L. LOZIANO.

RADIATOR.

APPLICATION FILED APR. 30, 1912.

1,053,309.

Patented Feb. 18, 1913.

2 SHEETS—SHEET 1.

Fig. 1

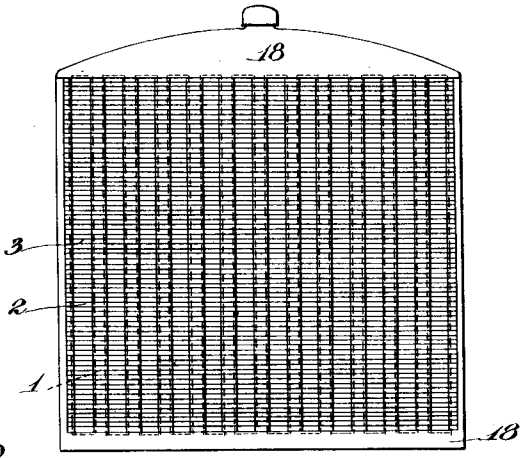


Fig. 2

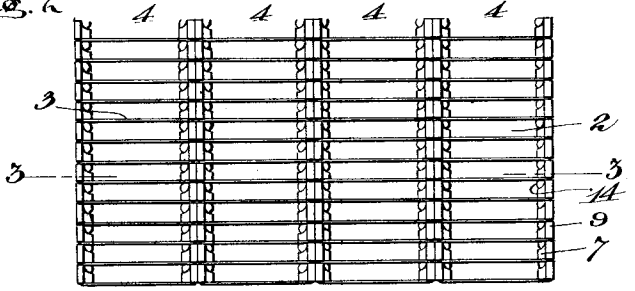


Fig. 3

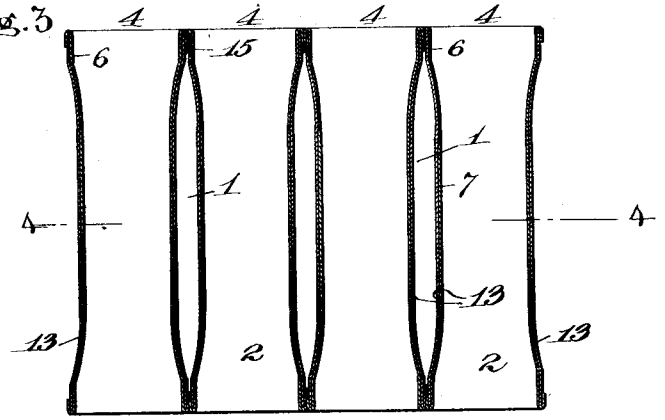
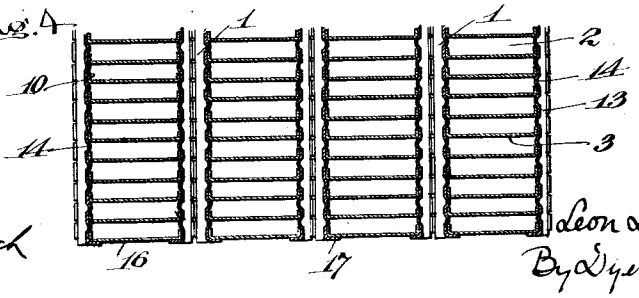


Fig. 4



Witnesses:

John L. Lotsch

Geo. J. Hanson

Inventor

Leon Loziano

By Dyer Dyer & Taylor

Attorneys.

L. LOZIANO.

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2 SHEETS—SHEET 2.

Fig. 5

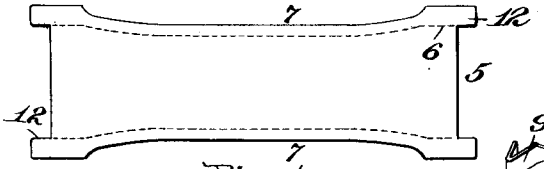


Fig. 6

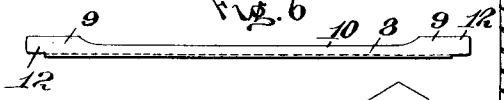


Fig. 7

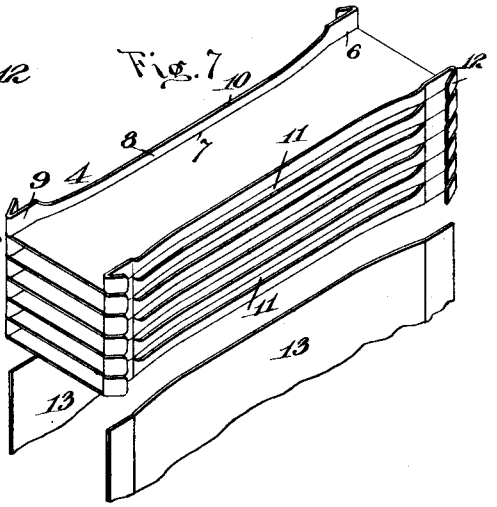


Fig. 8

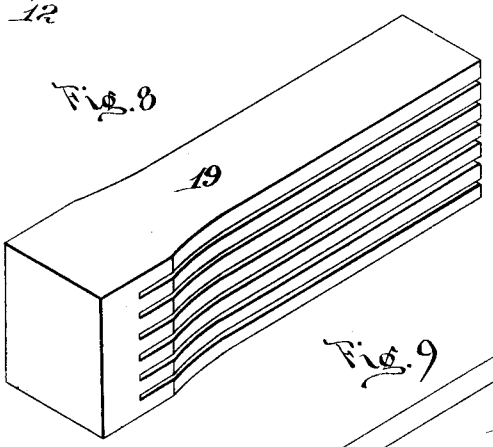


Fig. 9

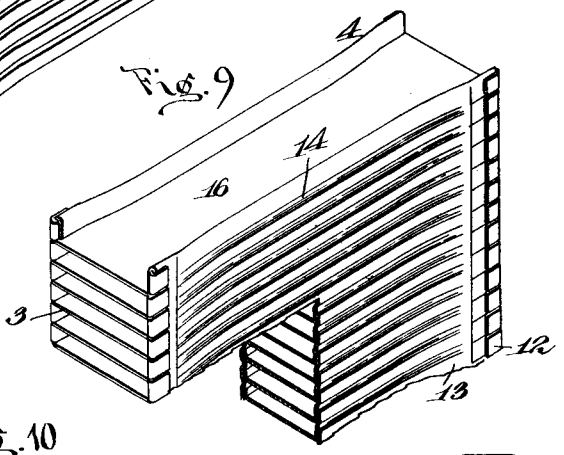
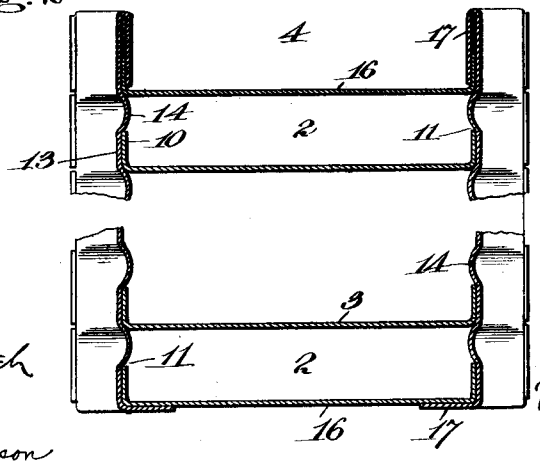


Fig. 10



Witnesses:

John K. Lotsch

Geo. J. Hanson

Inventor

Leon Loziano

By Dyer Dyer & Taylor

Attorneys.

UNITED STATES PATENT OFFICE.

LEON LOZIANO, OF PARIS, FRANCE, ASSIGNOR TO SOCIÉTÉ ANONYME MONTBARBON, OF NEUILLY-SUR-SEINE, FRANCE, A CORPORATION OF FRANCE.

RADIATOR.

1,053,309. Specification of Letters Patent. Patented Feb. 18, 1913.

Application filed April 30, 1912. Serial No. 694,199.

To all whom it may concern:

Be it known that I, LEON LOZIANO, a citizen of France, and residing at Paris, France, have invented certain new and useful Improvements in Radiators, of which the following is a specification.

This invention relates to radiators of the type known as "ribbed radiators," which have ribs located at intervals in the air passages and which are connected to the walls of the water ducts, so as to increase the radiating surface, and also to impart rigidity to the structure.

The invention is particularly adaptable for use in automobiles, but is not limited to such exclusive use.

The objects I have in view are to increase the rigidity and strength of the radiator, decrease the expense of manufacture and reduce the weight of the radiator, and, at the same time, increase its efficiency. These and further objects will more fully appear from the following specification and accompanying drawings, considered together or separately.

In the drawings, Figure 1 is a front view, of one embodiment of my invention, applied to an automobile radiator. Fig. 2 is a front view, of a portion of the structure illustrated in Fig. 1, but on a larger scale, so that the details are made more prominent. Fig. 3 is a sectional view, on the line 3—3, of Fig. 2. Fig. 4 is a sectional view, on the line 4—4, of Fig. 3. Fig. 5 is a plan view, of a blank from which one of the plates, of which the radiator is constructed, is made. Fig. 6 is a side view, of the same, but after the flanges have been bent to final position. Fig. 7 is a perspective view, of a pile of the plates, in position, showing the side sheets, which define the walls of the water ducts, about to be inserted in place. Fig. 8 is a perspective view, of the device used in connection with the plates, for keeping them in proper relative position. Fig. 9 is a perspective view, of a portion of one of the sections of the radiator in completed condition, but before they are soldered together. Fig. 10 is a view, similar to Fig. 4, but on a very much larger scale, showing only a portion of one section.

In all of the views, like parts are designated by the same reference characters.

My improved radiator has water ducts 1, and air passages 2. These water ducts and air passages cross one another at an angle. In the embodiment chosen for illustration, this angle is a right angle. Also in the embodiment chosen for illustration, the water ducts are vertical, while the air passages are horizontal. This arrangement, however, is not essential. The air passages 2 are provided with ribs 3, which cross them at close intervals and connect the walls of the water ducts on opposite sides of each air passage. These ribs strengthen the structure and augment the radiating surface.

The radiator is formed of a number of section, 4, 4, 4, 4, each preferably of identical character. The details of the sections and the manner of making the same are as follows: Each section is formed of a plurality of stiff metal plates 5. These plates form the ribs 3, and also define the shape of the water ducts. The plates are preferably made of tinned sheet iron (commonly called "tin plate" or "tin"), or some other relatively cheap and strong material. Tinned sheet iron, I find, is perfectly satisfactory for the purpose, as the plates do not come in contact with the water which circulates through the water ducts. These plates are arranged in piles of the depth of the section, and are separated at suitable intervals, which depends upon the spacing of the ribs 3. The size of the plates determines the length and breadth of the section, the number of the plates, and the spacing thereof, governing the height of the section. The plates are shown as being longer than they are broad, but these proportions may be varied as desired, to produce a different shape of radiator. In the embodiment chosen for illustration, each plate has a straight and parallel portion on each of its longer sides, indicated at 6. Between each straight and parallel portion 6, is a curved or bent portion 7, which defines one side of the water duct. The extent of curvature and the shape of the curve or bend, determines the size and cross sectional shape of the water duct. In the embodiment chosen for illustration, each plate is provided with a flange 8. The flange may be made by striking up the material at the edge of the plate along the dashed line shown in Fig. 5. In the embodiment chosen for illustration, the portion 9 of the flange 8 which is conterminous with the straight and parallel por-

tion 6 of the plate, is straight, and its free edge is parallel with the plate. In other words,—these portions 9, of the flange, are of uniform height throughout. The portion 10 of the flange which, in the embodiment chosen for illustration, is shown as conterminous with the curved or bent portion 7, is of less width or height than the portion 9, of the flange. When the plates are piled to form a section, as shown in Fig. 7, openings 11 are disclosed between the plates, such openings being conterminous with the lower portions 10 of the flange. The height of the portions 9 of the flanges of the plates will determine the distance at which the plates are spaced apart. The height of the lower portions 10 of the flange, will determine the width of the openings 11. These flanges may be so low at the portion 10 that they are of negligible height, in which case the openings 11 will be of the maximum width, with a given spacing of the plates.

The plates 5, which constitute a section which, in the embodiment chosen for illustration, is as high as the radiator, are piled together as shown in Fig. 7, and are suitably spaced. Each plate will rest upon the high portion 9 of the flanges of the plate below it. In addition to the flanges, each plate is provided with lips 12, adjacent to each end. These lips may be conveniently formed by continuing the flanges 8 beyond the ends of the plates, as shown, but they are not necessarily so made. The plates constituting a section are assembled, as shown in Fig. 7, and sheets 13 are placed against each side of the pile or bundle. These sheets 13 are preferably as wide as the length of the plates, and as long as the height of the pile. They are preferably made of very thin brass or copper, so that they will be pliable and, at the same time, will not be corroded by the action of the water. The sheets are placed in position against the sides of the pile of plates, and engage with the edges of the plates 6. The edges of the sheets lie under the lips 12. These latter lips are bent down so as to grasp the edge of the sheet, holding the latter in position. The lips may be bent down by a hammering or pressing operation so that they are forced tightly and closely against the edge of the sheets. In order to assist in holding the plates in proper position to apply the sheets, the device illustrated in Fig. 8 may be employed. This device consists of a comb 19, of any suitable material and of such a shape that the interstices between the fingers of the comb are spaced the same as the plates will be in the finished section.

After the sheets 13 are in place and secured by the lips, they are forced into close engagement with the side edges of the plates 5. Any suitable tool or mode of operation may be used for forcing these sheets into such engagement. As an additional refinement of the invention, I prefer to force the material of the sheets into the spaces 11, so that the material is distorted at these places and is formed in the shape of corrugations 14, as shown. This has the effect of greatly increasing the strength of the structure, and also brings the sheets 13 into more intimate contact with the edges of the plates 5. The next step in the manufacture of the radiator is as follows: The number of sections which constitute a complete radiator are next held together in the position that they will assume in the complete radiator. When the sections are thus combined, the juxtaposed sheets 13, of opposing sections, will define the water ducts. In other words,—one-half of each water duct is formed of the curved or bent depression in the side of the section, said depression extending throughout the height of the section. Solder is now applied to the sections, adjacent to the edges of the sheets 13 and the ends of the plates 5, to hold the parts together. A convenient way of doing this is to dip one face of the massed sections into a bath of solder to such a depth that the solder will enter the spaces between the contiguous lips 12, and will also enter the spaces between the abutting straight portion 6, at 15, as shown in Fig. 3. The other face of the mass of sections may then have solder applied to it in the same manner. The radiator is now complete, with the addition of the top and bottom manifolds 18. As the water will come in contact with the upper and lower plates of the sections, these plates 16 are best made of brass or copper. In order to produce a proper finish and to prevent the water from leaking out of the manifolds into the air passages, the upper and lower edges of the sheets 13 are bent over against the upper and lower plates 16, as indicated at 17 (Fig. 10).

My improved radiator is exceedingly strong, remarkably durable, very efficient, and extremely cheap to manufacture. The greater portion of it is constituted of the plates 5, which are of uniform shape and size and, therefore, cheap to manufacture and easy to assemble, and as they do not come in contact with the water, they may be made of tinned sheet iron, also adding cheapness and strength. The only brass or copper, or non-oxidizing material necessary, are the sheets 13 and the upper and lower plates 16. The tinned sheet iron is very much stronger and cheaper than brass, and produces a remarkably cheap and durable radiator. I regard the lips 12 as extremely important, as by their use the sheets 13 are held in position and may be distorted into close and intimate contact with the edges of the plates 5. The degree of contact be-

tween the sheets and plates determines the thermal efficiency of the radiator, therefore, this close contact of the sheets and plates produces a high thermal efficiency. The lips 12 also permit the use of very thin sheets 13, because they hold them in place while the elements of the sections are being assembled, and also hold them in place when the several sections are being held together during the soldering operation. While the radiator is in use, any pressure of water within the water ducts will tend to force the sheets into more intimate contact with the edges of the plates.

I regard the corrugation of the sheets as important but not essential. It greatly increases the strength of the radiator, causing more intimate contact between the sheets and edges of the plates and increases the thermal efficiency, as the air can come into direct contact with the sheets. I regard the flanges of the plates as important, but not necessary, as the plates may be held in properly spaced position by means of the comb 19 during the assembling of the parts, consequently, the flanges may be omitted if desired. It is also not necessary to make them of the shape shown, as the portions 10, of the flanges, may be omitted, as well as the portions 9. But the lips 12 must necessarily remain.

While I have described my invention as applied in connection with radiators for automobiles, it is apparent that it may be utilized for other purposes,—not only for cooling water, by the passage of air through the air passages, but for heating air, by the use of hot water. The radiator may be used also for other purposes, such as a condenser.

In accordance with the provisions of the patent statutes, I have described the principle of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is merely illustrative and that the invention can be carried out in other ways.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A radiator having water ducts and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates, forming the ribs; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end, straight and parallel, and intermediate these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates being piled together and spaced at regular intervals: there being lips on the plates adjacent to the ends thereof; sheets of thin pliant metal, on each side of each section, to form a wall of the water duct, the lips on the side of the plates of that section against which the sheet engages being bent around the edges of such sheet, said sheet being forced into close contact with the sides of the plates; the several sections being united to one another, and the sheets and plates in each section being permanently connected together by means of solder, which is applied to the plates and sheets adjacent to the ends of the former and the edges of the latter.

2. A radiator having water ducts and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates forming the ribs; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end, straight and parallel, and intermediate these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates being piled together and spaced at regular intervals, there being lips on the plates adjacent to the ends thereof, sheets of thin pliant metal, on each side of each section, to form a wall of the water duct, the lips on the side of the plates of that section against which the sheet engages being bent around the edges of such sheet, said sheet being forced into close contact with the sides of the plates, and distorted into the spaces between the plates; the several sections being united to one another, and the sheets and plates in each section being permanently connected together by means of solder, which is applied to the plates and sheets adjacent to the ends of the former and the edges of the latter.

3. A radiator having water ducts and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates forming the ribs, and piled together; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end, straight and parallel, and intermediate to these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates having flanges at their side edges, conterminous with the straight portions, the free edges of said flanges being parallel with the plates, so that when the plates are piled together, they will engage at the flanges, and thus provide open spaces between the middle portions of contiguous sheets; there being lips on the plates adjacent to the ends thereof, sheets of thin pliant metal on each side of each section, to form a wall of the water duct, the lips of the side of the plates of that section against which the sheet engages

being bent around the edges of such sheet, said sheet being forced into close contact with the sides of the plates; the several sections being united to one another, and the sheets and plates of each section being permanently connected together by means of solder, which is applied to the plates and sheets adjacent to the ends of the former, and the edges of the latter.

4. A radiator having water ducts and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates forming the ribs, and piled together; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end straight and parallel, and intermediate these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates having flanges at their side edges, conterminous with the straight portions, the free edges of said flanges being parallel with the plates, so that when the plates are piled together they will engage at the flanges, there being portions of the flanges extending beyond the ends of the plates, to form lips; sheets of thin pliant metal, on each side of each section, to form a wall of the water duct, the lips on the side of the plates of that section against which the sheet engages being bent around the edges of such sheet, said sheet being forced into close contact with the sides of the plates; the several sections being united to one another, and the sheets and plates of each section being permanently connected together by means of solder, which is applied to the plates and sheets adjacent to the ends of the former, and the edges of the latter.

5. A radiator having water ducts and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates forming the ribs, and piled together; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end, straight and parallel, and intermediate these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates having flanges at their side edges, conterminous with the straight portions, the free edges of said flanges being parallel with the plates, so that when the plates are piled together they will engage at the flanges, the portions of the plates between the flanges forming openings between the plates; there being lips on the plates adjacent to the ends thereof; sheets of thin pliant metal, on each side of each section, to form a wall of the water duct, the lips on the side of the plates of that section against which the sheet engages being bent around the edges of such sheet, said sheet being forced into close contact with the sides of the plates and distorted into the openings between the plates; the several sections being united to one another, and the sheets and plates of each section being permanently connected together by means of solder, which is applied to the plates and sheets adjacent to the ends of the former, and the edges of the latter.

6. A radiator having water duct and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates forming the ribs, and piled together; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end, straight and parallel, and intermediate these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates having flanges at their side edges, conterminous with the straight portions, the free edges of said flanges being parallel with the plates, so that when the plates are piled together they will engage at the flanges, the portions of the plates between the flanges forming openings between the plates; there being portions of the flanges extending beyond the ends of the plates, to form lips; sheets of thin pliant metal, on each side of each section, to form a wall of the water duct, the lips on the side of the plates of that section against which the sheet engages being bent around the edges of such sheet, said sheet being forced into close contact with the sides of the plates and distorted into the openings between the plates; the several sections being united to one another, and the sheets and plates of each section being permanently connected together by means of solder, which is applied to the plates and sheets adjacent to the ends of the former and the edges of the latter.

7. A radiator having water ducts and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates forming the ribs, and piled together; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end, straight and parallel, and intermediate these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates having flanges at their side edges, the portions of said flanges conterminous with the straight portions having free edges which are parallel with the plates and the portions of said flanges conterminous with the curved portions, being lower than the flanges which are conterminous with the straight portions, so that when the plates are piled together they

will engage with the portions of the flanges which are conterminous with the straight portions, there being portions of the flanges extending beyond the ends of the plates to form lips; sheets of thin pliant metal, on each side of each section, to form a wall of the water duct, the lips on the side of the plates of that section against which the sheet engages being bent around the edges of the sheet, said sheet being forced into close contact with the sides of the plates; the several sections being united to one another, and the sheets and plates of each section being permanently connected together, by means of solder, which is applied to the plates and sheets adjacent to the ends of the former and the edges of the latter.

8. A radiator having water ducts and air passages, said air passages being crossed by ribs at close intervals; said radiator comprising a plurality of sections, each section being formed of a plurality of stiff metal plates forming the ribs, and piled together; each plate being of rectangular shape, with the portions of opposite sides adjacent to each end, straight and parallel, and intermediate these straight portions, curved or bent inwardly to define the shape of one side of a water duct, said plates having flanges at their side edges, the portions of said flanges with the straight portions having free edges which are parallel with the plates, and the portions of said flanges conterminous with the curved portions, being lower than the flanges which are conterminous with the straight portions, so that when the plates are piled together they will engage with the flanges which are conterminous with the straight portions of the plates; there being portions of the flanges extending beyond the ends of the plates, to form lips; sheets of thin pliant metal, on each side of each section, to form a wall of the water duct, the lips on the side of the plates of that section against which the sheet engages being bent around the edges of the sheet, said sheet being forced into close contact with the sides of the plates and distorted into the openings or spaces between plates which is formed by the low portion of the flanges; the several sections being united to one another, and the sheets and plates of each section being permanently connected together, by means of solder, which is applied to the plates and sheets adjacent to the ends of the former and the edges of the latter.

This specification signed and witnessed this 11th day of April, 1912.

LEON LOZIANO.

Witnesses:

DEVIGNOIS,

H. C. COXE.