J. O. OLSON & W. W. GRANT.

METHOD OF FORMING CLOSED CONTINUOUS SPIRAL CHAMBERS FROM SHEET METAL.

APPLICATION FILED APR. 7, 1911.

1,029,310.

Patented June 11, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

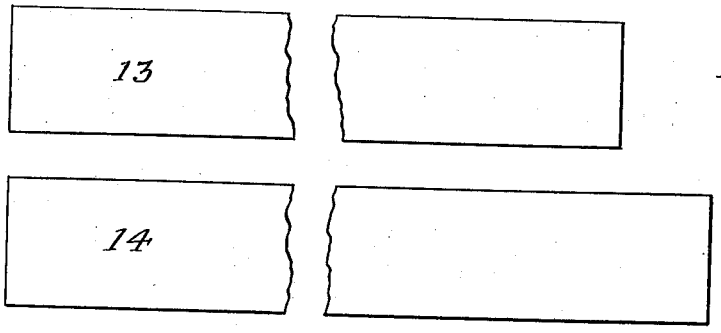


Fig. 2.

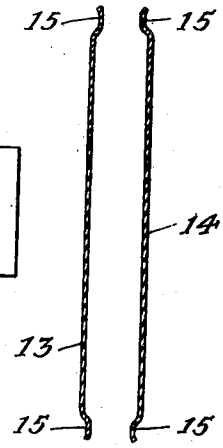


Fig. 3.

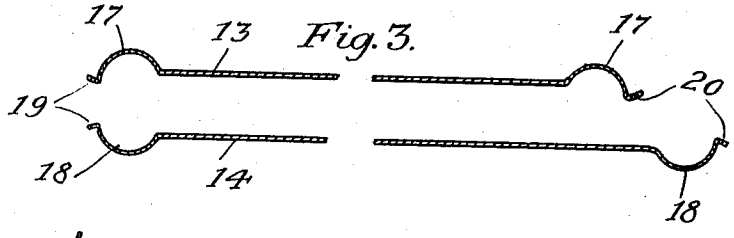


Fig. 4

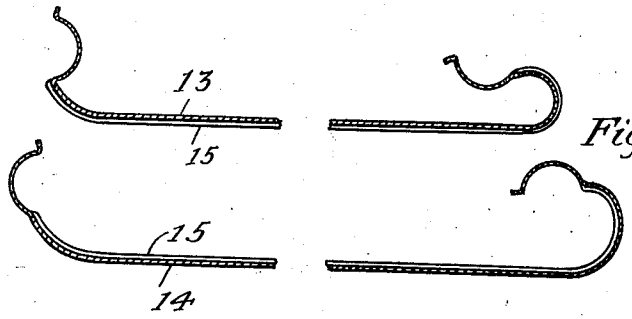


Fig. 5

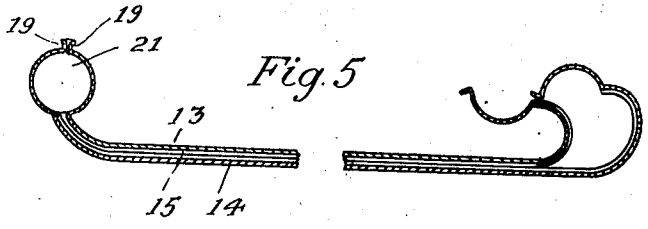


Fig. 6.

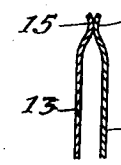


Fig. 7.

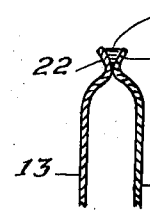
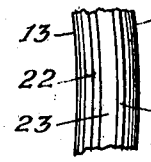


Fig. 8.



Witnesses:
Theo. Lagaard.
H. U. Bowman.

Inventors:
John O. Olson.
Willis W. Grant.
By F. A. Whiteley
their Attorney.

J. O. OLSON & W. W. GRANT.

METHOD OF FORMING CLOSED CONTINUOUS SPIRAL CHAMBERS FROM SHEET METAL.

APPLICATION FILED APR. 7, 1911.

1,029,310.

Patented June 11, 1912.

2 SHEETS—SHEET 2.

Fig. 11.

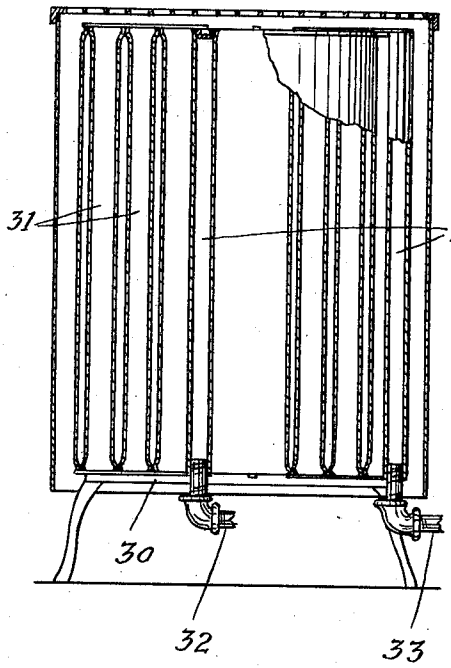
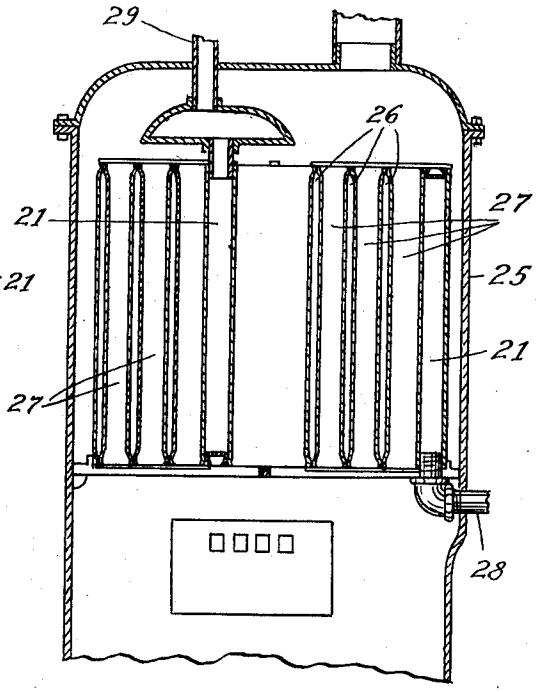


Fig. 10.



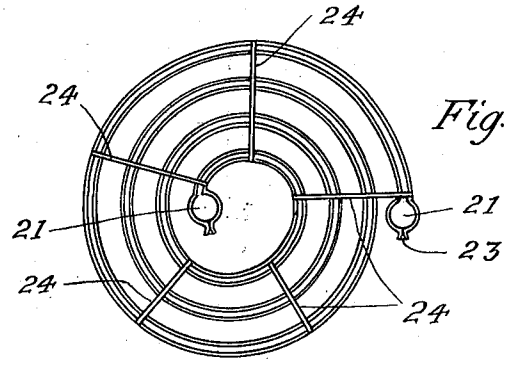


Fig. 9.

Witnesses:
Theo. Lagaard.
H. A. Bowman.

Inventors:
John O. Olson.
Willis W. Grant.
By F. A. Whiteley
their Attorney.

UNITED STATES PATENT OFFICE.

JOHN O. OLSON AND WILLIS W. GRANT, OF ST. PAUL, MINNESOTA, ASSIGNORS TO SPIRAL RADIATOR COMPANY, OF ST. PAUL, MINNESOTA, A CORPORATION OF ARIZONA.

METHOD OF FORMING CLOSED CONTINUOUS SPIRAL CHAMBERS FROM SHEET METAL.

1,029,310. Specification of Letters Patent. Patented June 11, 1912.

Application filed April 7, 1911. Serial No. 619,538.

To all whom it may concern:

Be it known that we, JOHN O. OLSON and WILLIS W. GRANT, citizens of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Methods of Forming Closed Continuous Spiral Chambers from Sheet Metal, of which the following is a specification.

Our invention relates to a method of forming a continuous closed spiral chamber of comparatively shallow and wide cross section from sheets of galvanized steel or other sheet metal, and has for its object to produce such a chamber in such manner that the sheets will be symmetrically curved without kink or other imperfection, held properly spaced in parallel relation and have their edges united so as to form a steam tight junction without the use of filler strips or other means of spacing than the seam itself.

It is an especial object of our invention to produce such a spiral chamber economically and having the above characteristics for use as a rapid heater in an instantaneous water heater or the boiler of a heating system, and also to be used as a radiator or heat delivering device in connection with such a system.

To this end our invention additionally provides a method of forming such a spiral chamber having expanded portions preferably of practically cylindrical shape extending along the inner and the outer ends of said chamber and formed of the same sheets which form the side walls of the chamber so that said expanded portion opens into said chamber throughout its length.

It is also an object of our invention to provide a new and improved seam or joint for holding said sheets of material together at the edges thereof and yet spaced apart without the use of filler strips, said seam or joint being effected by uniting the sheets by means of metal welded to said sheets.

It has been proposed to form spiral chambers for the uses above specified either by flattening out a tube and coiling the same in spiral form or by securing two plates in spaced relation and fastening the edges thereof by rivets or other steam tight seam and then forming said two sheets so fastened into a spiral coil. The first of these methods is practical only for a coil of very narrow width and comparatively light material. The second method is wholly impracticable since the sheet forming the outer side of the spiral chamber must be materially longer than the sheet forming the inner side. An attempt therefore to coil two sheets after the same have been secured together around the edges will inevitably result in buckling of the inner sheet such that folds of the same will intrude within the chamber and break the continuity thereof, which is a necessary feature of such a chamber to be used for the purpose stated. It is an important feature of our invention, therefore, that we have devised a method of securing together the sheets forming the inner and outer walls of our spiral chamber after said sheets have been placed in proper relative position and coiled into the desired spiral form.

The drawings are included as illustrating the successive changes in the material used as the spiral chamber is formed through the application of our method, and the figures of said drawings will be referred to as the different steps in the method are described. Also applications of the complete spiral chamber are shown.

Figure 1 represents a plan view of two sheets of metal showing that one is longer than the other. Fig. 2 is a transverse sectional view of such sheets, on a much larger scale, after the first operation of bending the edges to prepare for forming the joints or seams has been performed. Fig. 3 shows how the sheets may be formed with expanded portions at each end when it is desired to provide the spiral chamber with enlarged passages connected to the ends of said chamber throughout the length thereof. Fig. 4 illustrates the manner in which the plates are separately turned up at each end after the seaming operation shown in Fig. 2, preparatory to assembling said plates. Fig. 5 shows the plates assembled and secured together at one end preparatory to forming a spiral. Fig. 6 is a sectional view showing the relation of the plates as the spiral is formed. Fig. 7 is an edge view showing the manner in which the flanges at the edge of the plates are set down and opened to space the plates apart and to provide the valley for the binding seal of metal. Fig.

8 is a top view of one of the finished seams of joints. Fig. 9 is a top view of the complete spiral chamber. Figs. 10 and 11 are sectional elevations showing the application of our method in the construction of a boiler and a radiator, respectively.

The first step in the process of forming the spiral chamber is to cut two sheets of metal 13 and 14, which will be of the same widths, in the proper lengths to form the inside and outside walls, respectively, of said chamber. The exact relative lengths to be employed may be determined both experimentally and mathematically and of course will vary in accordance with the size of the chamber and the distance apart at which the said walls are spaced. In general it may be said that for the purposes above enumerated the best results are obtained by forming the chamber with the walls thereof spaced very close together, a maximum distance of from one-half of an inch to one inch being found to give the best results. It is usually necessary to use comparatively heavy sheet metal to withstand the internal pressure to which the walls of the spiral chamber are subjected, and our method is especially adapted to operate upon such heavy sheet metal, although equally good results may be obtained with lighter grades of material, and some steps may be omitted when the spiral chamber is formed of light material.

After the sheets have been cut to the proper relative lengths each sheet is creased along each side edge thereof to form shallow flat-topped bends 15, as shown in Fig. 2, the purpose of making these bends flat-topped being that when the sheets are placed in contact before rolling to form the spiral the flat surfaces of the bends will come together and will prevent the sheets from slipping to either side, thus holding them in proper relative position during the binding operation. If desired, this step need not be employed when working with light sheet metal.

Where the spiral chamber is to be used as a means in which to heat, or deliver heat from, some heat conveying medium, such as water or steam, which is the general end we have in view in our construction, it will be desirable to provide each end of the chamber with an expanded portion opening throughout its length directly into the chamber and adapted to conduct to or from said chamber the said heat conveying medium. To provide such an expanded portion, after the creasing described in Fig. 2, each of the sheets 13 and 14 will have formed at the ends thereof across said sheets semi-circular depressions 17 and 18, respectively, having flaring flanges 19 and 20, said depressions and flanges being formed symmetrically in the two respective plates so that when said plates are brought together so that the bases of said flanges contact the depressions 17 and 18 will form a substantially tubular expanded portion 21, as shown in Fig. 5. If it is not desired to form the spiral chambers with the tubular expanded portions 21 this step in our method may, of course, be omitted; that is, the flanges alone will be formed.

Each of the sheets 13 and 14 is now bent to form a partial coil at each end thereof, as shown in Fig. 4, the coils at one end being somewhat larger than at the other and the coils of the outside sheet 14 being preferably larger than those of the inside sheet 13. The sheets are then placed in position, sheet 13 upon sheet 14, as shown in Fig. 5, and secured together at the end thereof by filling the valley formed between the flanges 19 with brass or other metal and subjecting the same to a high degree of heat so that said filling metal may be firmly welded to the sheet metal forming said flanges 19. This particular seam we have found peculiarly effective in binding together sheets of metal and we use it for binding all of the edges of the sheets forming our spiral chamber. After securing the flanges 19 in the manner described the two sheets 13 and 14 are simultaneously formed into a spiral by means of rolling or otherwise, the coils so formed being kept properly spaced from one another during the operation of forming the spiral so that when the same is completed they will have something the shape shown in Fig. 9, the sheets 13 and 14 and the bend 15 occupying relative positions, such as shown in Fig. 6.

The two sheets 13 and 14 will, of course, be joined only at one end thereof and will lie loosely in contact with one another throughout the spiral coil. The bends 15, or, if no such bends have been formed previous to rolling, the edges of the sheets, are now each separately set down and turned back to form flanges 22, as shown in Fig. 7, this operation serving not only to space the sheets 13 and 14 the proper distance apart but also to form a small V-shaped valley 23 along the edges, which valley is now filled with metal and welded to the metal of the flanges 22 of the sheets 13 and 14 to form the same joint or seam as was formed with the flanges 19.

By means of the steps of forming into a spiral and setting down the bends 15, the flanges 20 at the other ends of the sheets 13 and 14 will have been brought into junction. These flanges are seamed together at 23 in the same manner as the flanges 19. Spacing blocks may be placed between the coils of the spiral to hold the same rigidly in position and tie-rods 24 will be secured to the top and bottom edges of the coils to hold the spiral coils in fixed position. If

said chamber has been formed without the expanded portions 21 it will now be completed. If, however, such expanded portions have been provided, one end thereof will preferably be sealed by brazing or otherwise securing thereto a metal cap, the other end being provided with a union for connection to a supply pipe.

In forming the welded metal seam we preferably use brass or some similar metal, and have found it convenient to feed the same to the valley formed at the edges of the sheets from a wire provided for that purpose, using an oxy-acetylene flame, or some similar means for producing the desired high temperature, to melt the filling metal and cause the same to weld firmly to the metal of the two sheets. The welding will be effected progressively along said seams from end to end thereof, the sheets being held so that the bases of the flanges will engage properly by clamps or spacing blocks. We have found that a seam produced in this manner gives most satisfactory service, the sheets themselves breaking from torsion and twisting of the union while the joint or seam remains intact. We do not, however, wish it to be understood that we limit ourselves to this precise form of securing the edges of the sheets after the spiral chamber has been formed, as it lies within the scope of our invention to use other means to join said edges. We contemplate in some instances to roll and position the sheets of metal while the same are unconnected so as to form said spiral chamber and then to seal the ends of the coils and secure the plates together by metal such as iron or brass cast directly upon said ends.

The illustration in Fig. 10 shows an adaptation of a spiral chamber formed in accordance with our method to purposes of heating water or generating steam within a furnace. The spiral chamber is arranged within the furnace casing 25 so that the coils 26 thereof extend vertically and the intervening passages 27 are entirely open at the top and bottom thereof so that the gases of combustion may flow freely in surrounding relation with the entire exterior surface of the walls of the spiral chamber. The expanded passage 21 at the exterior end of the spiral chamber is connected with a return pipe 28 at the bottom of said passage 21, and the expanded passage 21 in the interior of said spiral is connected at its top with a riser 29, said riser 29 and return pipe 28 forming the connections which place said spiral chamber in a circulating system for a heat-conveying medium in heating the rooms of a building.

In Fig. 11 is shown an application of our spiral coil to a heat-delivering member forming a part of such a circulating system. Like the coil in the furnace, the spiral chamber is placed on edge upon a supporting standard 30 and held spaced from the floor so that the air in the room may circulate through the passages 31 between the walls of said spiral chamber and extract the heat units from the heat-conveying medium and convey the same by convection throughout the room, the expanded portions 21 being connected by means of supply pipe 32 and return pipe 33 at the bottom ends of the inner and outer expanded passages, respectively, to place said heat-delivering spiral chamber in said circulating system.

Our method of uniting sheets of metal by a seam consisting of a valley formed by outwardly flaring bends along the edge of each sheet, said sheets contacting at the bases of said bends and the valley being filled with metal welded to the metal of each sheet, is especially adapted to use in the formation of a spiral chamber having the characteristics and adapted to the uses above enumerated; but we wish it to be understood that we do not limit the use of such seam to the formation of such spiral chambers but intend to claim the same broadly for use in any connection where it is desirable to unite sheets of metal by an enduring and steam-tight joint capable of meeting conditions of heavy wear and extensive pressure.

We claim:

1. The method of forming a closed continuous spiral chamber from sheet metal, which consists in cutting two sheets of different lengths to form the outer and inner walls of said chamber, placing said sheets in proper relative position and forming the same concurrently into a spiral, thereafter, and while said sheets are contactingly held in said spiral coil, forming in proximity to the adjacent edges of said sheets inwardly extended contacting corrugations to effect separation of the sheets and hold the same spaced from one another the desired distance throughout the extent of the spiral coil, and securing said sheets along all the edges thereof so as to form a steam-tight joint.

2. The method of forming a closed continuous spiral chamber from sheet metal, which consists in cutting two sheets of different lengths to form the outer and inner walls of said chamber, placing said sheets in proper relative position and forming the same concurrently into a spiral, thereafter, and while said sheets are contactingly held in said spiral coil, forming in proximity to the adjacent edges of said sheets inwardly extended contacting corrugations, the formation of said corrugations operating to effect separation of the sheets and hold the same spaced from one another the desired distance and to provide seaming valleys extending along the edges of said spiral coil, and uniting said edges so as to form a steam-tight joint by filling said valleys with metal and

welding said metal to each sheet by application of intense heat.

3. The method of forming a closed continuous spiral chamber from sheet metal, which consists in cutting two sheets of different lengths to form the outer and inner walls of said chamber, forming on each side of said sheets independently a flat topped shallow bend, placing the sheets in position so that the flat tops of said bends will engage, securing said sheets together along one end thereof, forming the two sets of sheets concurrently into a spiral of the desired form, additionally bending said side edges to space the sheets apart and form means of securing said side edges together, and securing the sheets along said side edges and the other ends thereof by a steam-tight joint.

4. The method of forming a closed continuous spiral chamber from sheet metal, which consists in cutting two sheets of different lengths to form the outer and inner walls of said chamber, forming along each side edge of said sheets independently a flat topped shallow bend, placing the sheets in position so that the flat tops of said bends will engage, securing said sheets together along one end thereof, forming the two sets of sheets concurrently into a spiral of the desired form, additionally bending said side edges to space the sheets apart and form an outwardly flaring seaming valley, and uniting said side edges and the other ends of the sheets by filling said valley with metal and welding said metal to each sheet by the application of intense heat.

5. The method of forming a closed continuous spiral chamber from sheet metal, which consists in cutting two sheets of different lengths to form the outer and inner walls of said chamber, forming along each side edge of said sheets independently a flat topped shallow bend and a flanged lip at each end of each sheet, curving each sheet separately to form approximately the beginning and final curves of the spiral, placing the sheets in position so that one set of said end curves will come together and the flat tops of said bends will engage, securing said sheets together along one end thereof, forming the two sets of sheets concurrently into a spiral of the desired form, additionally bending said side edges to space the sheets apart and form an outwardly flaring seaming valley, and uniting said side edges and the other ends of the sheets by filling said valley with metal and welding said metal to each sheet by the application of intense heat.

6. The method of forming a closed continuous spiral chamber having an enlarged portion at each end thereof, which consists in cutting two sheets of different lengths to form the outer and inner walls of said chamber, forming a substantially semi-circular depression and an outwardly-flaring lip across the width thereof at each end of each sheet, securing said sheets together along one end thereof so that said depressions at that end will be oppositely disposed and form an enlarged passage between the sheets, bending said sheets concurrently into spiral form having the coils thereof properly spaced from one another, spacing said sheets apart and securing the edges thereof throughout their entire length with a steam-tight joint, securing the other ends of the plates together so that the depressions at that end will form an enlarged passage between the sheets opening into the spiral chamber throughout its length similar to the first-mentioned enlarged passage, and sealing the ends of said enlarged passages.

7. The step in the method of forming spiral chambers of two sheets of metal which consists in securing said two sheets of metal together at the edges thereof by forming along the edges of each sheet a longitudinal corrugation such as to cause said edge portion to be bent angularly with respect to the plane of the sheet, placing said corrugations in conjunction so as to hold the sheets spaced from each other and so that said angularly disposed edge portions will form a valley between the same, and filling said valley with metal and welding said metal to each sheet by the application of intense heat.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN O. OLSON.
WILLIS W. GRANT.

Witnesses:
F. A. WHITELEY,
H. A. BOWMAN.