Solving for b,

$$b = 1.595\ H(P/nf)^{\frac{1}{2}} \qquad (41)$$

For 12 bolts and with same load and fiber stress as before,

$$b = 0.02377\ H \qquad (42)$$

For the general expression for any number of bolts and the same load and fiber stress,

$$b = 0.0823\ H(1/n)^{\frac{1}{2}} \qquad (43)$$

Comparison of Solutions: For a comparison of the solutions, take the case of 12 anchor bolts and assume B equals $3/2D$. Then the values for b are:

Solution 1: $b = 0.0193\ H$, from equation (30).
Solution 2: $b = 0.0112\ H$, from equation (37).
Solution 3: $b = 0.0237\ H$, from equation (43).

It is evident that the assumptions made in Solutions 1 and 3 will give stresses which will be too high, while Solution 2 will give stresses which will be too low as it neglects the stress in the bolts on the windward side which exists before the neutral axis of bending becomes coincident with the tangent on the leeward side. The probable true stress, therefore, would appear to lie between the extreme values given by the above solutions.

It is interesting to note that if B equals D, Solutions 1 and 3 give the same result.

Anchor bolts should always be upset at the threaded end and should extend nearly through the foundation with a nut and washer at the lower end.

Riveting.—A small rivet spacing should be used for all joints to insure tightness, being not less than 2.5 times the diameter of the rivet or more than 16 times the thickness of the plate. A single-riveted lap joint is commonly used for the vertical joints, while a double-riveted lap joint is used for the horizontal joints. It is very desirable that the horizontal joints should be water-tight, that the water running down the inside of the stack, which becomes strongly acid, may not get into the joints and cause corrosion, and also that the water may not run through the joint and give the outside of the stack a very untidy appearance.

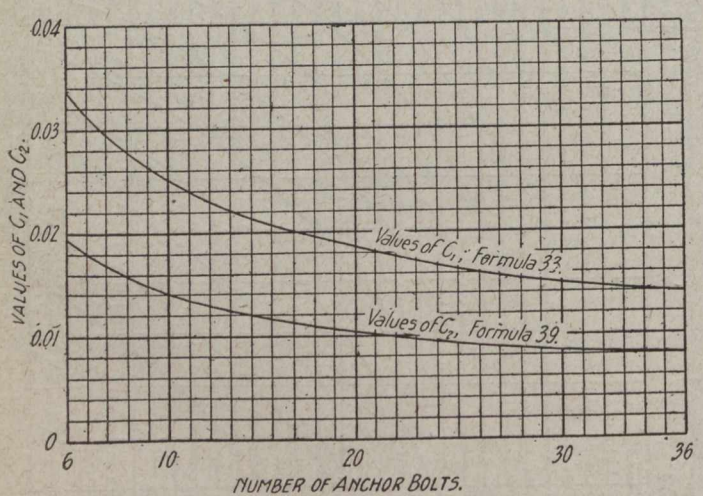

Fig. 5.

It will be found that the above recommended rivet spacings and joints will give ample strength at any section for direct stress or shear.

The connection of the shell to the base plate must be carefully investigated to insure a sufficient number of rivets to transfer the stress from the plates to the base plate. Equation (4) gives the stress per lineal inch along the circumference for a diameter D, therefore the stress per lineal inch at the base plate will be,

$$S' = 0.053\ PH^2/B \qquad (44)$$

From this equation the necessary rivet spacing is easily obtained.

Base Plate.—The base plate is commonly of cast iron, made up of sections from 20° to 180° of arc in length, which are firmly bolted together. The shell is riveted to the base plate and the anchor bolts pass down through it. Another form of base plate consists of a ring of angle iron around the inside of the shell, with short pieces of angles, placed vertically and in pairs that the anchor bolt may pass down between, riveted to the outside of the shell.

Each section of the cast base plate may be designed as a beam with a uniformly distributed load due to the wind pressure transferred through the plates, and two or more reactions due to the anchor bolts. The width of the base plate must be investigated also that the allowable bearing power of the concrete foundation be not exceeded.

Most authors have advocated a cut-and-try method for stack design, which might or might not involve many trials before a solution was obtained. The methods here presented should obviate this difficulty and lead to direct results.

THE TYPHOID TOLL.

Before the last annual meeting of the American Waterworks Association George A. Johnson, consulting engineer of New York, presented a noteworthy paper entitled "The Typhoid Toll." This paper was discussed by thirty-five representative physicians, engineers and sanitarians. The American Waterworks Association, in order to give this paper of Mr. Johnson's the widest possible circulation, together with the discussion, is issuing it in pamphlet form, and it will contain from 125 to 150 pages. It is a non-scientific treatment covering the general subject of typhoid fever, its causes and means of prevention. To give the information which the paper and discussion provided the widest possible circulation the association is offering to sell quantities of this pamphlet at a very reasonable price so as to bring it within the reach of everyone. Single copies up to a total of 100 will be sold for 20c. per copy or 25c. per copy if the discussion is included; 100 copies, $15 per hundred, $18.75 including discussion; 100 to 500 copies, $14 per hundred, or $17.50 with discussion; over 500 copies, $12.50 per hundred, or $15.75 with discussion. It is hoped that by this means the paper will be given great publicity and that it will help in the securing of a better water supply and better all round sanitary conditions in general. The copy containing the discussion is strongly recommended. This is a splendid opportunity for those who are concerned with matters of this kind to obtain a mine of good advice and sound information at a trifling cost, at the same time enabling them to disseminate information which is along the right lines, and it is hoped that great numbers of these pamphlets will be purchased and distributed.

J. M. Diven, Troy, N.Y., is secretary of the American Waterworks Association.

The railways which enter the city of Chicago have spent $100,000,000 upon the elimination of grade crossings within the city limits. When all the crossings shall have been eliminated the cost will be something like $200,000,000.