O. H. MUELLER.

COOLING TOWER.

APPLICATION FILED APR. 9, 1910.

989,631.

Patented Apr. 18, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

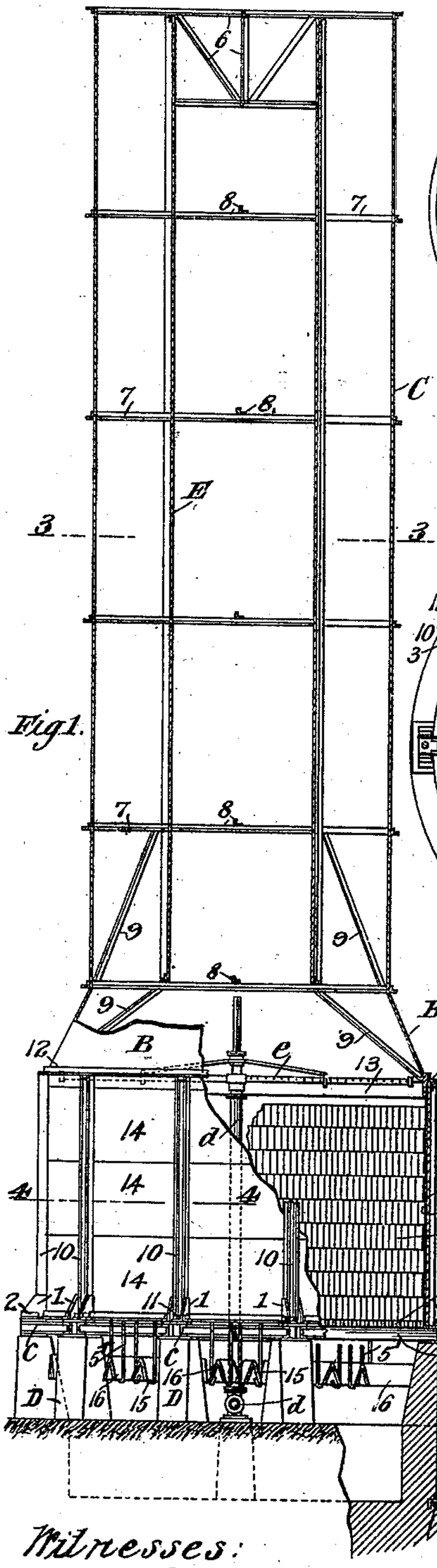


Fig. 2.

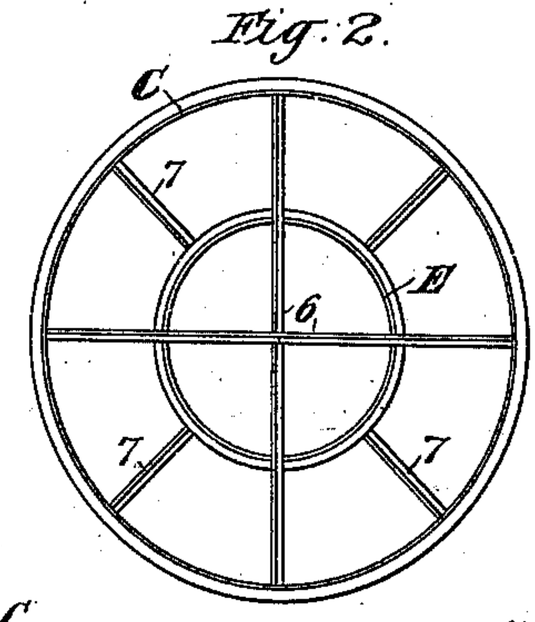


Fig. 3.

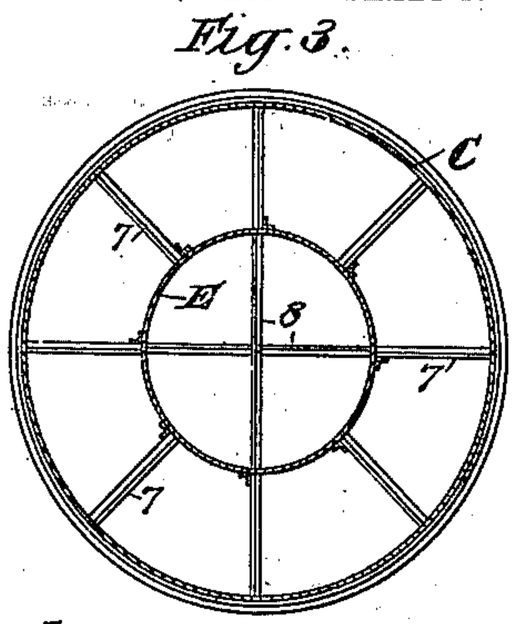


Fig. 4.

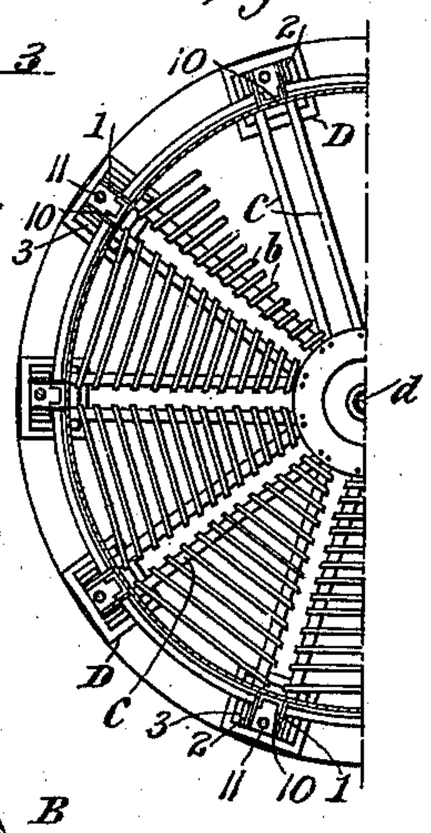


Fig. 5.

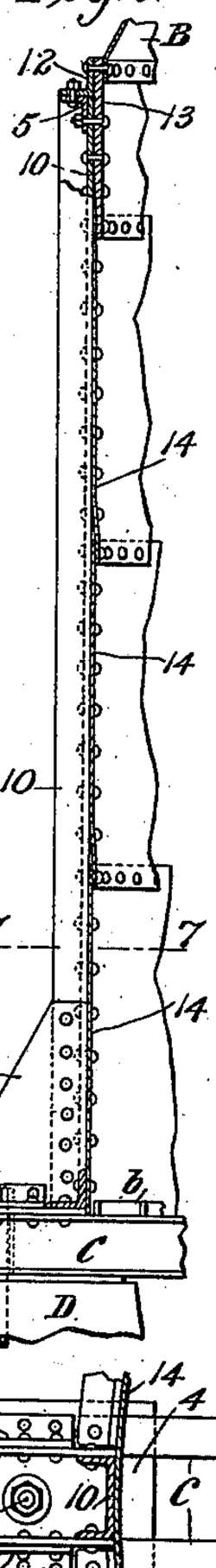
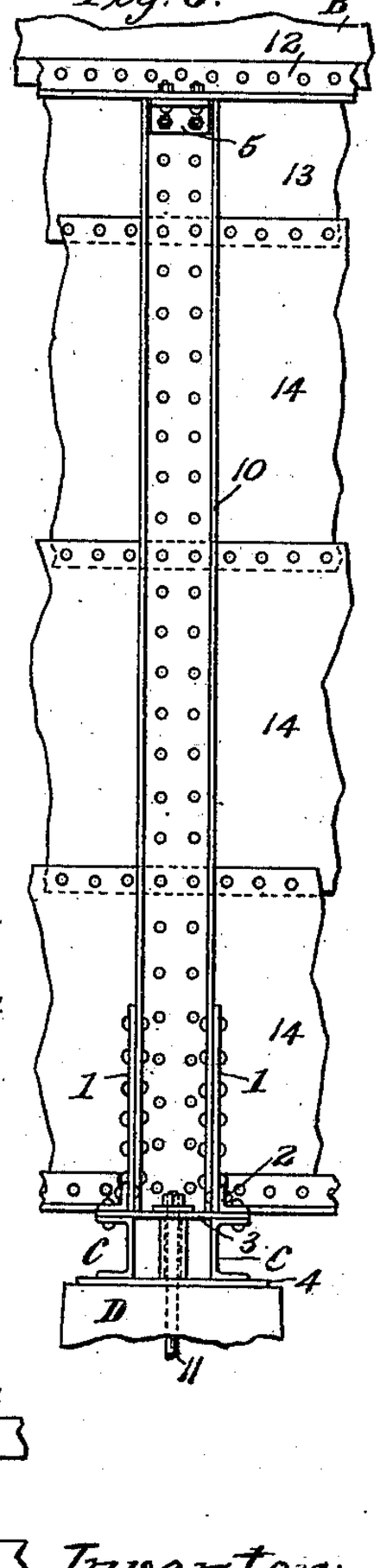


Fig. 6.



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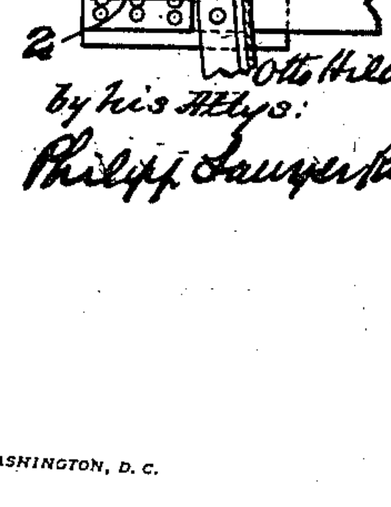

Witnesses:
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P. A. Tilden

Inventor:
Otto Hildebert Mueller
by his Attys:
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2 SHEETS—SHEET 2.

Fig. 8.

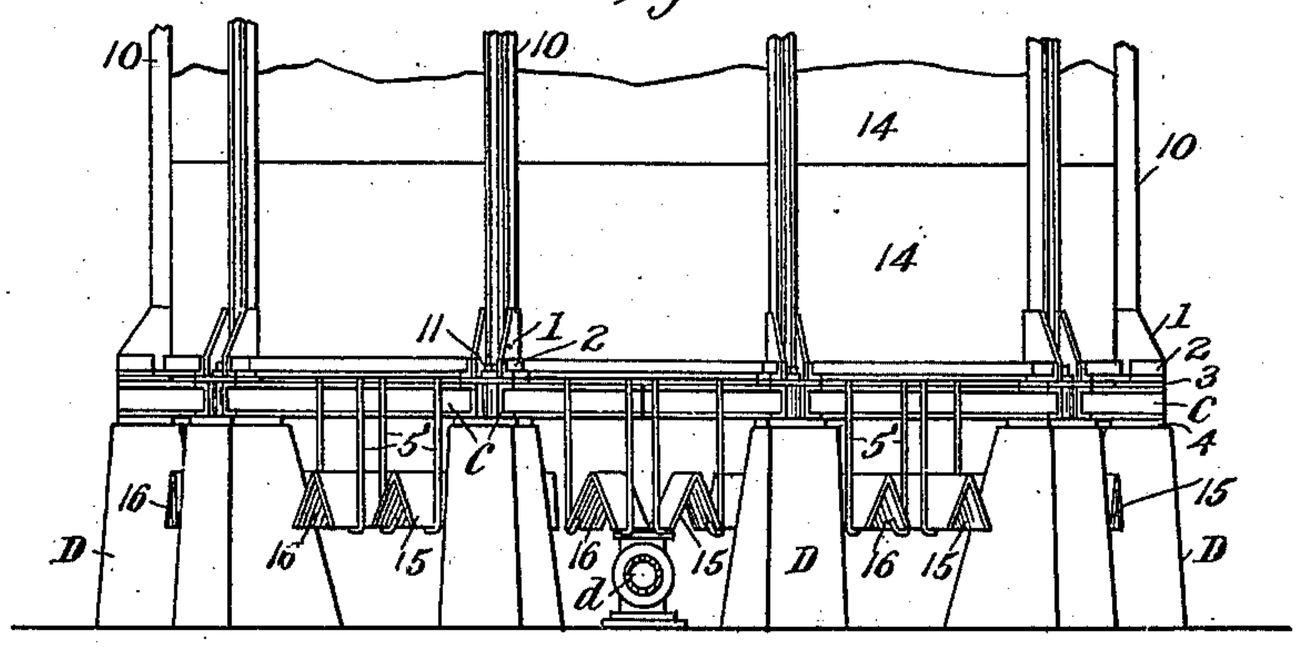
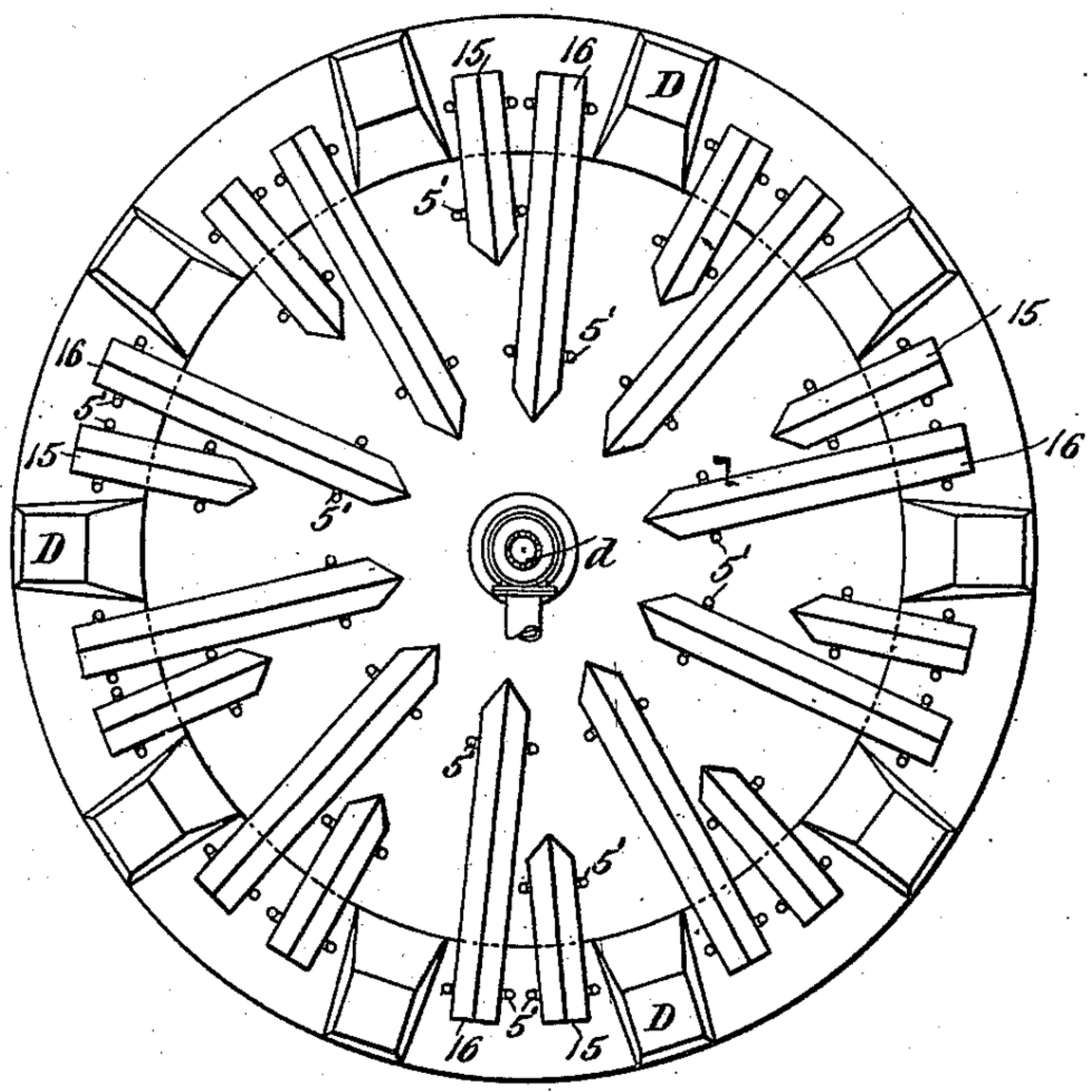


Fig. 9.



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UNITED STATES PATENT OFFICE.

OTTO HILDEBERT MUELLER, OF CAMBERWELL, ENGLAND, ASSIGNOR TO HENRY R. WORTHINGTON, A CORPORATION OF NEW JERSEY.

COOLING-TOWER.

989,631. Specification of Letters Patent. **Patented Apr. 18, 1911.**

Application filed April 9, 1910. Serial No. 554,334.

To all whom it may concern:

Be it known that I, OTTO HILDEBERT MUELLER, a subject of the German Empire, residing at 73 Sydenham Hill, Camberwell, county of Kent, England, have invented certain new and useful Improvements in Cooling-Towers and the Like, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to towers of that class used for cooling towers, air coolers and similar purposes, in which a system of filling is used to aid the exchange of heat between a liquid trickling downward over the filling and an air or gas current traveling upward, the invention being intended especially for use in large cooling towers such as are now used for cooling the water for condensation in large steam plants.

The object of the invention is to provide an improved construction of tower shell by which parts liable to rust or corrode can be renewed conveniently and cheaply, and further to secure an improved distribution of air to the bottom of the tower and an improved draft in large towers.

It is found in practice that, especially with water or gases containing acids, that portion of the steel or iron shell which surrounds the filling is liable to rust or corrode, thus weakening the tower, especially against wind pressure, so that it becomes necessary to renew the whole bottom portion of the shell, which is a very awkward and expensive operation on account of the large weight resting upon it.

One feature of the present invention consists in providing means for carrying the upper portion or chimney of the tower so that the lower portion of the shell may be formed of plates as thin as is suitable for inclosing the filling, and the plates can readily be removed and replaced by others if corroded, without interfering with the rest of the tower.

Other features of the invention relate to an arrangement of air ducts for distributing the air over the bottom of the cooling tower, so as to secure the proper action throughout the tower, and to the division of the chimney into a plurality of flues so as to avoid interference with the draft by eddies and counter currents which are liable to occur in flues of the size required for large cooling towers.

In the accompanying drawings forming part of this specification a construction embodying all the features of the invention in their preferred form is shown for the purpose of illustration; and this construction will now be described in detail and the features forming the invention then specifically pointed out in the claims.

In the drawings Figure 1 is a sectional elevation of the tower. Fig. 2 is a plan view of the same. Fig. 3 is a horizontal section on the line 3 of Fig. 1. Fig. 4 is a horizontal section on the line 4 of Fig. 1, with the filling removed. Figs. 5 and 6 are, respectively, a detail section and elevation showing the construction of the lower portion of the tower. Fig. 7 is a cross-section on the line 7 of Fig. 5. Fig. 8 is an elevation of the lower portion of the tower on an enlarged scale showing the air ducts. Fig. 9 is a plan view below the tower showing the arrangement of the air ducts.

Referring to said drawings, the cooling tower is shown as of circular form, the lower portion A of the shell inclosing the filling and being connected by the tapered portion B to the upper portion or chimney C of the tower. The lower portion A contains the filling *a*, which may be of any suitable form, but as indicated in the drawing consists of a great number of cylindrical pipes or tubes built up in several layers. This filling *a* is supported by the grating *b*, which is shown as laid on the girders *c* which rest on piers of masonry D forming the base of the tower. The water to be cooled is admitted through the inlet pipe *d* which passes up centrally through the filling and connects with the distributer *e* above the filling which is shown as a rotary distributer of common form.

Referring now to the construction of the lower portion A of the shell inclosing the filling, 10 are a series of vertical columns, preferably of channel iron, as shown, extending upward from the girders *c* to the top of the shell portion A. At their lower ends these columns 10 are connected to the girders *c* by plates 1, angle irons 2, and bottom plates 3, which bottom plates are bolted through the girders *c* and foundation plates 4 to the piers D by anchor bolts 11. At

their upper ends the columns 10 are bolted to a ring 12, preferably formed of angle iron, as shown, to which the columns 10 are bolted by angle irons 5, and the columns and ring 12 are bolted to a ring of plates 13, which are thick steel plates acting to form, with the columns, a rigid framework, stiffening the lower portion of the tower and supporting the inclined portion B and chimney C. The framework thus formed is covered to inclose the filling by thin steel plates 14 which are riveted or bolted on the inside of the columns 10 from the plates 13 down to the girders *c*, thus inclosing the lower portion of the tower containing the filling. These plates 14, when corroded, can readily be taken out and replaced, while the columns 10 with the ring 12 and plate 13 support the middle and upper portion of the shell, these plates 14 not being relied upon for support but only for inclosing the filling.

In order to secure the proper distribution of the air entering the bottom of the tower, so as to obtain a uniform action over the whole tower area, multiple air ducts are used, as shown in detail in Figs. 8 and 9. These air ducts, as shown, consist of simple roofs of wood or sheet metal extending inward beneath the tower, and acting to divide the rain of water falling from the tower so as to maintain free passages for the air to the interior portion of the tower area. As shown, these roofs forming the air ducts are arranged in two series, a shorter series, 15, and a longer series, 16, the longer series providing for the passage of the air to substantially the center of the tower, and the shorter ones to the portion between the center and the circumference, while in the outer portion of the tower air is entering direct through substantially the whole circumference. These roofs forming the air ducts may be supported in any suitable manner, but are shown as arranged between piers D and hung from the girders *c* by wire hangers 5′.

In very large towers having chimneys of large diameters, the draft may be interfered with by eddies and counter currents, and to avoid this and secure proper and uniform draft action the chimney is preferably divided into a plurality of flues, which may be done by partitions arranged in any suitable manner either concentrically or radially. As shown, the chimney is divided by an inner shell E into two concentric flues within the outer shell C. In these large towers, also, suitable bracing is required to secure the desired strength, especially against wind pressure. In the construction shown, the outer shell C is braced at the top by the cross and diagonal struts 6, and the inner shell E is braced and the two shells tied together at intervals throughout the height of the chimney by cross struts 7, extending between the inner and outer cylinders, and similar struts 8 extending through the inner cylinder. The lower end of the chimney and the tapered portion B of the tower are also preferably braced by diagonal struts 9, as shown.

While the invention has been shown as applied in a cooling tower having a circular shell, it will be understood that the invention is applicable also in cooling towers having polygonal shells, and other modifications may be made in the construction shown without departing from the invention as defined by the claims.

What I claim is—

1. A tower of the class described, having an open metal frame work extending through the filling portion of the tower and supporting the upper portion of the tower, and thin plates removably secured on said framework and inclosing the filling.

2. A tower of the class described, having the lower filling portion formed of a series of metal columns secured to the base of the tower and tied together at the top to form a structure supporting the upper portion of the tower, and thin metal plates removably secured to the columns and inclosing the filling.

3. In a tower of the class described, the combination with the piers and base girders thereon, of metal columns extending upward through the filling portion of the tower and anchored to the girders and piers, a ring of tie plates at the top of the columns, a chimney secured to and supported by the columns and tie plates, and thin metal plates secured to said columns and inclosing the filling.

4. In a tower of the class described, a plurality of sets of air ducts at the bottom of the tower, the ducts of the different sets being of different lengths and arranged to admit air to different portions of the tower and to provide for the admission of air direct to the outer portion of the tower.

5. In a tower of the class described, the combination with the filling, liquid supplying means, and air or gas inlets below the filling, of a draft chimney above the filling divided into a plurality of vertical flues.

In testimony whereof, I have hereunto set my hand, in the presence of two subscribing witnesses.

OTTO HILDEBERT MUELLER.

Witnesses:

H. D. JAMESON,

R. J. WILLIAMS.