at one end and field-riveted at the other end and to the intersecting struts.

The most interesting feature of the design is the floor system; which, as already stated, is carried on special longitudinal girders in the planes of the trusses. These girders are made in sub-panel lengths of $10\frac{1}{2}$ to 13 ft. They are supported by from 25 to 40 $\frac{7}{8}$ -in. field rivets in single shear through the inner flanges of the vertical and subvertical posts at each end. The heaviest girders are made with a $38 \times 13/16$ -in. web and four $6 \times 6 \times \frac{5}{8}$ -in. flange angles. Small $\frac{1}{2}$ -in. filler plates are riveted to the inner faces of the webs with three countersunk rivets each and eight field rivets for the connections to the 24-in. 90-lb. I-beams, $15\frac{3}{4}$ in. apart on centers, which form the floor platforms. The regular I-beams are nearly 28 ft. long and are covered continuously by $62\frac{1}{2} \times \frac{1}{2}$ -in. full-length flat plates, shop-riveted to their top flanges. One plate and four I-beams make a regular shop-riveted section, and the plates are joined over the center lines of every fourth I-beam, which is shop-riveted to one plate and field-riveted to the adjacent plate. Numerous holes are tapped through the plates for 2-in. drain pipes. The floor plates are not covered with ballast nor are they waterproofed except with paint, and the track rails are not laid on ties, but are secured by continuous longitudinal wooden-flange cover strips bolted to 15-in. channels countersunk-riveted to the floor plate. Each channel has a $6 \times 4 \times \frac{3}{4}$ -in. angle, with the 6-in. flange vertical, riveted to its inner flange to serve as a guard rail.

The bridge was designed by the engineering department of the Delaware, Lackawanna & Western Railroad, Mr. G. J. Ray, chief engineer, and Mr. A. E. Deal, bridge engineer. The structural steel work, weighing about 1,000,000 lb., was fabricated by the American Bridge Company and erected by the railroad company's forces.

Reinforced Concrete Ties.

Reinforced-concrete ties designed by Mr. L.

LOGARITHMIC DIAGRAMS BASED ON ISOPLETHE POINTS.

By H. A. Gehring, Assistant Engineer, Bureau of Hydraulics, New York Barge Canal Office.

There have appeared from time to time in the engineering periodicals, diagrams based on D'Ocagne's Principle of Isoplethe Points, but as far as the writer is aware, the principles on which the diagrams were based were not set forth sufficiently clear so as to bring the method of plotting into general use. It is for the purpose of analyzing and explaining the construction of diagrams by this method that the following discussion is presented.

On a horizontal axis AB , Fig. 1, are erected three perpendiculars at A , B and C , the point C being anywhere between A and B . The three variable quantities concerned are y , x and z , plotted on their respective perpendiculars. Assume the straight line yxz and note its intersection with the three axes, giving the points y , z and x . These points represent (according to special scales constructed on the verticals) simultaneous values of the variables, provided the geometrical construction of Fig. 1 is properly related to the equations between the variables. So also, by proper construction, it may be brought about

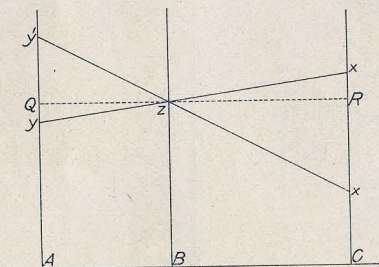


Fig. 1.

that any other straight line $y'z'x'$ will intersect the verticals so as to give another set of simultaneous values.

Evidently, in order to make this a general condition of things, it first must be possible to express the relation between certain functions of the variables in the form of a straight-line equation.

Straight-Line Equation.—The straight-line equation is an equation of the first degree. It is usually expressed as a two-variable relation, and in its slope form is as follows:

$$y = k + sx \quad (1)$$

Eq. 6 shows a negative slope, or the fact that as x increases, z decreases. Eqs. 4, 5 and 6 are only particular forms of the general equation 3. These equations apply to the plotting of Fig. 1. In this figure z is shown as constant, hence from Eq. 4

$$y = k + (n/m)x$$

This equation in another form would be

$$y = kx^{(n/m)}$$

which would not plot a straight except when $n/m = 1$.

Taking the logarithm of both sides, however, we have

$$\log y = \log k + (n/m) \log x \quad (7)$$

which will result in a straight line if $\log y$ and $\log x$ are plotted on ordinary cross-section paper instead of y and x themselves. Eq. 7 is the same thing as Eq. 4 and in all the equations so far developed we must remember that in each case the logarithm of the variable is meant and not the variable itself, the variable having been used merely for brevity until it could be demonstrated by Eq. 7 that the logarithm of the variable is what must really be plotted. In the subsequent illustration the notation will be that of the variables themselves, although their logarithms are actually plotted.

If Eq. 7 were plotted on two axes at right angles to each other, one straight line would result having a slope of (n/m) . It being, however, desirable to plot this equation on three parallel axes, one axis for the temporarily constant $\log z$, involved in $\log k$, for each different value of $\log y$, a differently sloped line results. This is only an apparently, although geometrically an actually differently sloped line. (n/m) is a constant, and numerically cannot have different values. The geometric change of the slope (n/m) is due to the construction. The slope is, however, maintained numerically constant by employing proper relative scales for the variables as deduced by combining their algebraic relations with the geometrical relation of the plotting.

Before doing this, Eq. 3 will first be written in the same form as Eq. 7, whence in general

$$m \log y = d \log z + n \log x \quad (8)$$

also for particular values

$$m \log y' = d \log z' + n \log x' \quad (8')$$

and

$$m \log y'' = d \log z'' + n \log x'' \quad (8'')$$

Geometrical Relations.—By similar triangles the following equations are readily verified, remembering that the logarithms of the variables are actually plotted, the notation, however, being