No. 776,758. PATENTED DEC. 6, 1904.

G. H. RHEUTAN.

BOILER SEAM.

APPLICATION FILED APR. 14, 1904.

NO MODEL.

Fig. 1.

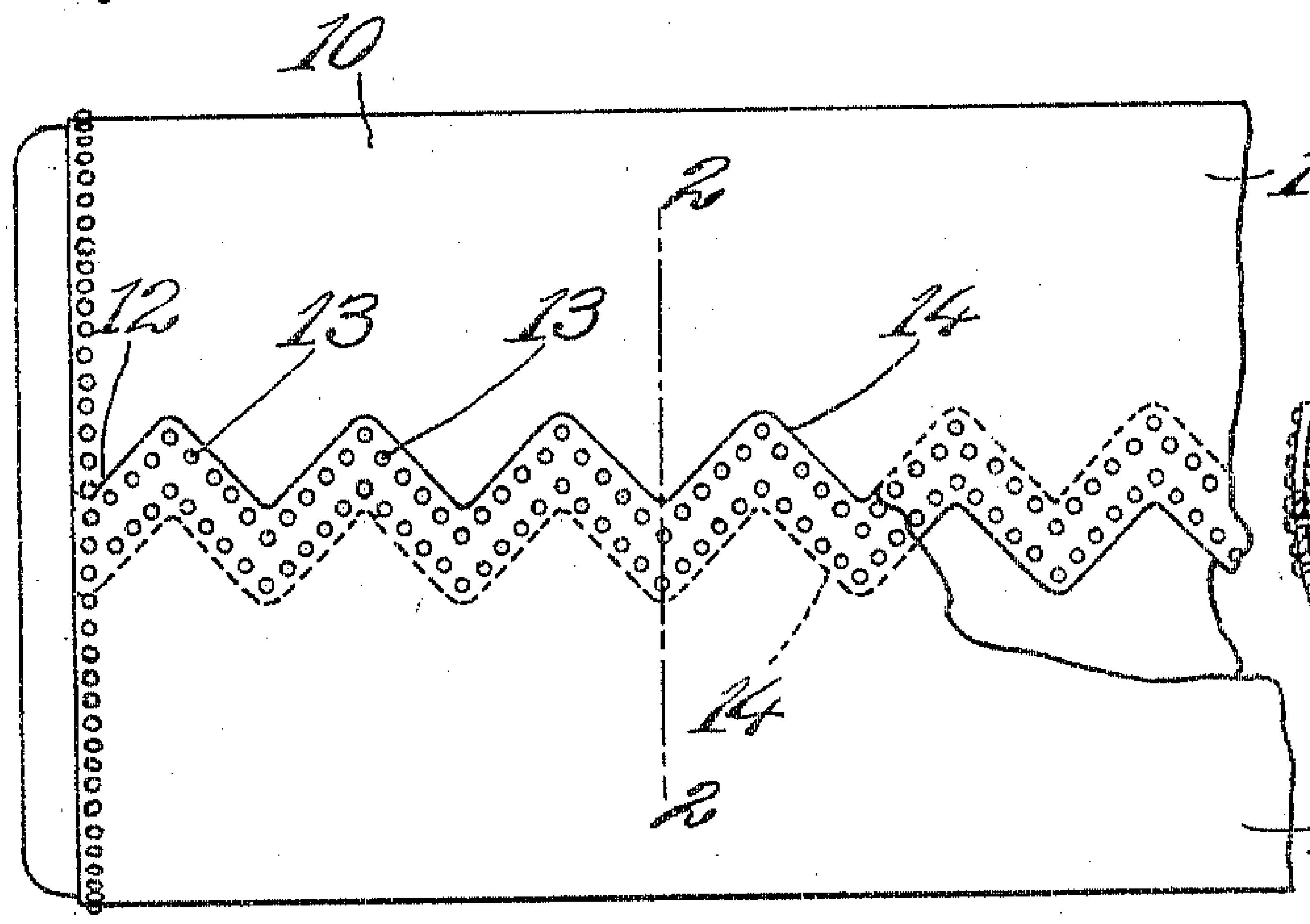


Fig. 2.

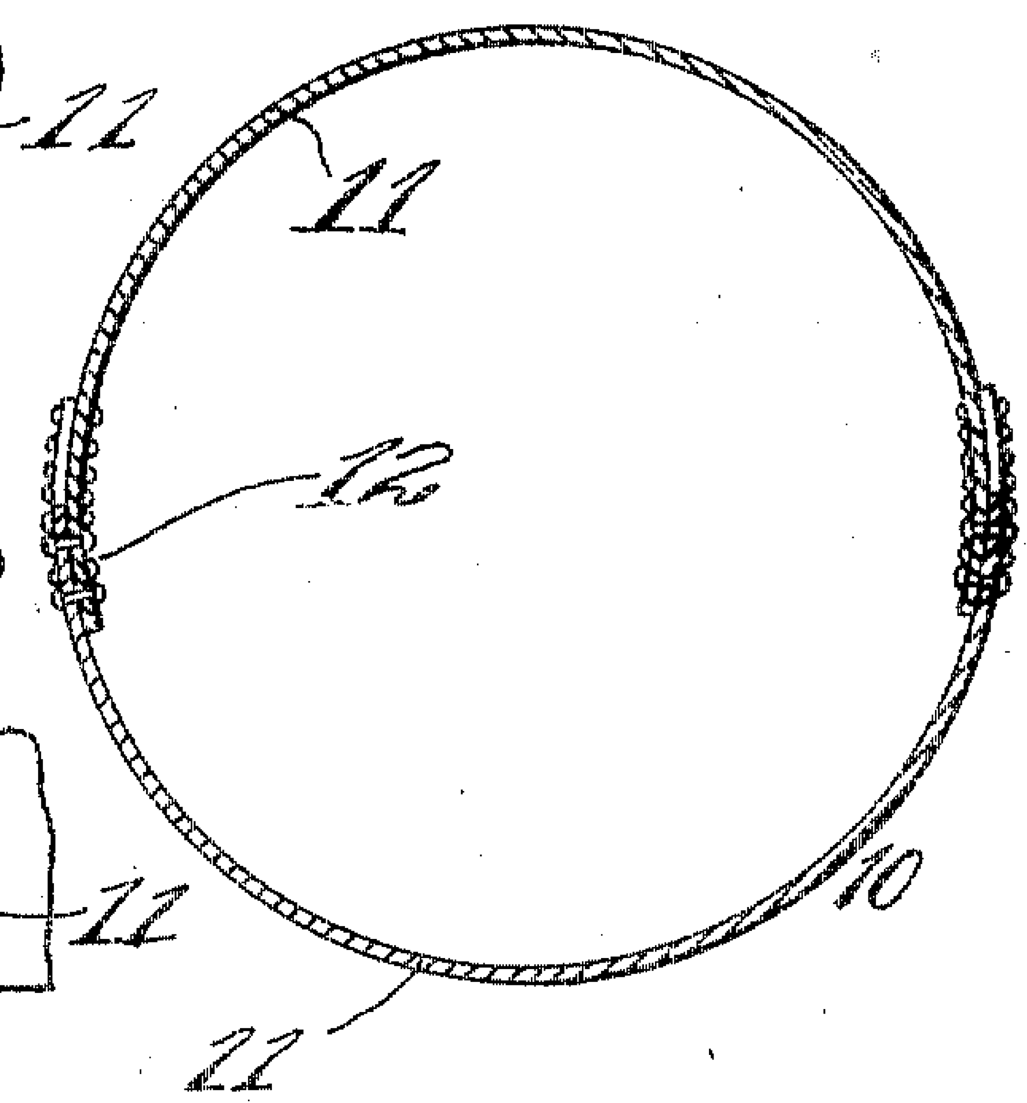
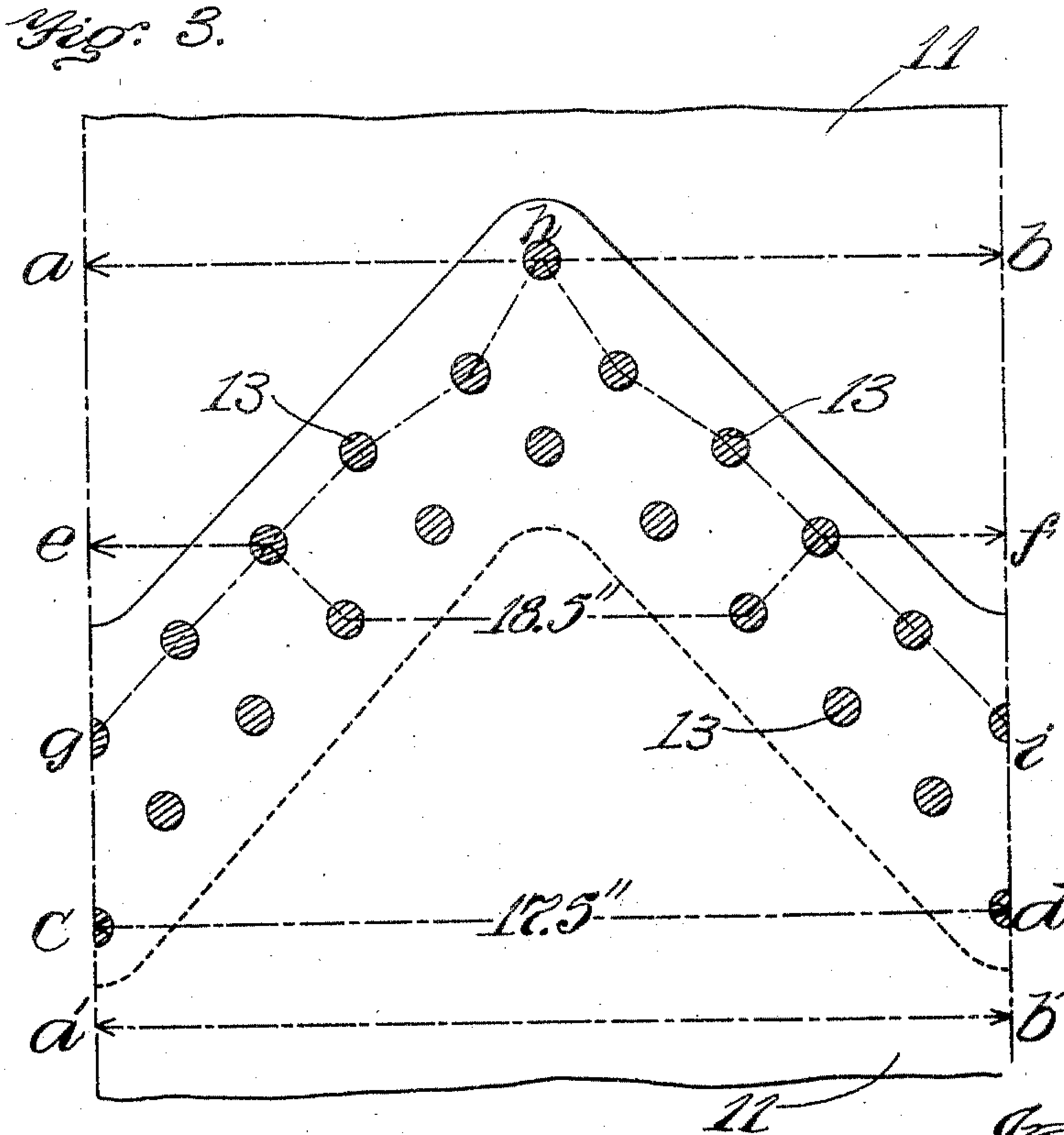


Fig. 3.



Witnesses:
P. W. Pezzetti
A. C. Ratigan

Inventor:
G. H. Rheutan.
by Wright, Brown & Quinby,
Attys.

No. 776,758.

Patented December 6, 1904.

UNITED STATES PATENT OFFICE.

GARRETT H. RHEUTAN, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO ROBERT B. LINCOLN, OF WALTHAM, MASSACHUSETTS.

BOILER-SEAM.

SPECIFICATION forming part of Letters Patent No. 776,758, dated December 6, 1904.

Application filed April 14, 1904. Serial No. 203,194. (No model.)

To all whom it may concern:

Be it known that I, GARRETT H. RHEUTAN, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Boiler-Seams, of which the following is a specification.

This invention relates to riveted seams of steam-boilers and other pressure vessels or structures subject to tensile strain; and it has for its object to attain greater strength in lapped seams than has heretofore been obtainable, thereby providing a form of joint which affords to the structure a degree of strength which has been obtainable only by the use of bulky and cumbersome butt or strap seams, an increased degree of elasticity, less weight, and a less-expensive form of construction. In steam-boilers this seam may be placed nearer to the fire than a butt or strap seam without danger, and its use dispenses, if desired, with the roundabout-seams heretofore employed in boilers.

The invention applies particularly to the outside shells or similar parts of boilers, which are subjected to a tensile strain tending to pull the edges of the plates apart at the seam.

Of the accompanying drawings, Figure 1 represents a side elevation of the shell or drum of a boiler or similar pressure vessel provided with a seam constructed according to my invention. Fig. 2 represents a transverse section thereof. Fig. 3 represents an enlarged view of one of the units or angles of the seam with the rivets in section.

The same reference characters indicate the same parts in all the figures.

In the drawings, 10 is a cylindrical shell made up of plates 11 11, having overlapping edges riveted together and forming longitudinal seams or joints 12. The rivets 13 are arranged in two parallel zigzag lines or rows composed of a series of arched units, one of which is enlarged in Fig. 3, the units preferably forming substantial right angles, as shown. I prefer also to form the edges 14 of the boiler-plates in zigzag or sinuous lines parallel to the lines of the rivets, as this saves material without sacrificing strength and increases the flexibility of the seam.

A seam of the above character exhibits a strength considerably above that of the ordinary lapped seam and equal to or exceeding the usual forms of butt-seams employing reinforcing straps, plates, or welts, besides being much lighter, flexible, and less expensive than the last said seams and capable of being subjected to the action of the fire without danger. My seam may be employed in connection with ordinary roundabout-seams, if desired—that is, by bending up single plates into the form of short cylinders having longitudinal joints constructed according to my invention, a number of these short cylinders being riveted together by roundabout-joints to form a complete drum or shell. It is permissible, however, and in general preferred to do away with the roundabout-seam and run the plates lengthwise of the boiler, as indicated in Fig. 1. This gives a much lighter and more flexible boiler, and although the seams 12 may be more or less subjected to the action of the fire there will obviously be a smaller number of rivets directly in the flame than would be the case with a number of seams occurring on the bottom of the boiler.

As is well known to those skilled in the art, certain requisites must be observed in making a riveted seam whose strength shall be the maximum obtainable with the particular design of seam and the minimum amount of material, and among these requisites are, first, a certain proportion between thickness of plate and diameter of rivet-hole. Thus with a boiler-plate of .375 inch thickness the rivet-holes should be about .78 inch in diameter. A second requisite is to have the shearing strength of the rivets in the seam substantially equal to or somewhat exceeding the tensile strength of a thickness of plate, since otherwise the rivets would give way to a strain before the plates would do so. Calculation will show that if this second requisite be preserved in a straight lapped seam having a single line of rivets the minimum pitch for the above given dimensions of plate and rivet would be about 1.75 inches, and the strength of metal remaining in the plate in any cross-section of a zone extending longitudinally of the direction of greatest tension can never exceed about 55.5 per cent. of the strength of a similar unperforated section of plate. If such a seam be double-riveted, a maximum strength of about 68.5 per cent. of that of the plate may be obtained. A third requisite is that the calking pitch must not exceed a certain maximum amount beyond which the plates would have a tendency to bow between the rivet when calked. This maximum pitch for the thickness of plate above assumed—namely, .375 inch—would be about 2.5 inches.

In the above calculations a tensile strength of plate of sixty thousand pounds to the square inch and a shearing strength of rivet of forty-six thousand pounds to the square inch has been assumed.

Examining Fig. 3, which represents a single unit of the joint, it is evident that the greatest strain or tension is exerted in lines which are parallel to a zone or parallel-sided strip of the shell extending vertically of the paper and having a width *a b*. The theoretical lines of fracture are therefore in general parallel to *a b*. Let it be assumed that the distance *a b* is equal to 17.5 inches, the thickness of the plates .375 inch, the diameter of rivet-holes .78 inch, the maximum calking pitch between centers of rivets 2.5 inches, and the lap of the plates 4.25 inches. The strength of the joint along various lines of possible fracture may then be examined. Along the lines *a b* and *c d* the metal removed by a single rivet-hole amounts to 4.46 per cent. of the total section of the plate along this line, and the strength of the plate along said line is therefore 95.54 per cent. of the strength of a similar section of imperforate plate. If a similar calculation be made for the fracture-line *e f*, it will be found that the total amount of linear inches of the two plates remaining after abstracting the diameters of the four rivet-holes crossed by this line amounts to about 18.5, which is obviously more than one hundred per cent. of the metal in the shortest imperforate section of the zone, such as *a' b'*. Similarly, it will be found that the strength of double plate along the line *g h i* amounts to about 99.7 per cent. of the strength of the imperforate section *a' b'*. By a like process it will be found that the percentage of strength of the plates along any other fracture-line between lines *a b* and *c d* is in excess of the strength along either of said lines *a b* or *c d*. The weakest fracture-line (there being two such fracture-lines in this instance) is therefore that which includes the smallest number of rivets. Thus the upper line *a b* includes one whole rivet and the lower line *c d* two half-rivets. Since there must be in any riveted joint at least one unsupported rivet for each unit along any fracture-line, it is evident that by the construction described I am enabled to make the joint of a strength corresponding to a fracture-line taken through single rivets pertaining to units of a length considerably increased over that heretofore attainable.

It will be observed that the number of rivets shown in Fig. 3 in the unit zone is twenty. With the dimensions of parts and strengths of materials hereinbefore assumed the aggregate shearing strength of the rivets therefore equals that of 19.32 inches of plate, so that the second requisite, as well as the other two requisites before referred to, are satisfied by the construction of my improved joint. It will be understood that the invention is not confined to the dimensions nor to the exact spacing, arrangement, or number of rivets per unit herein given. The construction of the joint is such that by increasing or decreasing the number of rivets in each unit by adding rivets to or subtracting them from the base of the pyramid or triangle the percentage of strength of the joint may be increased or diminished. This is equivalent to saying that the strength of the joint increases as the relative length of the units increases, and vice versa.

It is apparent that the serration of the edge of at least one of the overlapping plates is an important feature with respect to the calking of my improved form of joint applied to a pressure vessel. The apex rivets of the several units are too far apart for proper calking if the edge of the plate is made a straight line, and accordingly the plate whose edge is to be calked is made to follow the line of rivets nearest its edge in order that the plate may be calked without bowing between rivets. In general the outer plate, such as the one whose edge is uppermost in Fig. 1, is the one to be calked.

I claim—

1. A pressure vessel having a pressure-retaining wall including a pair of overlapping main shell-plates subject to tensile strain, and a zigzag series of rivets connecting the margins of said plates, the arrangement being such that the weakest fracture-line of the joint is that which includes the least number of rivets.

2. A pressure vessel having a pressure-retaining wall including a pair of overlapping main shell-plates subject to tensile strain, and a zigzag double row of rivets connecting the margins of said plates.

3. A pressure vessel having a pressure-retaining wall including a pair of overlapping plates subject to tensile strain, and a zigzag series of rivets connecting the marginal portions of said plates, said portions having sinuous edges substantially parallel to the line of the rivets.

4. A boiler or other pressure vessel comprising a plurality of longitudinal plates form-

ing an outwardly-convexed tubular shell and having longitudinal overlapping margins connected by a zigzag line of rivets.

5. A riveted lapped joint comprising overlapping main wall-plates subject to tensile strain and connected by a series of rivets arched across a zone extending longitudinally of the direction of greatest tension, the weakest fracture-line of the joint being that which includes the smallest number of rivets.

6. A riveted lapped joint comprising overlapping main wall-plates subject to tensile strain, and an angular series of rivets arched across a zone extending longitudinally of the direction of greatest tension, said series consisting of rivets at the apex and ends of the arch and intermediate rivets along the sides thereof.

7. A riveted lapped joint comprising overlapping main wall-plates subject to tensile strain, a row of rivets next the edge of one of said plates arched across a zone extending longitudinally of the direction of greatest tension, and a second row of rivets arched across said zone and substantially parallel to the first said row.

8. A pressure vessel having a pressure-retaining wall including a pair of overlapping main shell-plates subject to tensile strain, a zigzag row of rivets connecting said plates and having apex rivets at a greater distance apart than the proper calking pitch, and a sinuous calked edge portion on one of the plates following the line of rivets, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

GARRETT H. RHEUTAN.

Witnesses:
R. M. PIERSON,
A. C. RATIGAN.