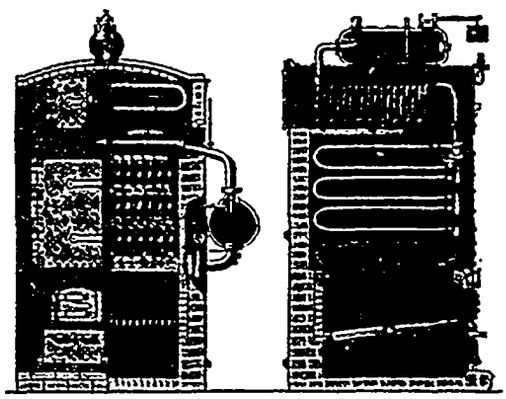
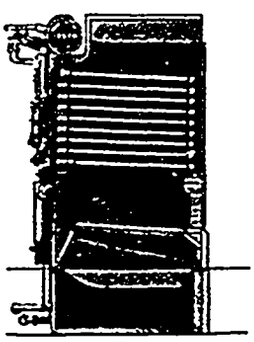
considered the father and godfather of troubles in this line. The lower tubes were used as grates, as in Gurney's 1826 design. The familiar "up-flow" and "down-flow" pipes, connected by fittings (made specially, as there were at that time no regular ones on the market), were present. All ideas of the necessity of steam or water capacity, or desirability of access for internal cleaning, were absent Surface, weight and space occupied dominated the design.

BELLEVILLE, a French engineer, introduced a box coil boiler, made up of bent U pipes screwed into return bends, a series of these coils being placed vertically side by side, connected, connected at the top to a separating drum, and at the bottom to a common feed pipe. It was fitted with various automatic devices for controlling the feed, circulation, blow-off and pressure—the latter as it was found necessary to run the boiler at a higher pressure than that desired in the engine, throttling down to prevent the water from bodily leaving the boiler. They are used principally in marine service.



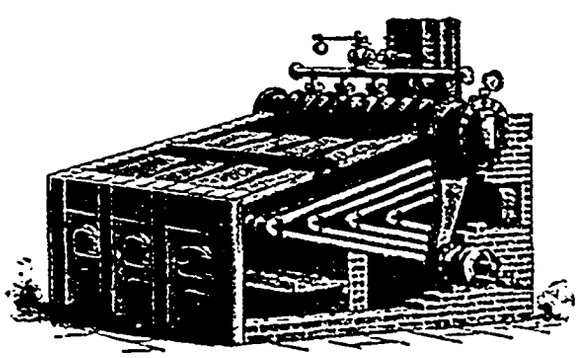
NO. 36. 1865—TRADE CIRCULAR.



About 1877 the bent pipe was discarded and return bends used on both ends of a series of straight tubes. This boiler could be cleaned by taking it all apart. One particular advantage of this boiler seems to be that the steamship owner has the opportunity to constantly displace paying freight by carrying round a mass of brick work.

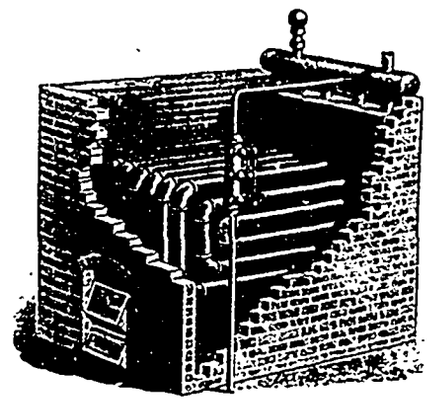
NO. 37. 1877—TRADE CIRCULAR.

J. C. KILGORE originated the "Eclipse" boiler, using pipes and fittings to build up his U tube sections; otherwise it was a copy of Allen's 1872 design.

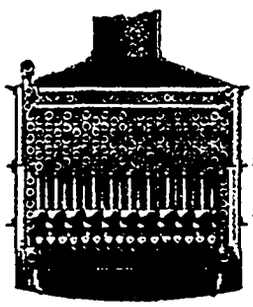


NO. 38. 1874.—TRADE CIRCULAR ISSUED IN PITTSBURG.

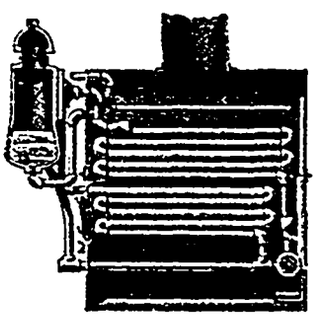
JOSEPH SHACKLETON used return bend units connected to vertical manifolds, placed side by side, connected at the top to a steam collector and at their bottom ends to a common feed pipe.



NO. 39. 1876—TRADE CIRCULAR ISSUED IN SENECA, N Y.

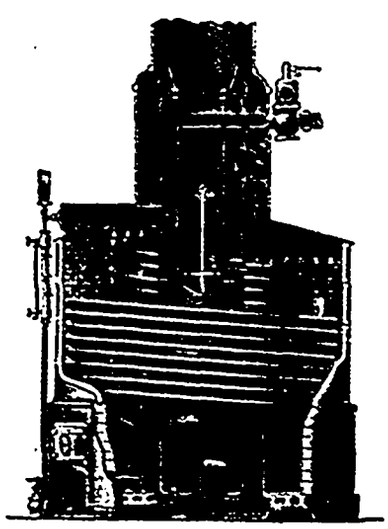


HERRESHOFF rechristened Belleville's 1877 boiler, staggered the tubes, and added a feed-water coil above it made up in the same manner, made of pipes and fittings.



NO 40. 1890—INTERNATIONAL ENGINEERING CONGRESS, 1894.

CHARLES WARD used a vertical cylinder surrounded by a series of concentric coils interrupted twice in their circumference, on opposite sides, by vertical manifolds. These manifolds on one side were connected by a radial pipe to the bottom of the cylinder, and at the other side to a similar pipe connecting near the top of the cylinder.



NO. 41. 1879—U. S. NAVAL REPORTS.

E. E. ROBERTS, of New York, bred a cross between Belleville's 1877 and Herreshoff s 1890 boiler, and while "favoring" both its parents, developed outside down-take pipes of its own. Made of pipes and fittings.