

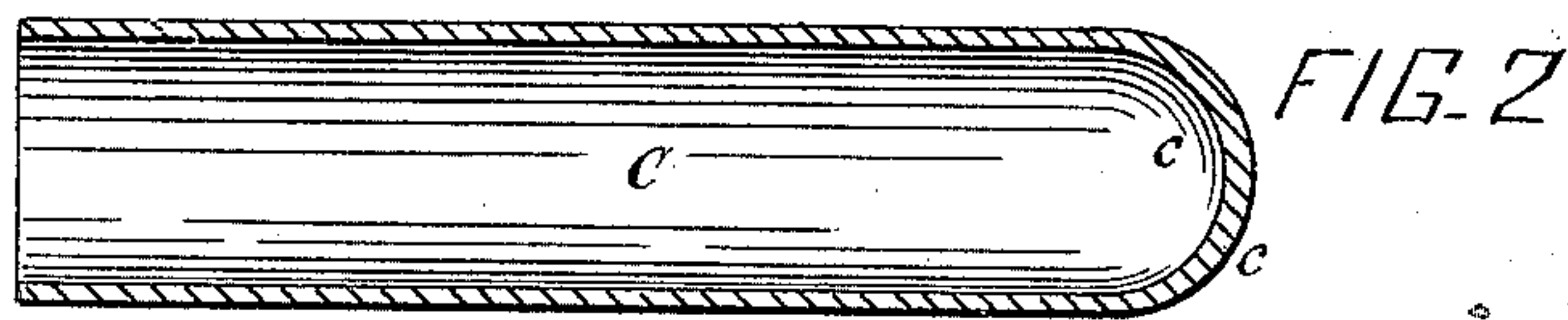
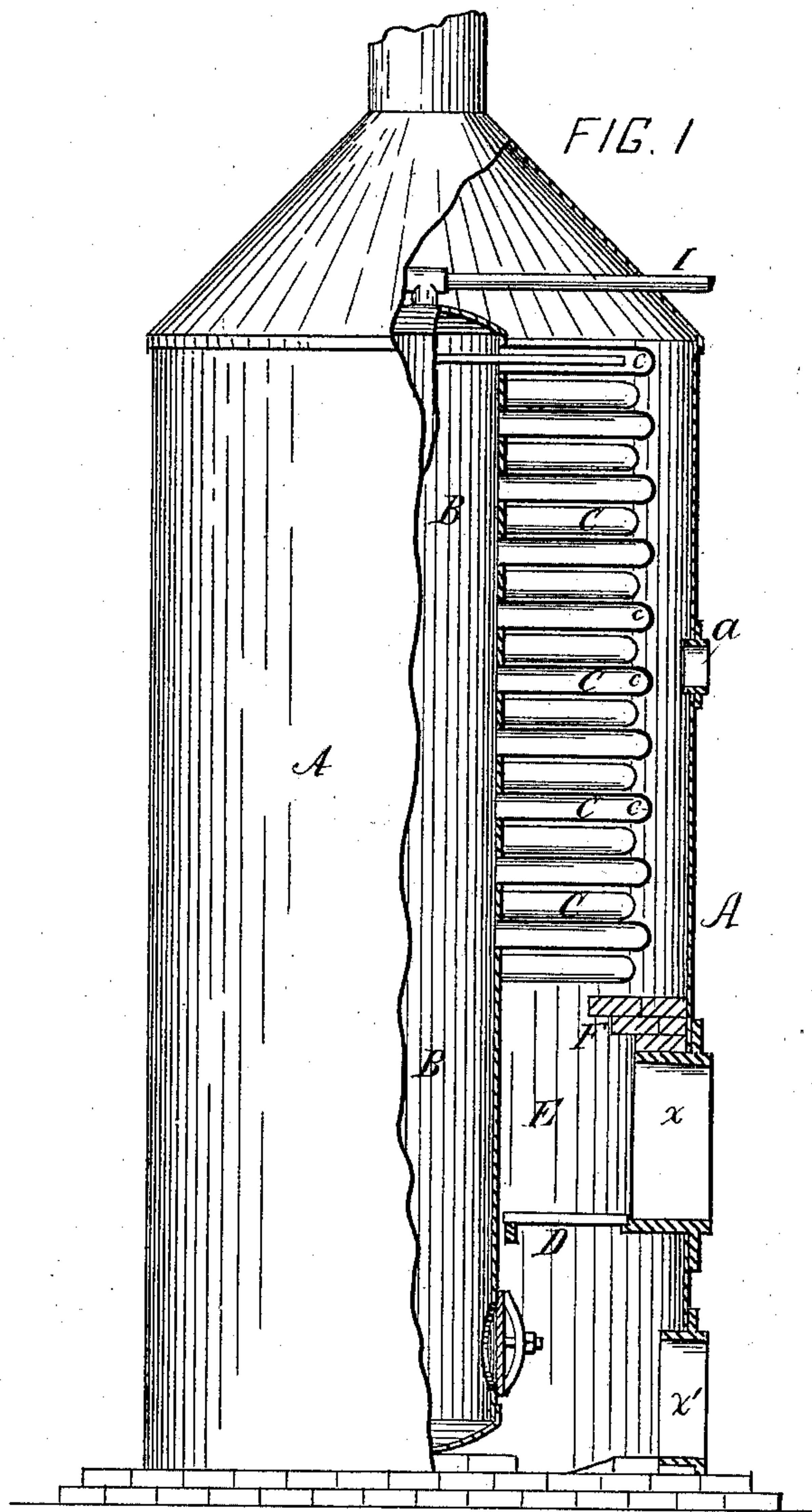
(No Model.)

E. S. T. KENNEDY.

BOILER TUBE.

No. 368,836.

Patented Aug. 23, 1887.



WITNESSES

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EDWARD S. T. KENNEDY, OF NEW YORK, N. Y.

BOILER-TUBE.

SPECIFICATION forming part of Letters Patent No. 368,836, dated August 23, 1887.

Application filed December 8, 1886. Serial No. 220,991. (No model.)

To all whom it may concern:

Be it known that I, EDWARD S. T. KENNEDY, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Boiler-Tubes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to vertical cylindrical steam-boilers having radial tubes of that particular variety known as the "porcupine" type, and more particularly concerns the wrought-iron radial tubes used in my improved high-pressure boiler. In this kind of boiler difficulty has been experienced in effectually closing the outer free ends of the wrought-iron tubes and preventing leakage of steam or water, due to expansion and contraction of the metal and consequent opening of the joints at the line of welding, or of a screw-plug. It has been my practice to close the outer end of the tube by inserting a plug or disk of metal so as to be flush with the end of the tube and at a suitable heat, welding the wall of the tube to the plug or disk. This has given comparatively good results, but has not been wholly satisfactory, since, under the influence of heat, the parts would occasionally spring apart so as to blow water or steam, and require repair before other portions of the tube or boiler showed appreciable wear. Screw-plugs heretofore used for closing the end of the wrought-iron tubes were objectionable, because they necessitated joints exposed to the fire and hot products in the furnace, which joints were liable to leak after short use. The operation of screw-threading the tube and plug and fitting them together is objectionably laborious and expensive, besides forming a closure which is inefficient and requiring frequent repair.

It has heretofore been proposed to close the ends of metal tubes by means of concave dies alone, operating upon the outsides of the tubes, but the weld thus effected was imperfect and unsatisfactory, and, besides, the end of the tube was drawn into irregular conical form, with wrinkled inner and outer surfaces, and in such conical end the dirt would collect in practice when applied to a boiler and cause injurious

overheating and burning of the tube. It has also been proposed to close the end of a metal tube by simply placing it upon a mandrel having a rounded end and compressing the projecting end of the tube by a hollow die; but this proved inoperative to weld together the end walls of wrought-iron or steel tubes. A wrought-metal tube having a tight welded end could not be produced by such operation. By my present invention I overcome these difficulties and objections and provide the tube with a perfectly secure jointless closed hemispherical end of thickened metal by welding the tube-wall at the end directly upon itself, as hereinafter more specifically described with reference to the accompanying drawings, in which—

Figure 1 represents the boiler partly in vertical section, showing the central cylinder and the radial tubes. Fig. 2 represents a longitudinal section of one of the detached wrought-iron tubes.

The boiler-inclosing shell A, though here shown of a single thickness of metal, may be made double, with a non-conducting packing or a water filling, or may be built up of brick-work, as shown in my Patent No. 349,720, September 28, 1886. The shell is provided internally with the grate D, combustion-chamber E, and deflector F, shown in such patent. The central boiler-cylinder, provided with the radial tubes C, is set up in the shell, as described in my former patents. Door-frames $x x'$ are secured in the shell, and form openings leading to the combustion-chamber and ash-pit. Sight-holes a , in any desired number, are provided in the shell, and in practice are closed with doors. They afford access for cleaning dust off the outside of the tubes when required. Steam-discharge pipe I leads from the dome or top of cylinder B, as usual in my boiler.

In order to perfect my radial tube or porcupine boiler, which is now in economical and successful operation, I have devised the herein-described improved means for effectually closing the free exposed ends of the wrought-iron or steel water-tubes. The tube C, having been cut to the required length, is heated at the end to the proper temperature, and by means of semi-conical concave swages or dies is first formed with a conical end having a short pro-

jecting end or tail-piece of metal at the apex. For effecting this formation the semi-conical cavities of the swaging-tools have each a groove extending through it from its apex or contracted portion, so that when the upper and lower swages are placed together a central cylindrical opening extends from the interior conical formation. The metal of the tube-walls thus squeezed together by the operation of the swages projects centrally in a very much reduced diameter from the end of the tube. The swaging with the conical tubes having been thoroughly performed, the extreme end of the tube is reheated to a welding heat, and the tube is then slid down over the rounded or hemispherical end of a vertical mandrel, and then, by means of a cupping-tool having a hemispherical depression, the conical end of the tail-piece is worked down into the thickened rounded or hemispherical solid end shown at *c* in Fig. 2. The ends of the tube-walls are thus securely welded upon themselves without seam or joint, and the ends are so thickened that they are stronger there than at any other portion. By being rounded internally the circulating water scours the end of the tube and prevents the deposit of dirt, so that the metal is protected from injury by overheating, which results when dirt collects in the corners of square-ended tubes.

It will be seen that the wrought-metal tube having its end closed by welding the metal upon itself, so as to form a solid rounded seamless end of thickened metal, is an important feature in my improved porcupine type of boiler, since the tube cannot get out of order in ordinary use, and requires no repair, and since the necessity of stopping the generation

of steam to repair a single tube would entail a considerable loss upon the manufacturer employing a number of workmen, whose operations are dependent upon the integrity of the boiler.

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

1. A wrought-metal boiler-tube having its hemispherical end closed by the metal welded upon itself and such end made gradually thicker from the circumference to its center, for the purpose described.

2. A wrought-metal tube for boilers, having its end wall closed and welded upon itself in a rounded or hemispherical form and the end portion made thicker than the cylindrical wall of the tube.

3. In combination with the vertical boiler-cylinder, the radial water-tubes having closed jointless rounded ends of thickened metal welded upon itself, for the purpose described.

4. In combination with any form of porcupine boiler, the wrought-metal water-tubes having closed welded seamless ends of thickened metal, with smooth or even inner surfaces of round or hemispherical form, whereby in operation the water will uniformly scour the insides of the tubes, thus preventing deposits of dirt and consequent overheating and destruction of the metal.

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

EDWARD S. T. KENNEDY.

Witnesses:

JOHN P. KENNEDY,
LUTHER S. CONKLING.