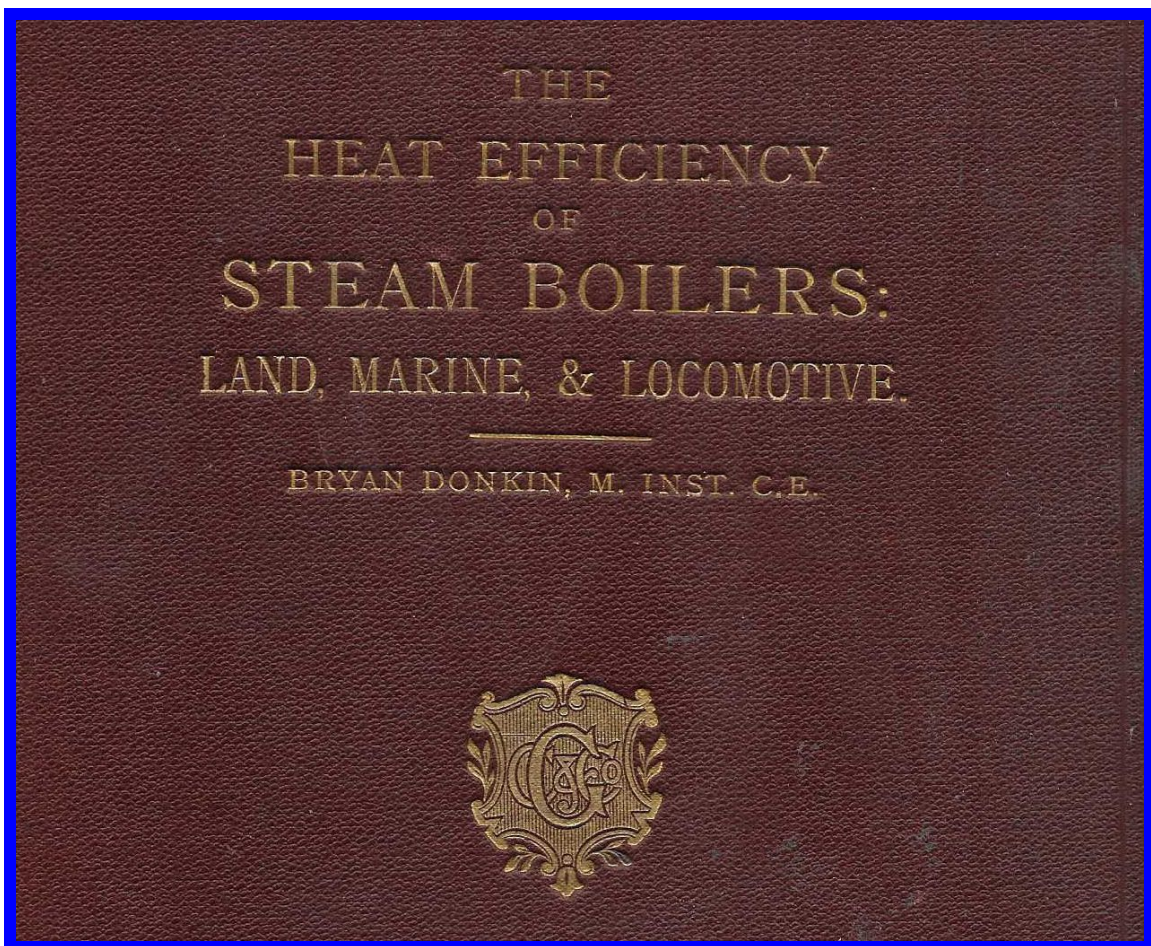


# STEAM & HOT WATER BOILERS 1750-1930

## *Steam Boilers*



ILLUSTRATIONS FROM DONKIN 1898 HANDBOOK

A. C. HOLTBY.

THE

HEAT EFFICIENCY

OF

STEAM BOILERS:

LAND, MARINE, AND LOCOMOTIVE.

WITH TESTS AND EXPERIMENTS ON DIFFERENT TYPES,  
HEATING VALUE OF FUELS, ANALYSES OF GASES,  
EVAPORATION, AND SUGGESTIONS FOR  
TESTING BOILERS.

BY

BRYAN DONKIN,

MEMBER OF THE INSTITUTION OF CIVIL ENGINEERS; MEMBER OF THE INSTITUTION OF MECHANICAL  
ENGINEERS; MEMBER OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS;  
MEMBER OF THE VEREIN DEUTSCHER INGÉNIEURE; AUTHOR OF  
"A TEXT-BOOK OF GAS, OIL, AND AIR ENGINES," ETC.

*WITH NUMEROUS TABLES, PLATES, AND ILLUSTRATIONS IN THE TEXT.*

LONDON:

CHARLES GRIFFIN & COMPANY, LIMITED,  
EXETER STREET, STRAND.

1898.

*[All Rights Reserved.]*



## ANCIENT AND MODERN LAND STATIONARY BOILERS—1775 and 1897.

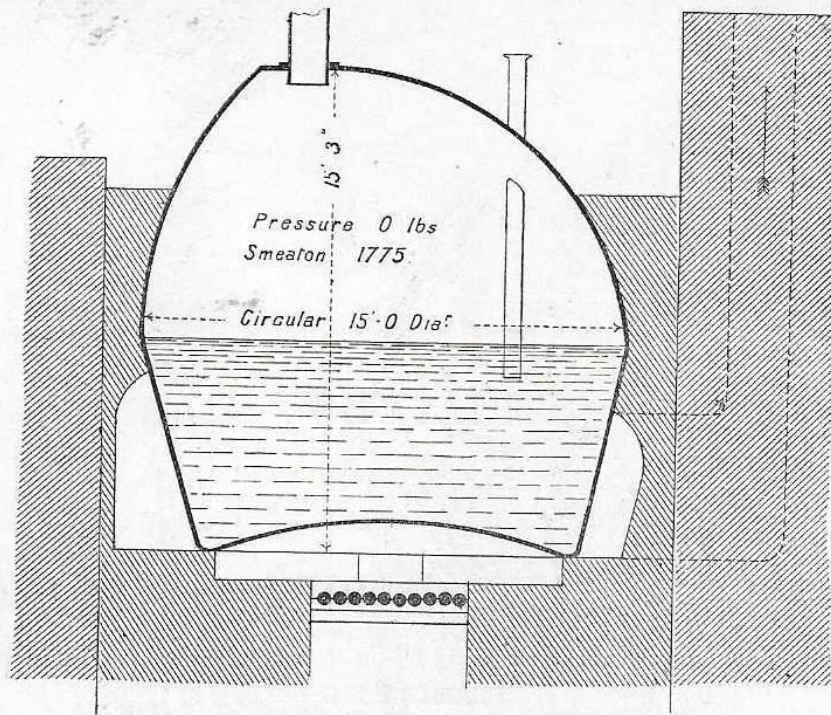


Fig. 80.—SMEATON'S BOILER, 1775. About 155 sq. ft. heating surface. External fire.

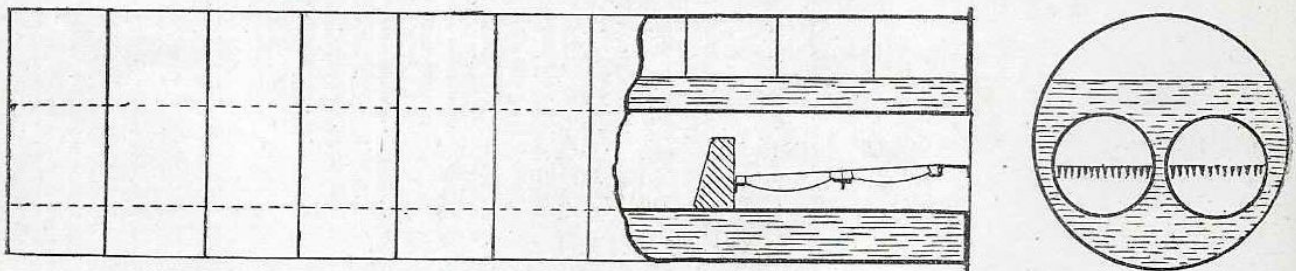


Fig. 81.—LANCASHIRE BOILER, 1897. With two internal fires. 30 ft. long by 8 ft. diameter. About 1000 sq. ft. heating surface. 200 lbs. pressure.

*Both drawn to same scale.*



ANCIENT AND MODERN MARINE STEAM BOILERS—1820—1893.

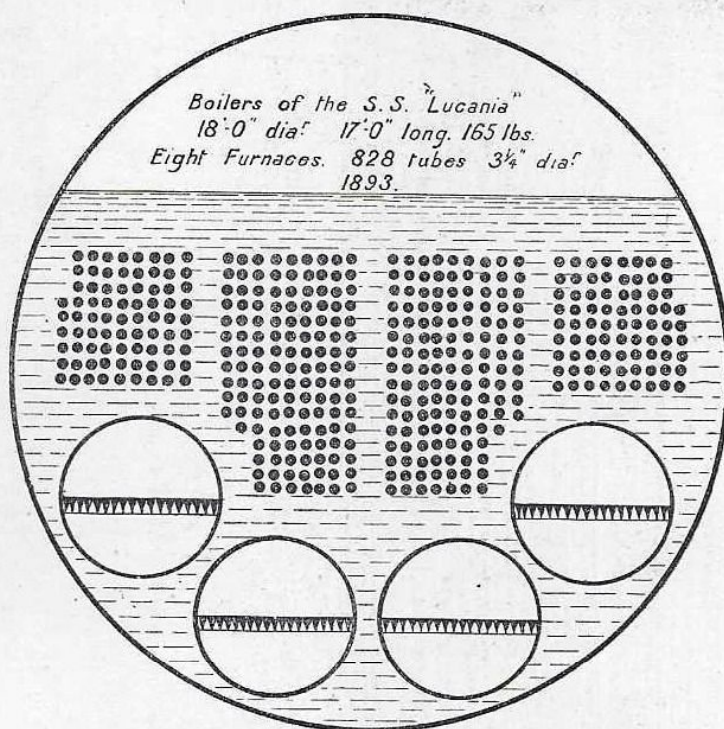


Fig. 82.—BOILER OF S. S. "LUCANIA," 1893. Pressure, 165 lbs. Double ended.  
 12 Boilers in this S. Ship.

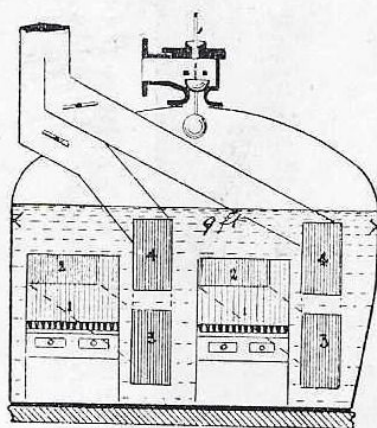


Fig. 83.—MARINE BOILER, 1820. 16 ft. long, 0 to 5 lbs. pressure.

*Both drawn to same scale.*



EXAMPLES OF MODERN MARINE BOILERS—INTERNAL FIRES.

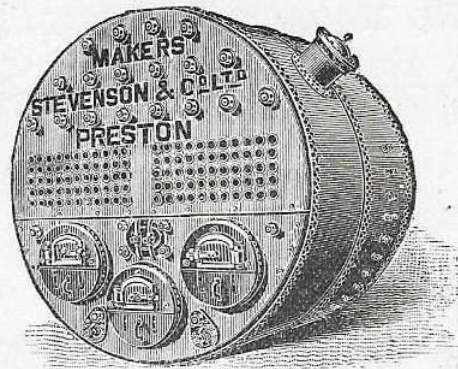


Fig. 88.—THREE FLUE AND THREE FURNACE BOILER, with Smoke Tubes.

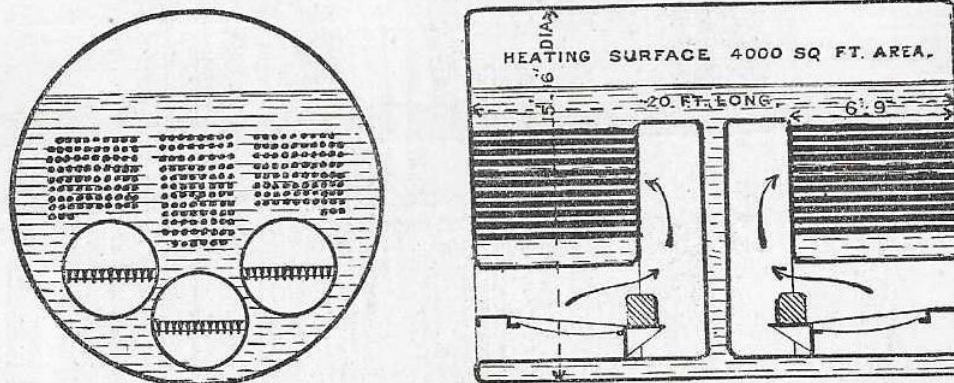


Fig. 89.—THREE FLUE SCOTCH BOILER, Double ended, with Six Internal Fires.

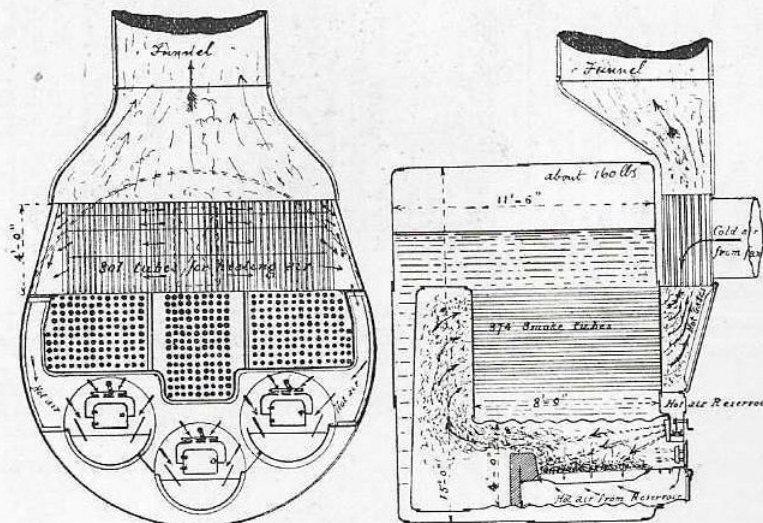


Fig. 90.—Howden's method of Heating the Air for Combustion by the Hot Gases.

# BELLEVILLE MARINE BOILERS WITH ECONOMISERS.

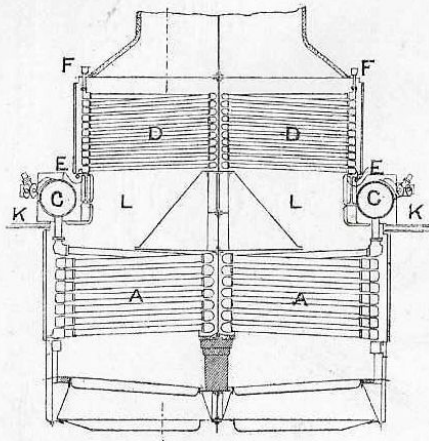


Fig. 91.

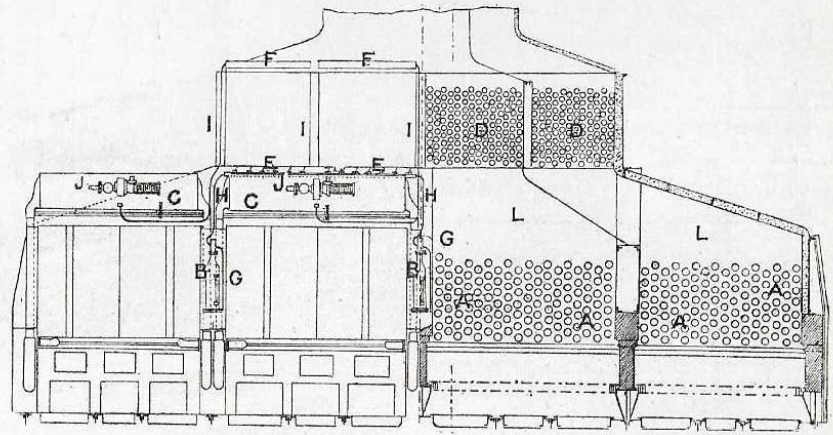


Fig. 92.

- A. Water tubes.
- C. Steam drums.
- D. Economiser tubes.
- E. Cold water pipes.
- F. Hot water pipes.
- G. Feed pipes to regulator.

- H. Pipes from feed regulator to cold water pipes.
- I. Pipes between hot water pipe and feed valve.
- J. Steam valves.
- K. Platforms.
- L. Combustion chambers.



EXAMPLES OF OLD BOILERS—1750-1815.

WITH EXTERNAL AND INTERNAL FIRES.

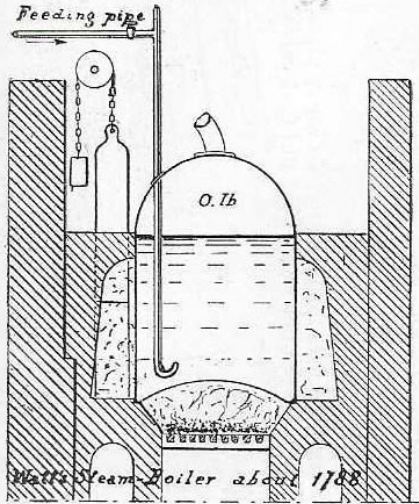


Fig. 93.—WATT, 1788.

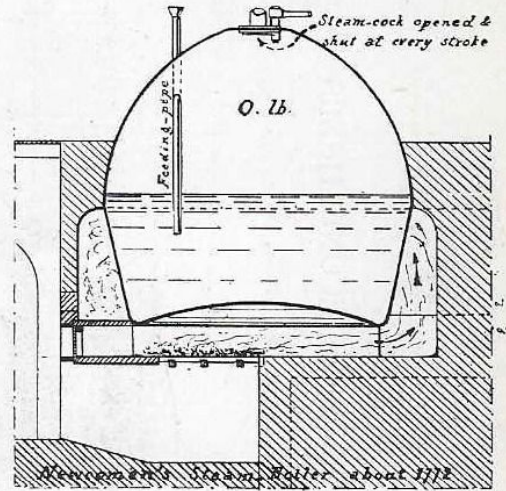


Fig. 94.—NEWCOMEN, 1772.

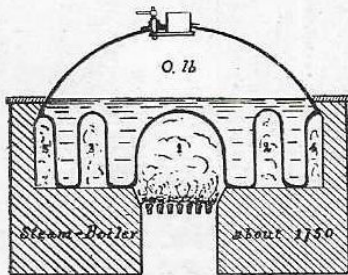


Fig. 95.—OLD STATIONARY BOILER, 1750.

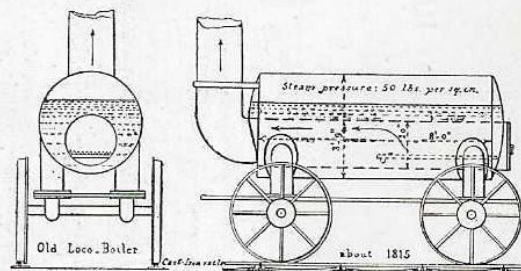


Fig. 96.—OLD LOCOMOTIVE BOILER, 1815.



MODERN LANCASHIRE BOILER.

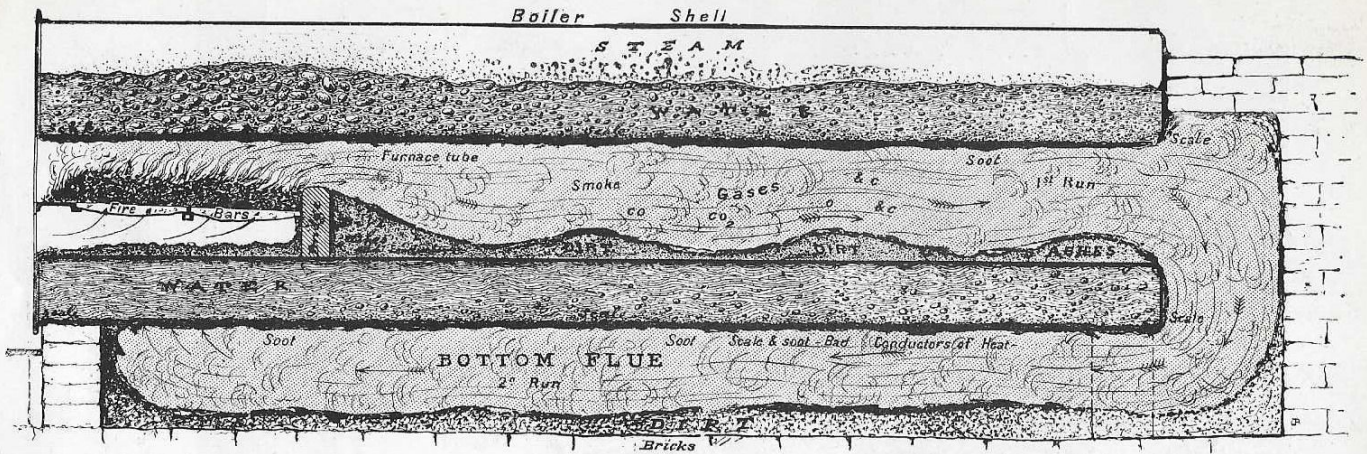


Fig. 97.

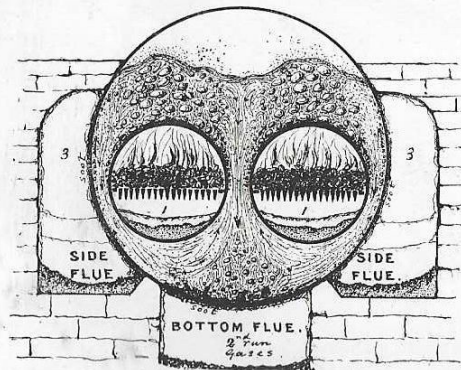


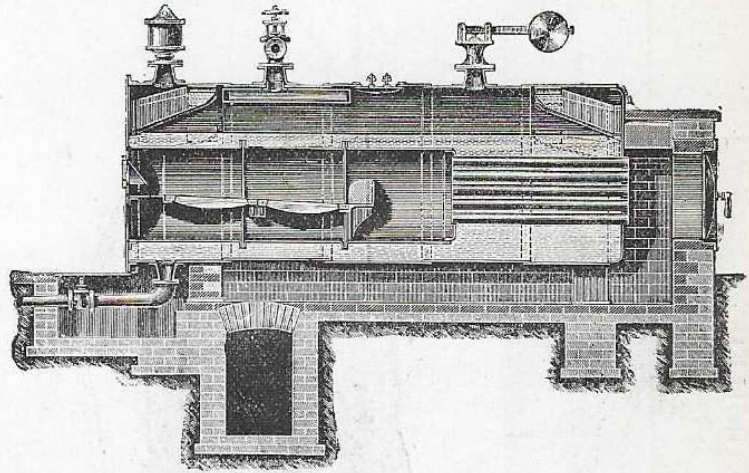
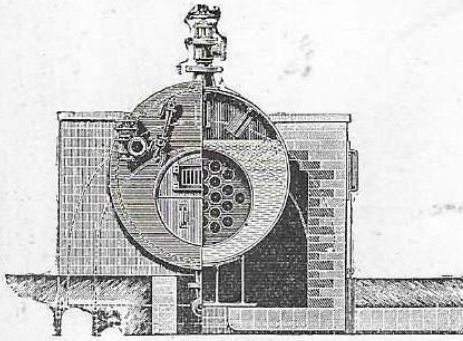
Fig. 98.

Figs. 97 and 98.—LANCASHIRE BOILER, with two Internal Fires; showing dirt, soot, &c., as in an actual boiler. With approximate representation of the evaporation of water at different parts of the boiler, maximum being over the fires. Drawn by the Author.



EXAMPLES OF MODERN CORNISH AND LANCASHIRE BOILERS.

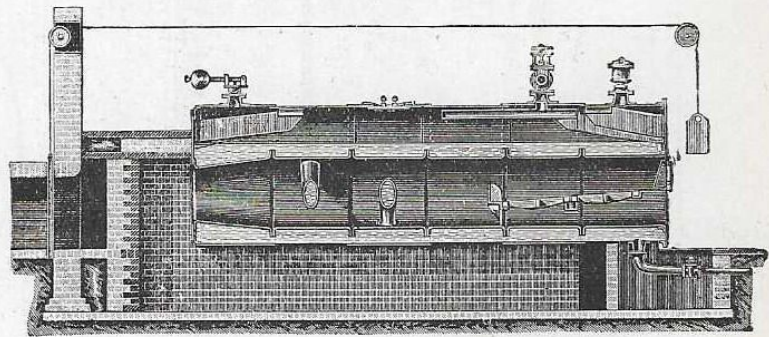
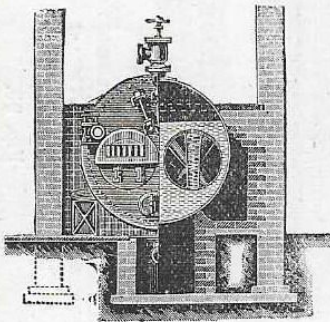
INTERNAL FIRES.



CORNISH BOILER, with Smoke Tubes (Messrs MARSHALL & Co.).

Fig. 99.—Cross Section.

Fig. 100.—Longitudinal Section.



LANCASHIRE BOILER, with Cross Water Tubes (Messrs MARSHALL & Co.).

Fig. 101.—Cross Section.

Fig. 102.—Longitudinal Section.



EXAMPLES OF MODERN CORNISH AND DRY BACK BOILERS.  
WITH INTERNAL FIRES.

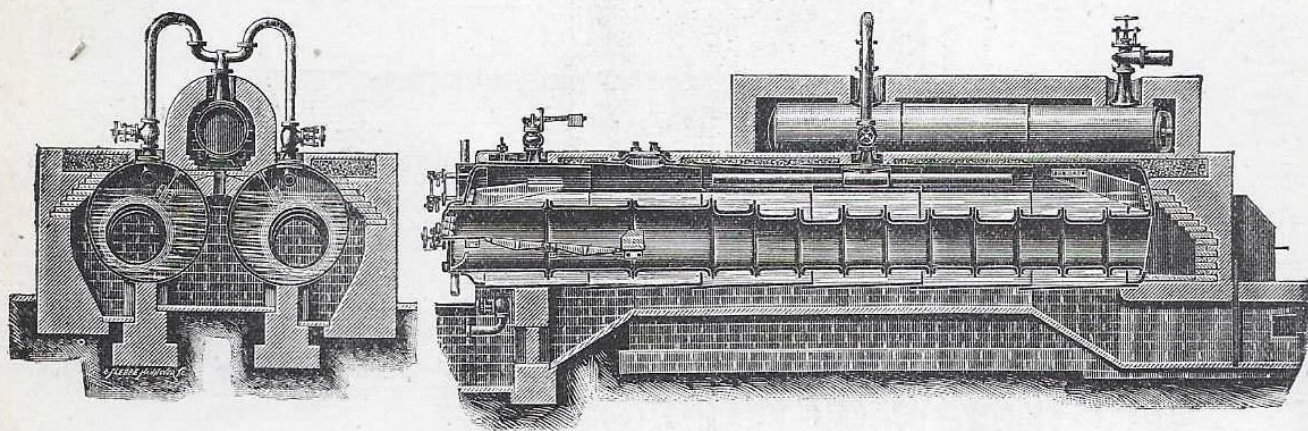


Fig. 103.—CORNISH BOILER (H. PAUCKSCH, Landsberg, Germany). Furnace flue in short lengths and different diameters. (Copyright.)

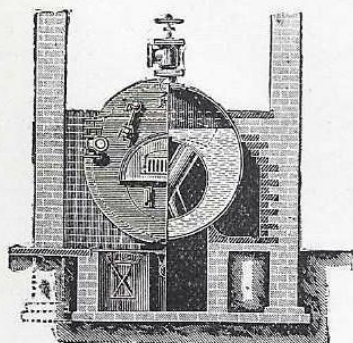


Fig. 104.—CORNISH BOILER  
(Messrs MARSHALL).

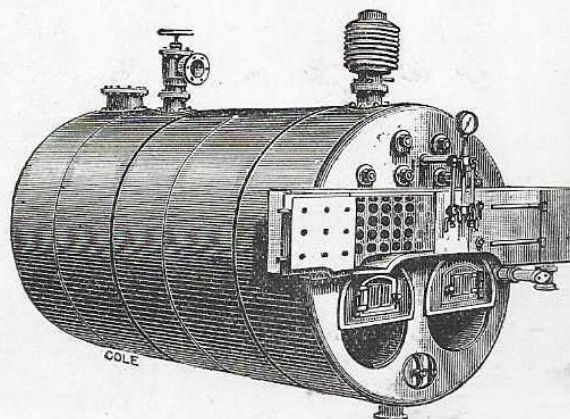


Fig. 105.—DRY BACK BOILER, with smoke tubes  
(Messrs PAXMAN).



EXAMPLE OF A MODERN LANCASHIRE BOILER WITH TWO INTERNAL FIRE TUBES.

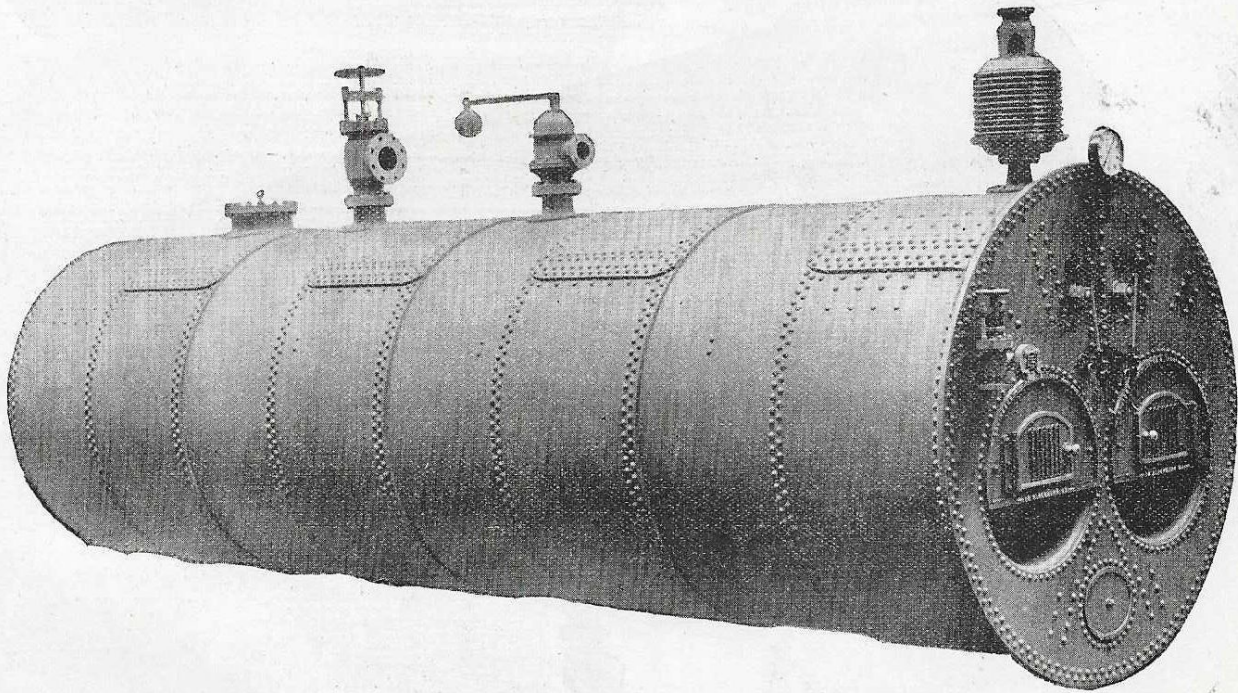
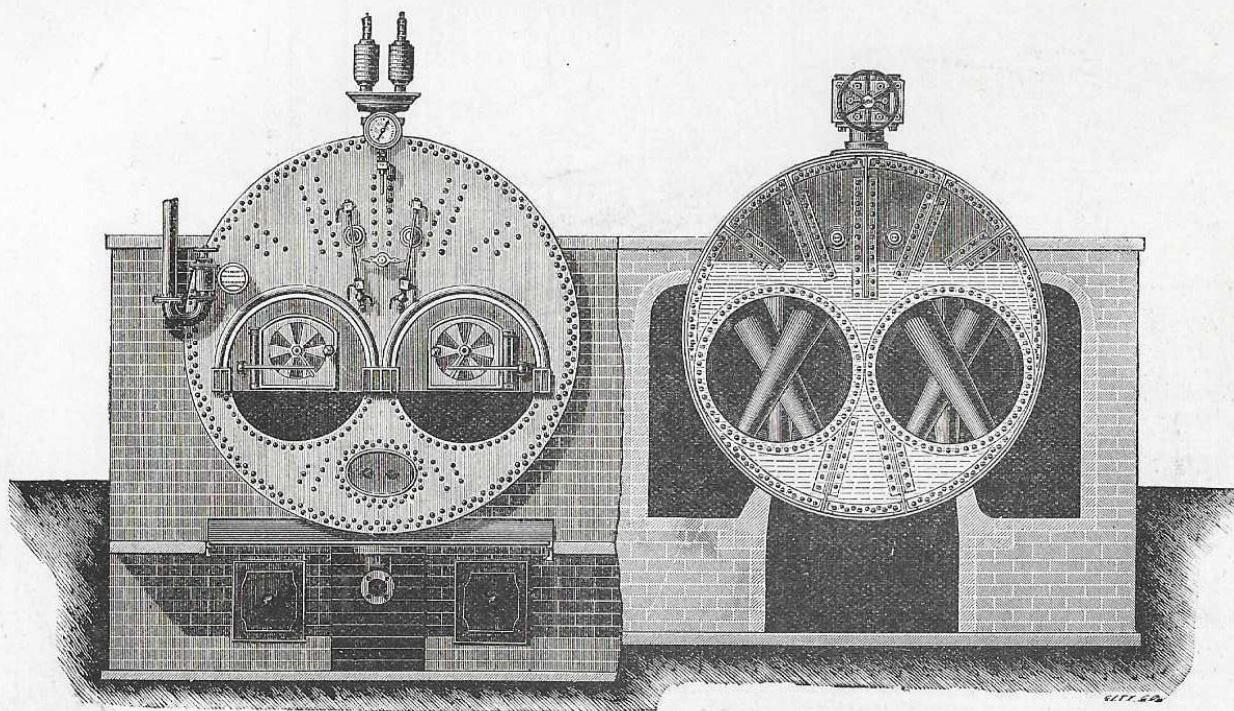


Fig. 109.—TWO-FLUE LANCASHIRE BOILER. 8 ft. diameter by 30 ft. long, 200 lbs. pressure  
(Messrs YATES & THOM).

EXAMPLE OF A MODERN LANCASHIRE BOILER WITH TWO INTERNAL FIRES  
AND CROSS WATER TUBES.



Front View.

Section of Brick Setting.

Fig. 110. —LANCASHIRE BOILER (Messrs MUSGRAVE).



# HEAT EFFICIENCY OF STEAM BOILERS.

## EXAMPLE OF A MODERN STATIONARY BOILER.

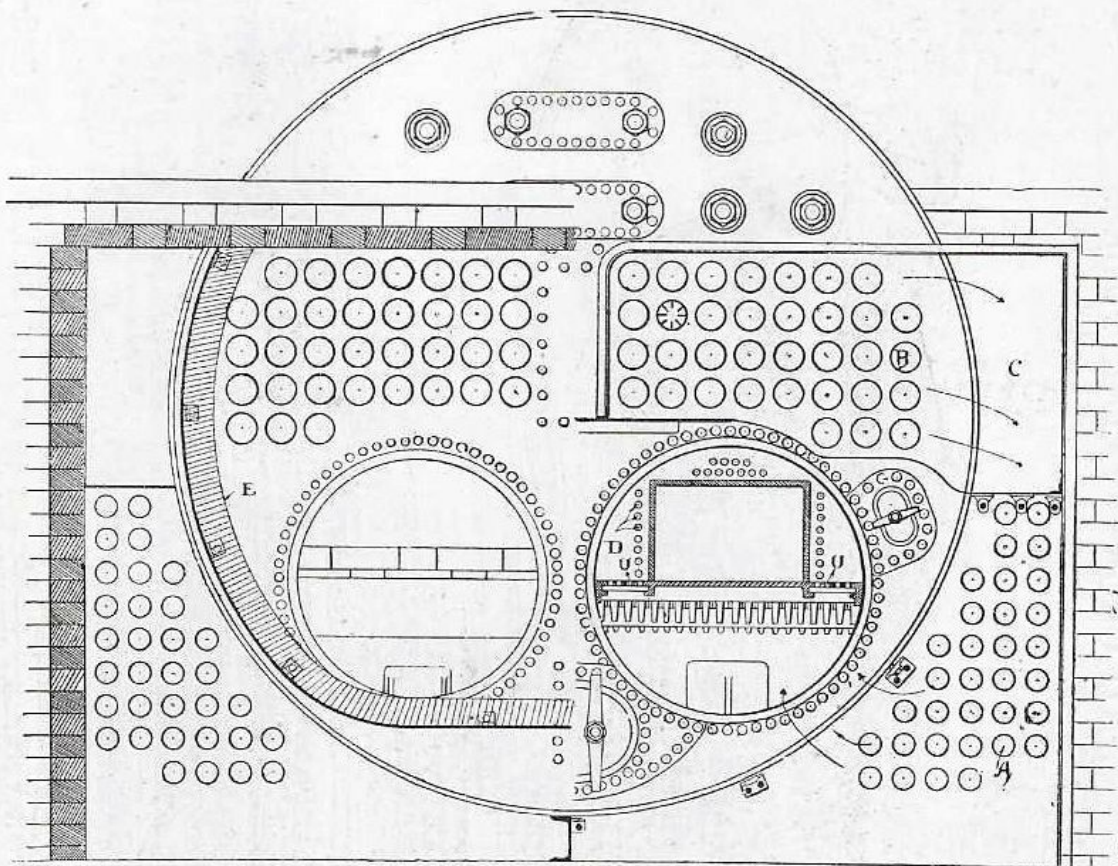
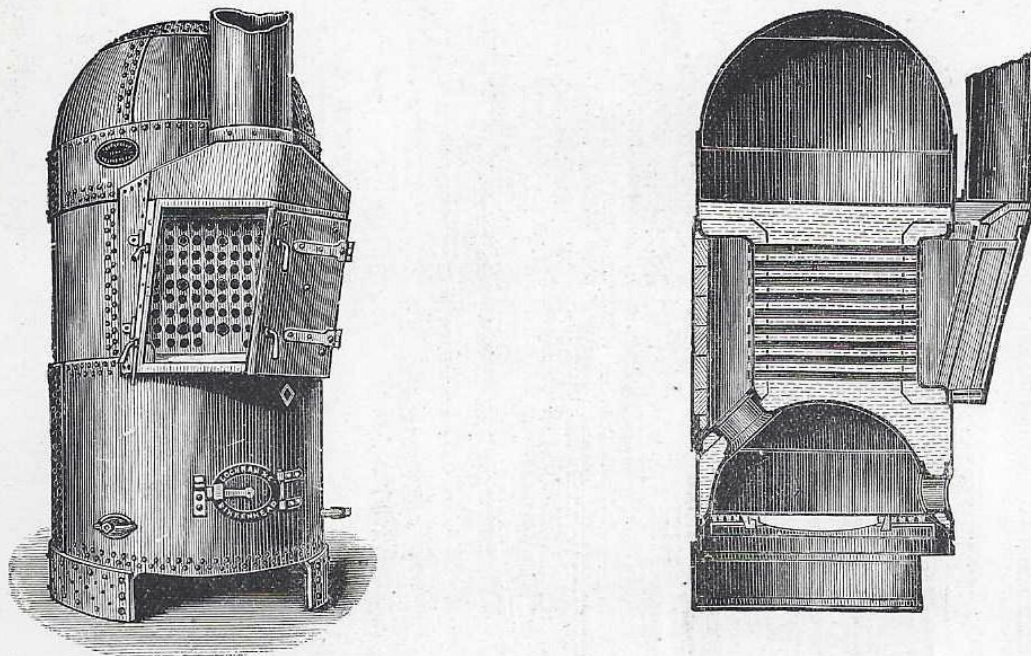


Fig. 111.—DRY BACK BOILER. Internal Lancashire Furnace below and Smoke Tubes above ; with arrangement for heating the air for combustion by J. FRASER & SON. Air heating pipes in brick flues on each side.

## EXAMPLES OF MODERN VERTICAL BOILERS—EXTERNAL FIRES.



Figs. 112 and 113.—VERTICAL BOILER with Horizontal Smoke Tubes (Messrs COCHRAN & Co.).

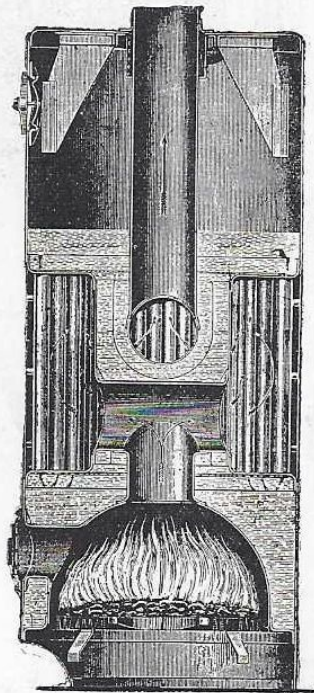


Fig. 114.—VERTICAL BOILER, with Vertical Water Tubes (Messrs TINKER).



EXAMPLE OF A MODERN TWO-STOREY BOILER.

TWO-FLUE LANCASHIRE BOILER BELOW AND SMOKE TUBES ABOVE

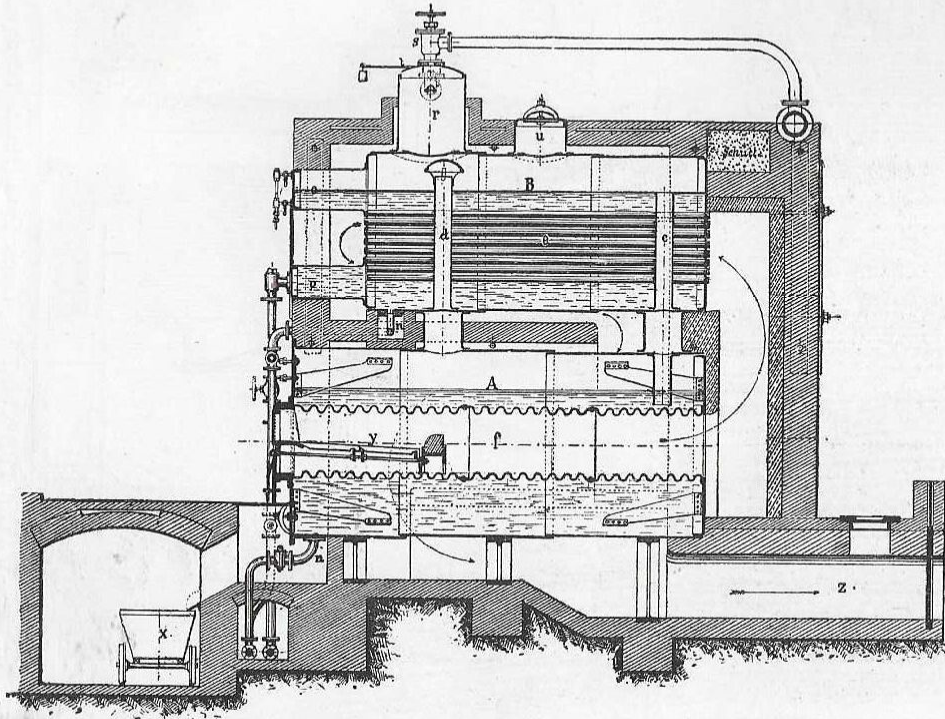


Fig. 119.—Longitudinal Section.

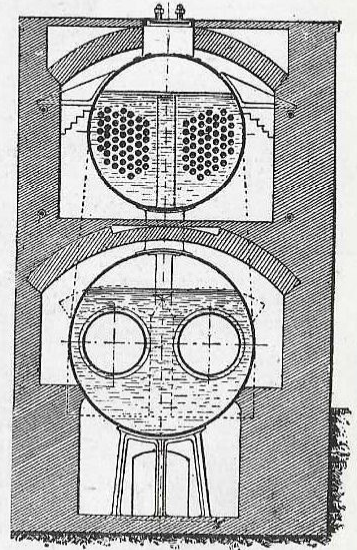
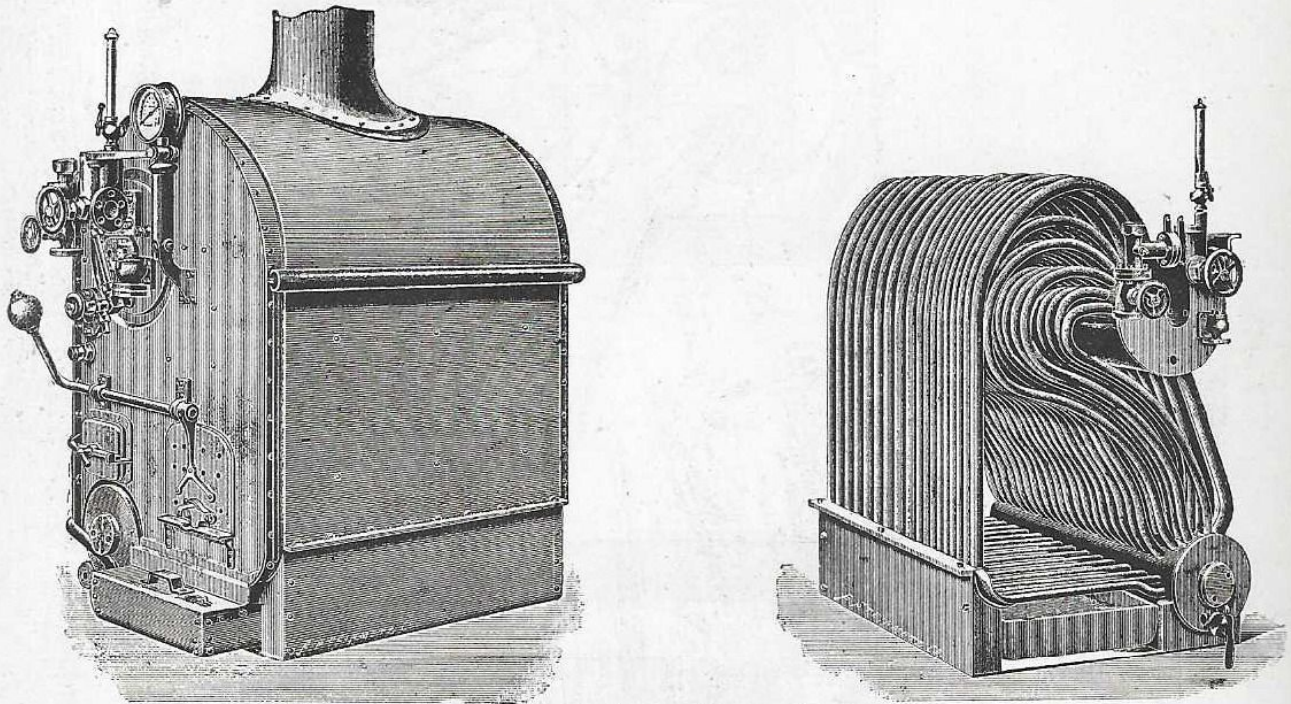


Fig. 120.—Cross Section.



## EXAMPLES OF MODERN WATER TUBE BOILERS.

## EXTERNAL FIRES.



Figs. 121 and 122.—WATER TUBE BOILERS with Small Tubes (Messrs THORNYCROFT).

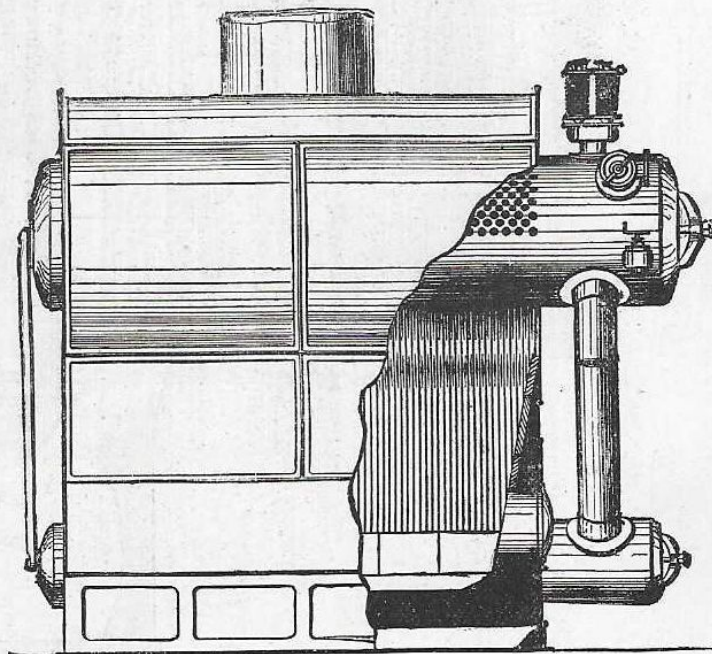


Fig. 123.—WATER TUBE BOILER, Larger Type (Messrs THORNYCROFT).



EXAMPLES OF MODERN WATER TUBE BOILERS.

EXTERNAL FIRES.

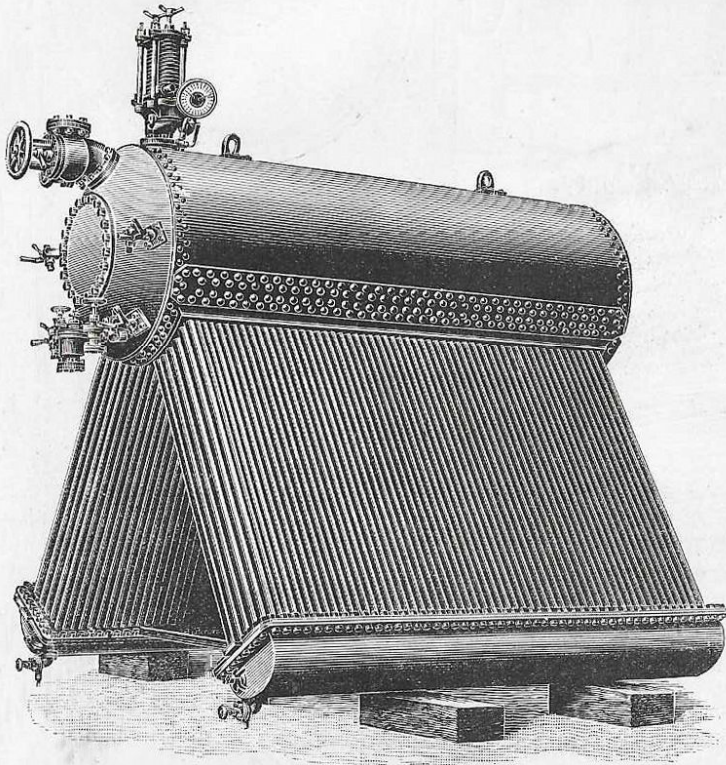


Fig. 124.—“YARROW” WATER TUBE BOILER. Straight Small Tubes.

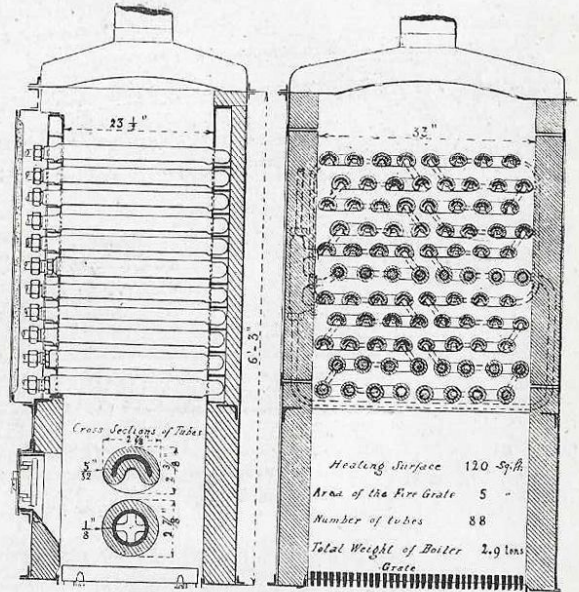


Fig. 125.—“SERPOLLET” BOILER.



EXAMPLE OF A MODERN WATER TUBE BOILER—CLIMAX BOILER.  
EXTERNAL FIRE—500 H.-POWER.

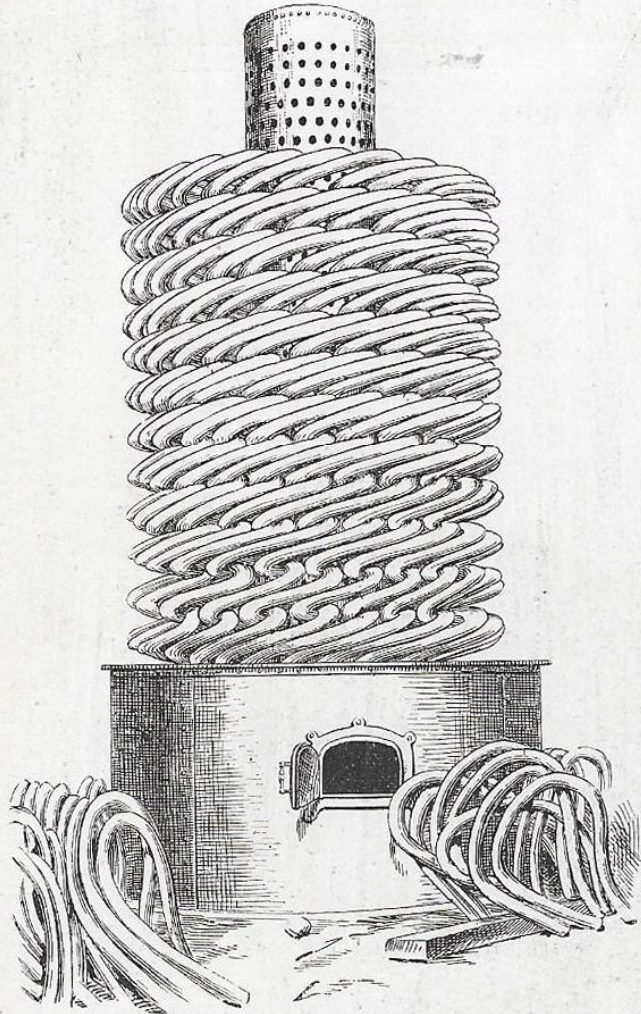
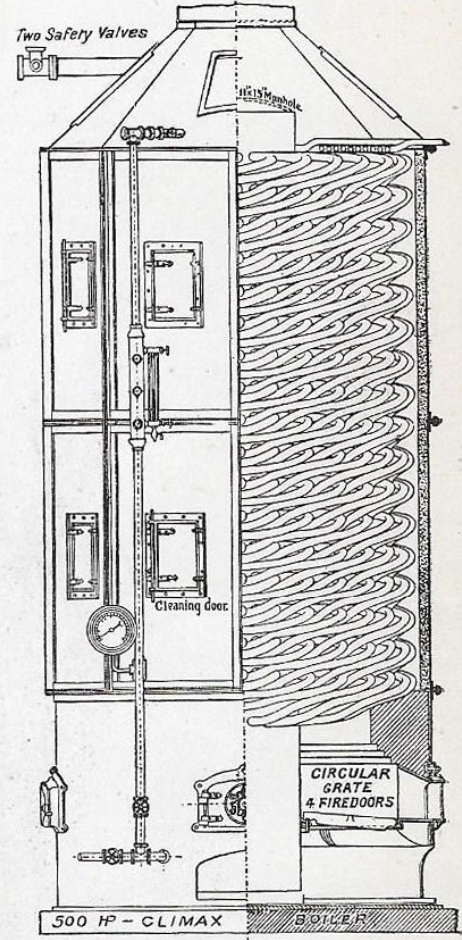


Fig. 126.—With small Steel Tubes. No Brick Flue  
One Circular Grate, with Four Firing Doors.



Elevation.

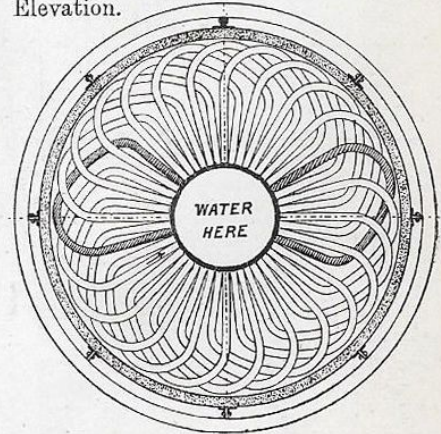


Fig. 127.—Plan.



EXAMPLES OF MODERN WATER TUBE BOILERS (WITH SMALL TUBES).

EXTERNAL FIRES.

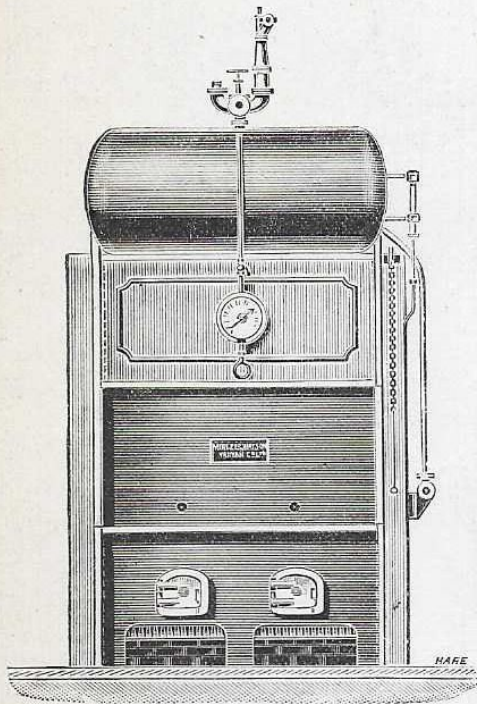


Fig. 128.—WATER TUBE BOILER (Messrs MIRRELES, WATSON, & YARYAN Co.).

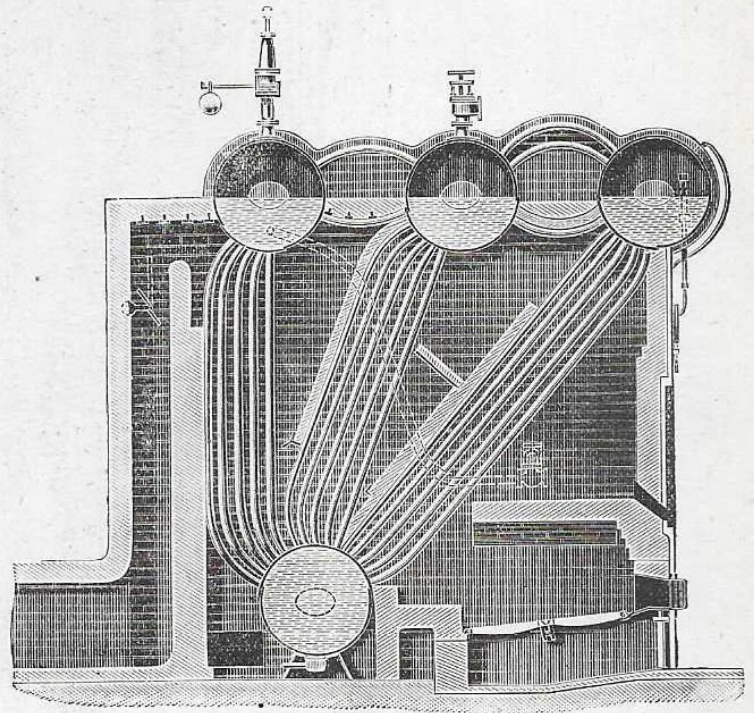


Fig. 129.—WATER TUBE BOILER, small Tubes (Messrs MIRRELES, WATSON, & YARYAN Co.).

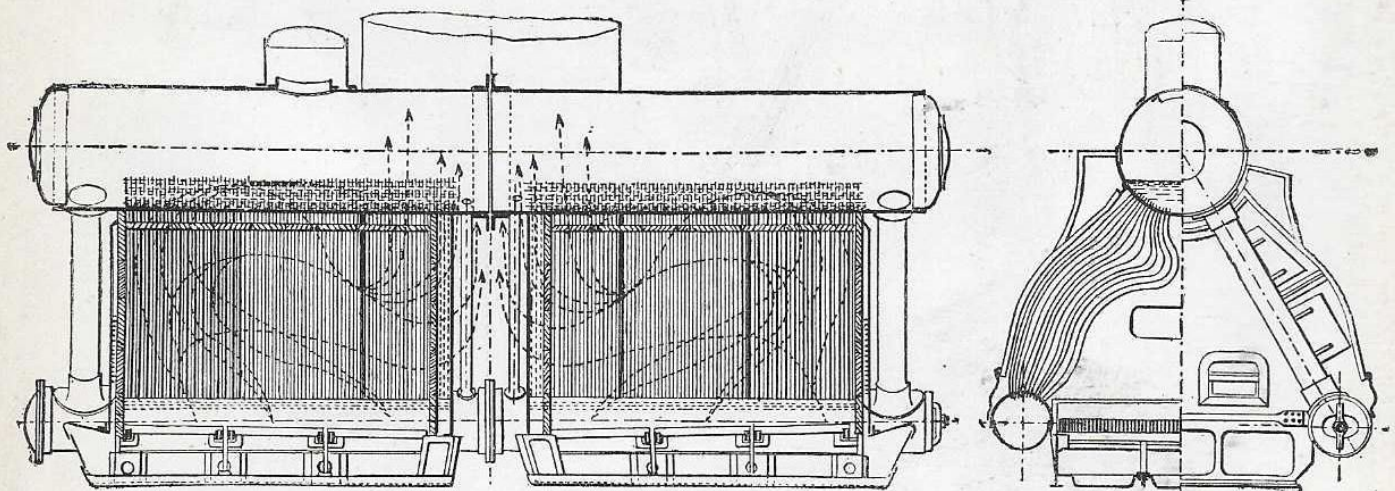


Fig. 130.—WATER TUBE BOILER, with small Tubes (Messrs NORMAND & Co., Havre).