

Sixth.—The construction should be such, that one can readily gain access to all parts for cleaning, examination and repairs and that all parts exposed to fire may be renewed without interfering, seriously, with the remainder of the boiler.

Seventh.—Its general arrangement should be such that mud and grease may collect somewhere at the bottom, out of the reach of the fire.

Eighth.—Should the supply of feed-water be interrupted, the boiler could steam for some time without the water lowering sufficiently to uncover any of the heating surfaces.

As to cost, the water-tube boiler proper is cheaper of construction, but when installation and royalties on patents are considered, the water-tube boiler costs just about the same as the cylindrical. The thickness of the material forming the heating surface is a very important consideration. We have already found, that the increased temperature of the water decreases the efficiency of the heating surfaces, and if we are also compelled to increase the thickness of the plates, or tubes, we shall still further decrease the efficiency. All things else being equal, we shall necessarily increase the thickness of circular furnaces, increase the thickness of flat stayed surfaces, or decrease the pitch of the stays, and increase the thickness of stay tubes, but plain tubes will not need to be increased in thickness, because they are now made sufficiently thick, hence a preference will be given the boiler in which as large a proportion of the heating surface as possible consists of plain tubes. As to size and arrangement of combustion chamber, too much consideration cannot be paid. If complete combustion of furnace gases is not effected before they pass to the heating surfaces and lose a portion of their heat, much of the fuel will pass off into the up-take, never having been burned at all. The ideal combustion chamber would be a large free space, immediately above the grate bars.

The distribution of the gases over the heating surfaces, and the time which they are in contact with the heating surfaces, affects the efficiency of the boiler very much. To secure a large efficiency, the water must extract as much heat as possible from the hot gases. Up to a certain limit, the gases must be as long a time as possible in passing over the heating surfaces, and they must also be well broken up into small currents, so that they may yield up their heat as readily as