der as steam; the rest passes through the engine as water, or is sometimes partially re-evaporated, but never in such fashion or at such time as to be of much real service in doing work. There are thousands of engines at work to-day, in which for every ton of water which has been evaporated in the boiler half a ton does no good whatever, except to warm up (by being condensed itself) the engine sufficiently to allow the other half ton to do work. Here, truly, is a field for economy, and one with very great possibilities. Aside from steam jacketing and other methods in partial mitigation of the waste, Prof. Kennedy states that there is no doubt that the great benefits which have been derived from superheating, and the still greater possibilities of economy which exist in it, and will probably soon be more heard of, are not at all connected only with the rise of maximum theoretical efficiency. The drying of the steam very largely influences its behavior under the conditions mentioned, and unquestionably helps enormously to diminish the waste. In the case of the incandescent electric lamp, to quote another instance of waste of energy, about 95 per cent. is expended in heat and only 5 per cent. in the actual production of light. The great desideratum here is to obtain light without heat, or at any rate, with a minimum of heat; but the Professor acknowledges that he does not see from what direction the necessary improvements are to come.

A NEW MARINE BOILER.

It is well known that the construction of the marine boiler is not favorable to satisfactory circulation of the water in it, by means of which it can be maintained in all parts at the same temperature, says the *Engineering Review*. The lower parts get several degrees colder than the parts which are over the furnaces, and the colder and heavier water remains there without being stirred up to mix with the lighter and hotter water from which the steam is escaping at the higher level. The consequence of this inequality of temperature is a series of strains upon the shell, which are particularly trying and create a liability to leak at the seams. This leakage is the first step towards that corrosion which is always an element of danger, and which it is desirable to prevent if it is in any way possible. This difficulty gives especial interest to a form of water-heater which is being experimented with at Liverpool, the principal feature of which is that the suction of the feed-pump is taken partly from the hot well of the engine, where it has a temperature of 110° to 130°, and partly from the lower part of the boiler under the furnaces. Of course the latter water will be at a temperature higher than 212°, and by suitably adjusting the proportions the water which passes out through the delivery-pipe can be brought up to that temperature. By this means the water in the boiler is compelled to a circulation to supply the place of that withdrawn.

LIGHTHOUSES.

One of the most serious problems to be considered in lighting a coast is the question of differentiating one lighthouse from another in order that no mistake may be made either by day or by night. This is especially difficult when there are several lights within a few miles of each other. Various means have been devised to mark them by daylight, such as painting the lighthouses of different colors, with red or black and white bands or stripes, or pure white or red, or by having two lighthouses adjoining and the like. At night the lights are either fixed or revolve, or flash at certain intervals, or show different colors. But all these devices, especially those for the night, are becoming insufficient as steam navigation increases, and vessels going twenty miles an hour cannot or will not stop to study out the character of a distant light. The greatly increased number of other lights, and particularly electric lights, as the coast becomes more densely settled, is also found to add to the difficulty of distinguishing lighthouses at night. For these reasons experiments are now in progress, says an American paper, for introducing some system of numbered sequence in throwing out the light from the lantern similar to the method in use with steam foghorns, by which a given lighthouse or lightship is indicated by the sequence of the blast from the foghorn. Three numbers, sufficient for several hundred combinations, might be the basis for the method. Undoubtedly there are great difficulties to be overcome in maturing some good system, but something will have to be done to keep lighthouses up to the needs of the present day.

THICKNESS OF BOILER PLATES.

A. Blechynden, in a paper contributed to the Institution of Naval Architects, London, Eng., gives the results of some experiments upon the transmission of heat, with special reference to the efficiency of boilers. The experiments were in two directions, viz.: those in which there were varying differences of temperature at the two sides of the plate, and secondly, those in which the thickness of the plate varied. The general conclusion arrived at was, that heat transmitted is proportional to the square of the difference between the temperatures at the two sides of the plate. There was a general rise in the value of the moduli for temperature with decrease of thickness, but the progress was by no means constant and regular. This the author attributed to the difference in surface, and more especially the difficulty of maintaining it uniformly clean. It was found that the very slightest trace of grease caused a very large fall in the rate of transmission; even wiping the outer surface with a piece of rag was sufficient to influence the result. The smoothness of the surface was also shown to be an important factor. The author also noticed that the carbon content appeared to affect the conductivity, the plate lowest in carbon being also the lowest in conductivity. The results of these experiments certainly point to conclusion that the thinner the plates forming part of the heating surface of a boiler, the higher should be the boiler's efficiency, always provided that the plates are clean; but it will be evident that if the plates are coated with a covering of scale or some bad conductor, then the less must be the influence of the thickness on the efficiency, while with a thick coat of oil the influence might become practically unimportant. The fact that the heat transmitted is proportional to the square of the difference of the temperatures of the two sides of the plate, shows the importance of high furnace temperatures if efficiency is aimed at, and emphasizes the importance of rapid combustion, either by means of air supplied by fans or by height of funnel.