

fuel; and no construction of furnace can prevent this. Mr Watt, therefore, set his invention to work to discover methods of husbanding this heat. The cylinder of his little model was heated almost in an instant, so that it could not be touched by the hand. It could not be otherwise, because it condensed the vapour by abstracting its heat. But all the heat thus communicated to the cylinder, and wasted by it on surrounding bodies, contributed nothing to the performance of the engine, and must be taken away at every injection, and again communicated and wasted. Mr Watt quickly understood the whole process which was going on within the cylinder, and which we have considered so minutely, and saw that a very considerable portion of the steam must be wasted in warming the cylinder. His first attempts were made to ascertain how much was thus wasted, and he found that it was *many* times as much as would fill the cylinder and work the engine. He attempted to diminish this waste by using wooden cylinders. But though this produced a sensible diminution of the waste, other reasons forced him to give them up. He then *surrounded thin* metal cylinders *with* a wooden case. By this, and using no more injection than was absolutely necessary for the condensation, he reduced the waste *considerably*; and there consequently remained in it a steam of very considerable elasticity, which robbed the engine of a proportional part of the atmospherical pressure. He saw that this was unavoidable as long as the condensation was performed in the cylinder.

54. The thought struck him to attempt the condensation in another place. His first experiment was made in the simplest manner.* A globular vessel communicated by

* "The globular vessel only existed in Mr W.'s mind, and was never executed. The tin cylinder is a mistake; there never was any used in this model, the cylinder being of brass. The crushing relates to another experiment on the thickness of cylinders necessary to resist the pressure of the atmosphere." W.