

sides so as to allow the free escape of steam, and hence the truth of the observation that "the object of the fire box is more to generate heat than to absorb it, and the absorption takes place chiefly in the tubes."

In relation to the tubes Mr. D. K. Clarke says: "There is reason to believe that in the upper semi-circle part of such tube, the efficiency chiefly resides. The winding progressive motion, observable in tubes of considerable diameter, confirms the conclusion, as it is with much probability due to the cooling of the upper portions of the gases of combustion which, as they cool, also become heavier, and descend laterally to make room for the hotter smoke next the bottom of the flue, the general result of which is the spiral motion of the current in its progress forwards."*

The writer in the *Railway Times* has introduced most of the above quotations in his article, apparently for the purpose of paving the way for proposing a new plan of constructing Locomotive Boilers. If Mr. Clarke reasons correctly, however—and his argument appears to have been well considered and based on actual experiment—it is difficult to understand what advantages are likely to arise from the introduction of Montgomery's principle into the construction of the Locomotive Boiler, as proposed by the writer above alluded to, for though there is no doubt but an advantage in point of area would be obtained by applying the heat to the outer instead of the inner surface of the tubes, proportionate to the increased diameter, we are still unable to reconcile the following with Messrs. Armstrong and Clarke's experiments and deductions in relation to vertical free surfaces:

"If the ideas of Clarke and of Overman are correct, the value of vertical flues with the water inside, as compared with the horizontal flues with water outside, will be as follows: neglecting the physical advantage of applying heat to the convex surface so highly estimated by Overman.

One half of the surface of the horizontal tube (the upper half) is available, but this half generates steam twice as fast as the vertical sides of the upright tubes. Thus the amount of evaporation will be the same in either position for the same absolute tube surface, not considering the increase obtained by applying the heat to the increased surface of the outside over the inside."

Now it appears to us that Mr. Armstrong has shown that vertical surfaces are only one half as efficient as horizontal ones

* *Railway Machinery*, folio 126.