placed over the heat, and Mr. Clarke clearly says that the principal efficiency of tubes is in the upper semi-circle, from which it evidently results that the vertical tube would not be any more efficient, if so much so, as the horizontal one, unless the advantage resulted for the application of the heat to its exterior surface.

There are some good suggestions, however, in the following remarks, and especially in reference to contracting the ends of the tubes by the insertion of ferrules, which we have ever viewed as a serious, though unavoidable evil:

"We now submit the following application of Montgomery's boiler to the locomotive engine for increasing the efficiency of the steam-generating parts. Retaining the common firebox shell, produce it forwards, so that it shall just clear the driving axle, then let the sides drop to within two feet of the rail, and close up the bottom. Next, inside of this, place a rectangular box, which shall be a continuation of the inner fire-box, the top being about 9 inches above the diametric chord of the barrel, leaving a water space of 4 to 5 inches between the sides and bottom of the boxes. Fill the inner box with vertical tubes, the top and bottom being flue plates. The tubes being screwed in at one end, and fitted with a screw thimble at the other, may be removed for cleaning at any time, and will effectually stay the inner box against the immense pressure to which it is subjected. The pressure, being inside of the tubes, will tend to keep the end joints tight, where in the common boiler the reverse is the case.

"That the gases may retain sufficient heat to burn until they are discharged, there should be less tube surface to absorb the heat at the back, than at the front end; a requirement which is easily satisfied by decreasing the number and increasing the size from the front to the back end. *In the common boiler the ferrule area being less than the flue area, a stronger blast is required than is economical, because by drawing hard enough to get the gases through the ferrules, we draw too hard to carry them through the flues at a rate slow enough to admit of a complete extraction of their heat.* By means of the vertical flues we may arrange the gas area in any way we please, making it larger at the fire end, if necessary.

"Again, any amount of oxygen may be applied to the gases at any point of their passage from the furnace to the smoke box, by the admission of fresh air to any part of the barrel; thus the advantage of a combustion chamber (if there is any) is obtained without the sacrifice of a single inch of tube surface, as we are required only to admit the air between the tubes, and not inside of them. This may be done