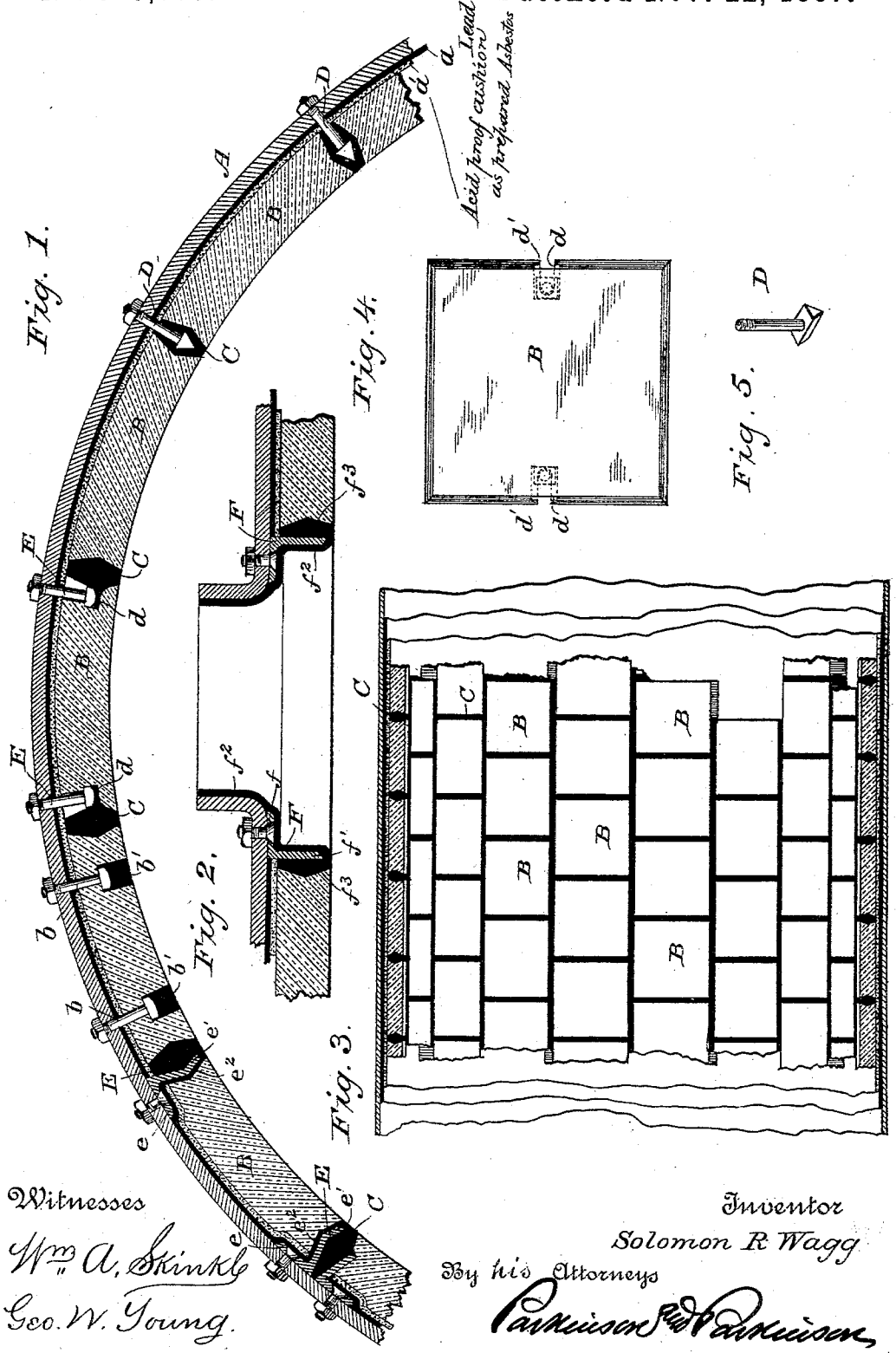
(No Model.)

S. R. WAGG.

PAPER PULP DIGESTER.

No. 373,703. Patented Nov. 22, 1887.



Witnesses
Wm. A. Skinkle
Geo. W. Young.

Inventor
Solomon R. Wagg
By his Attorneys
Parkinson & Parkinson

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

SOLOMON R. WAGG, OF NEENAH, WISCONSIN.

PAPER-PULP DIGESTER.

SPECIFICATION forming part of Letters Patent No. 373,703, dated November 22, 1887.

Application filed February 28, 1887. Serial No. 229,088. (No model.)

To all whom it may concern:

Be it known that I, SOLOMON R. WAGG, a citizen of the United States, residing at Neenah, in the county of Winnebago and State of Wisconsin, have invented certain new and useful Improvements in Paper-Pulp Digesters, of which the following is a specification.

This invention relates more particularly to that class of digesters employed in the process of boiling wooden chips for reduction to fiber in a solution of sulphurous acid, and generally known in the art as the "bisulphite process," although various features may be beneficially employed in other processes than this. The acid used in the above-named process has a corrosive or destructive effect on the metallic shell of the boiler, whether of iron or steel, and when allowed to come in contact with said shell rapidly destroys the same and carries resultant salts into the pulp, blackening and injuring it. To guard against this, numerous devices for lining have been employed—such as lead and alloy, and porcelain, brick, &c.; but great trouble has been experienced in keeping the lining in place on the metallic shell, lead expanding more than double the expansion of iron under like temperature and conditions, and, owing to the fact that it cannot after expansion contract to its original condition, it has a marked tendency to creep or crawl upon the shell, eventually causing blisters and cracks, so that the acid gets through and attacks the shell with rapidly-destroying effects, necessitating expensive repairs and delays. Where lead has been used for a lining, the digester or boiler has usually been known as a "rotary" boiler—that is, revolving on trunnions at the ends or sides—and this type has come to be preferred over a stationary cooking-boiler, for the reason that by its slow even revolution the wood or other material being cooked is, as often as a revolution takes place, completely submerged, and the wood chips moving and rolling one upon the other have a direct mechanical effect in loosening and disintegrating the fiber and causing the pulp to come out evenly and uniformly cooked, so that a uniform grade of paper can be made therefrom with an even and unchanging color.

So far as I am aware there has never been any pulp boiler or digester of the rotating type lined with porcelain or earthen glazed brick, or with tiles of any material, such being entirely confined to stationary boilers, because of the jar and shake that would be incident to the rotary motion. The brick and tile, being only fastened by setting in cement in such boilers, would become loosened from the vibrations and get out of place, thus admitting the acid to the iron shell and destroying the same.

The object of my invention is to line rotary boilers (or stationary boilers, for that matter) with tiles of any material that will successfully resist the corrosive action of the acids employed in such manner that if subjected to rotation they shall be still firmly held as if one homogeneous lining; and to this end I employ any suitable number of tiles conforming in longitudinal and cross-section to the interior of the boiler and adapted to be arranged side by side and end to end in series, such tiles being undercut or chamfered concavely at their edges and being united together along the seams formed by their abutting edges by lead or other suitable non-corrosive filling tamped or compressed therein so as to wedge into these chamfered or undercut portions as if dovetailed therein, and such seams being secured to the boiler-shell. I further place between the tiles and the boiler-shell a cushion, lining, or packing of somewhat elastic material, serving to take up jar, and preferably of asbestus, that it may also serve to shield the higher conductor from the other. Further, I propose to place in direct contact with the boiler-shell, and between it and the tiles and packing, a thin lining or sheet of lead or other acid-resisting material, to more perfectly prevent leakage. Other details of my invention will appear from the ensuing description.

In the drawings, Figure 1 is a cross-section through a portion of a rotary boiler embodying my invention and exposing alternative forms in different portions of the periphery. Fig. 2 represents a section through a manhole, pipe-hole, or similar aperture, to explain the features of construction at such point; Fig. 3, a longitudinal section showing a portion of the interior of the boiler; Fig. 4, a detail of a tile adapted to be used in my improvement, and Fig. 5 a detail view of a bolt

that may be employed to secure the dovetail seaming to the metal shell.

A represents the boiler-shell, of iron or steel or any other suitable metal known in the art. For the purpose of lining this, I first clean the interior walls and then give them a coat of tin by applying with a metallic brush or by electroplating, then apply a film of lead, *a*, over the tin by a metallic brush or by coating with a soft solder having a lower melting-point than tin, and attach the same by a blow-pipe by pressing against the walls of the boiler and fusing the two together, or by placing said lining in position throughout the boiler and then pumping in comparatively cool air up to a pressure sufficient to force all parts of the lead and solder into close contact with the boiler-walls—that is, about fifty or sixty pounds of pressure. The temperature of the air after such assured contact is reached is to be gradually raised to a point less than the melting-point of tin—421° Fahrenheit—or less than that of lead—594° Fahrenheit—but greater than the solder or flux; or, in case tin is not used, then less than the melting-point of lead, and when the melting of the solder takes place the temperature is to be gradually reduced, so that the whole shall be fused solidly together. This preliminary preparation of the boiler-walls is not, when tile or other intermediate lining is employed, a matter of necessity, but is purely to insure greater safety against the possibility of leaks doing any damage.

After the lead has been once fixed upon the interior of the walls, an acid-proof cushion or packing, *a'*, is laid upon the lead. This packing I prefer to make of asbestus soaked in any of the usual preparations for making it more durable against liquids—for instance, boiled linseed-oil and red or white lead or tar. Upon this sheet of packing I lay tiles or bricks, B, of porcelain or other acid-resistant material, such tiles having a curvature in cross section or longitudinal section corresponding to the curvature of the boiler-shell, but being rectangular or polygonal in plan shape, so that they may practically adjoin along all their edges. Each tile may be secured primarily by bolts *b* passing through it at or near the corners, and having their heads covered with lead or some acid-resistant, *b'*, advisably by sinking the heads into a recess in the tile and tamping or calking this recess with lead, the outer end of the bolt being secured to the metal shell by a nut, as usual. The abutting edges of the tile are chamfered concavely, so that a section through the seam between two adjoining tiles (it being understood that they will not quite abut, but at the outset will leave an open seam) will present the outline of a double frustum of a cone, or of two wedges placed back to back, or other ultimately interlocking shape. These seams, which extend continuously between all of the tiles, will now be packed, calked, or tamped with lead or other acid-resistant, C, whether it is put in by layers or poured in as a fluid, thus firmly wedging all of the tiles together and bracing them in a homogeneous cylinder, thereby effectually preventing leakage and insuring that the pressure of the steam within the boiler during the digesting operation shall only more firmly bind them against the exterior boiler-shell, since the dovetail feature arising from the chamfer of the tiles and the tamping renders the whole series practically a single lining arched or keyed in such manner that so long as supported against the outer metal shell it cannot fall inward, even if the bolts primarily securing it should be released. Yet, for greater safety or out of abundant caution, I prefer to add additional bolts; but this may be done in several ways. First, as represented at the right hand of Fig. 1, it consists in placing such bolts D along the seams so that their heads come about at the widest part of the chamfered seams, and then introducing the lead or other alloy, which, when tamped, will be packed into the seam and around and beneath the bolt-head, and above it also, and will hold it firmly and protect it from corrosion. Then by applying nuts to the screw-threaded exterior of the bolts so sunk in the seams they will, through the lead tamping, hold the tiles in place. Another mode of applying such bolts is represented at E, about midway of Fig. 1. In this form I undercut or recess the tiles from the chamfers, as at *d*, and also on the side adjacent to the metal shell or boiler-shell I slot them, as at *d'*, to admit the shank of the bolt, its head resting in the undercut recess. Then, when the lead tamping is inserted, the bolt will be locked in the recess and its head fully covered and protected by said tamping.

In some cases I prefer to re-enforce the seams by means of angle-irons E, one flange, *e*, of which rests upon and is bolted to the interior walls of the boiler-shell, and the other flange, *e'*, is in a measure perpendicular thereto, but of such outline that it substantially interlocks with the grooves, channels, or chamfers in the tiles. Where the seams are unbroken, as they will often be along the length of the boiler, these angle-irons may be of length corresponding to a number of the tiles; but where they are broken, as shown in Fig. 3, transversely of the boiler, or where the cross-flanges intersect the others, they will be of appropriately shorter length. When such flanges are used, the interior lead sheet, if that is employed, will be passed up between the perpendicular flanges and the tile, as at e^2, to make a close joint between the two, and will cover the edge of the flange and then become homogeneous with the packing or calking of the seam. Such angle-irons are shown at the left hand of Fig. 1 in two different forms, that farthest to the left extending only to the center of the tile, and not having a lead lining between it and the tile, the seam being sufficiently protected in such case by lead tamping, which is carried up flush with the tiles. Furthermore, where such tiles adjoin a man-hole or pipe-hole or

other aperture in the boiler, I intend to use an angle-iron ring, F, one flange, *f*, of which rests on the boiler-shell and is bolted thereto, while the other flange, *f'*, is practically perpendicular thereto and shown in the drawings as perpendicular, but may or may not be of irregular outline to interlock with the chamfers of the tiles. This ring and the man-hole or aperture will be covered by a sheet of lead, f^2, which will unite with the non-corrosive tamping or calking f^3 that will be inserted into the pocket formed between said flange and the chamfer.

I claim as my invention—

1. The process, substantially as hereinbefore set forth, of lining metal boilers with lead, consisting in coating one side of a sheet of lead with solder that melts at a lower temperature, placing said sheet within the boiler so as to entirely cover its inner walls, with the solder adjacent to said walls, introducing comparatively cool air under pressure until the sheet of lead is forced compactly against the sides of the boiler-shell, then applying heat sufficient to melt the solder, but not the lead, until the lining and the shell are fused together, and finally lowering the temperature and reducing the pressure.

2. The process, substantially as hereinbefore set forth, of lining boiler-shells, consisting in coating a thin sheet of lead with solder on one side and applying it to the interior walls of the boiler until they are covered, introducing air of a temperature below the melting-point of the solder and under pressure until the lead has been forced into contact with the internal surface of the boiler, then raising the temperature of said air while still continuing said pressure to the point at which the solder will melt, finally cooling said air, and then reducing the pressure.

3. The combination, substantially as hereinbefore set forth, of a boiler-shell and internal lining or coating of lead upon its inner walls, a cushion or lining of an elastic nature next to said coating, and an interior lining of tiles seated upon said cushion.

4. The combination, substantially as hereinbefore set forth, of a boiler-shell, an interior lining of non-corrosive material, and a cushion or packing of asbestus interposed between said lining and the shell.

5. The combination, substantially as hereinbefore set forth, of a metal boiler-shell, a cushion or packing of an elastic nature lining the internal walls thereof, and an interior lining composed of slabs or tiles of non-corrosive material.

6. The combination, substantially as hereinbefore set forth, of a metal boiler-shell, asbestus packing lining the interior walls thereof, tiles forming the interior lining, and a non-corrosive tamping filling the seams between said tiles.

7. A boiler-lining consisting of tiles arched and keyed by means of seams of tamping, lead, or equivalent non-corrosive material.

8. The combination, substantially as hereinbefore set forth, to form a boiler-lining, of a series of tiles having chamfered or undercut edges and a calking of lead or equivalent material filling the seams between the edges.

9. The combination, substantially as hereinbefore set forth, of a metal boiler-shell, tiles held thereto by bolts, non-corrosive packing covering the heads of said bolts, and seams of lead or equivalent non-corrosive material between the adjacent edges of the tiles.

10. The combination, substantially as hereinbefore set forth, of a boiler-shell, a series of tiles forming the lining and having undercut or chamfered edges, lead packing filling the seams between said edges, and bolts having their heads sunk in said lead packing and securing the tiles and seams to the boiler-shell.

11. The combination, substantially as hereinbefore set forth, of the tiles having chamfered edges, the angle-iron rings surrounding man-holes or apertures in the shell, the lead packing between the perpendicular flanges of said rings and the tiles, and the lead sheet covering the rings and apertures.

SOLOMON R. WAGG.

Witnesses:
J. C. KERWIN,
CHRISTIAN NELSON.