

over twelve hours' duration, under ordinary service condition, in all parts of the world, and with coal of ordinary quality. These trials have shown that about 90% of the theoretical gain, due to the use of increased steam pressure, has been realized in practice, and we are, therefore, safe in assuming an advance of efficiency of 8%, due to changing from a triple expansion engine using steam at 168 pds. to a quadruple using steam at 250 pds. pressure.

Now, as to a few of the considerations, that will influence us in the design or choice of the boiler, most suitable for this altered pressure. Rankine says, that the transmission of fire heat to water, varies as the square of the difference of temperature between the fire and the water. It is difficult to arrive at a thoroughly satisfactory conclusion on this point, as the result of several experiments seem to be somewhat contradictory. Then, it, also, is a question, whether a plate offers the same resistance, whether the transmitting medium be fire, heat or steam. Results show, that the temperature of the fire must be higher to maintain a given difference in temperature between the two sides of the plate, than in case of steam, but that the same quantity of heat is transmitted. This would indicate, that the resistance of the plates is the same, whatever the transmitting medium.

Mr. Bleckyn den has made a series of experiments with plates of different thickness, and he finds that between certain limits, about $1\frac{1}{8}$ " and $\frac{1}{2}$ ", that the transmission of heat varies inversely as the square root of the thickness, for any given difference of temperature, but that below $\frac{1}{2}$ ", the transmission varies inversely as some higher root of the thickness. Fig. 1 gives the results of his work.

Dr. Kirk made a number of experiments with thick plates, and he tells us that one side became red hot, while the other side remained at 212° , the temperature of the water. He says that it would seem, that with plates above $\frac{3}{8}$ " in thickness, that the transmission of heat varies inversely as the thickness. Combining these results, we find that the transmission of heat varies as the square of the difference of temperature between the fire and the water, inversely as the thickness for thick plates, inversely as the square root of the thickness for medium plates, and inversely as the cube root of the thickness for thin plates.

With these results in view, we can ascertain what effect the rise in boiler pressure will have upon the transmission of heat. We may

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