upper one. When this has been completed, the ſteam is again admitted into the upper receiver. This allows the water to run back into the lower receiver, and the air returns into the ſmall receivers in the pit, and allows the water to run out of each into its proper ciſtern. By this means the water of each pipe has been raiſed 15 feet. The operation may thus be repeated continu­ally.

The contrivance is ingenious, and ſimilar to ſome which are to be met with in the hydraulics of Schottus, Sturmius, and other German writers. But the opera­tion muſt be exceedingly slow ; and we imagine that the expence of ſteam muſt be great, becauſe it muſt fill a very large and very cold veſſel, which muſt waſte a great portion of it by condenſation. We see by ſome late publications of the very ingenious Mr Blackey, that he is ſtill attempting to maintain the reputation of this machine by ſome contrivance oſ this kind ; but we imagine that they will be ineffectual, except in ſome very particular ſituations.

For the great defect of the machine, even when we can ſecure it againſt all riſk of burſting, is the prodigi­ous waſte of ſteam, and conſequently of fuel. Daily experience ſhows, that a few ſcattered drops of cold wa­ter is sufficient for producing an almoſt inſtantaneous condenſation of a great quantity of ſteam. Therefore when the ſteam is admitted into the receiver of Savary’s engine, and comes into contact with the cold top and cold water, it is condenſed with great rapidity ; and the water does not hin to ſubſide till its ſurface has become ſo hot that it condenſes no more ſteam. It may now begin to yield to the preſſure of the incumbent ſteam ; but as ſoon as it deſcends a little, more of the cold sur­face of the receiver comes into contact with the ſteam, and condenſes more of it, and the water can deſcend no farther till this addition of cold ſurface is heated up to the ſtate of evaporation. This rapid condenſation goes on all the while the water is deſeending. By ſome ex­periments frequently repeated by the writer of this arti­cle, it appears that no leſs than 11/12ths of the whole ſteam is uſeleſsly condenſed in this manner, and not more than 1/12th is employed in allowing the water to deſeend by its own weight ; and he has reaſon to think that the portion thus wasted will be conſiderably greater, if the ſteam be employed to *force* the water out of the receiver to any conſiderable height.

Obſerve, too, that all this waſte muſt be repeated in every ſucceeding ſtroke ; for the whole receiver muſt be cooled again in order to fill itſelf with water.

Many attempts have been made to diminish this waſte ; but all to little purpoſe, becauſe the very fill­ing of the receiver with cold water occaſions its ſides to condenſe a prodigious quantity of ſteam in the ſuc­ceeding ſtroke. Mr Blackey has attempted to lessen this by uſing two receivers. In the first was oil ; and into this only the ſteam was admitted. This oil paſſed to and fro between the two receivers, and never touched the water except in a ſmall surface. But this hardly produced a ſenſible diminution of the waſte : for it muſt now be obſerved, that there is a neceſſity for the first cylinder’s being cooled to a conſiderable degree below the boiling point ; otherwiſe, though it will condenſe much ſteam, and allow the water to riſe into the receiver, there will be a great diminution of the height of ſuction, unleſs the veſſel be much cooled. This appears plainly by inspecting the table oſ elasticity. Thus, if the veſſel be cooled no lower than 180⁰, we ſhould loſe one half of the preſſure of the atmoſphere ; if cooled to 120, we ſhould ſtill loſe 1/10th. The inſpection of this table is of great uſe for understanding and improving this no­ble machine ; and without a conſtant recollection oſ the elaſticity of ſteam correſponding to its actual heat, we ſhall never have a notion oſ the niceties of its opera­tion.

The rapidity with which the ſteam is condenſed is really aſtoniſhing. Experiments have been made on ſteam-veſſels of six feet in diameter and ſeven feet high; and it has been found, that about four ounces of water, as warm as the human blood, will produce a complete condenſation in leſs than a ſecond ; that is, will pro­duce all the condenſation that it is capable of producing, leaving an elaſticity about 1/5th of the elaſticity of the air. In another experiment with the ſame ſteam-veſſel, no cold water was allowed to get into it, but it was made to communicate by a long pipe four inches in diameter with another veſſel immerſed in cold water. The condenſation was ſo rapid that the time could not be meaſured : it certainly did not exceed half a ſecond. Now this condenſation was performed by a very trifling ſurface of contact. Perhaps we may explain it a little in this way : When a maſs of ſteam, in immediate con­tact with the cold water, is condenſed, it leaves a void, into which the adjoining ſteam inſtantly expands ; and by this very expanſion its capacity for heat is increaſed, or it grows cold, that is, abſtracts the heat from the ſteam situated immediately beyond it. And in this ex­panſion and refrigeration it is itſelf partly condenſed or converted into water, and leaves a void, into which the circumjacent ſteam immediately expands, and produces the ſame effect on the ſteam beyond it. And thus it may happen that the abſtraction of a ſmall quantity of heat from an inconſiderable mass of ſteam may produce a condenſation which may be very extenſive. Did we know the change made in the capacity of ſteam for heat by a given change of bulk, we ſhould be able to tell exactly what would be the effect of this local actual condenſa­tion. But experiment has not as yet given us any preciſe notions on this ſubject. We think that this rapid condenſation to a great diſtance by a very moderate actual abſtraction of heat is a proof that the capacity of ſteam for heat is prodigiouſly increaſed by expanſion. We say a *very moderate actual abstraction* of heat, becauſe very little heat is neceſſary to raiſe four ounces of blood­warm water to a boiling temperature, which will unfit it for condenſing ſteam. The remarkable phenomenon of ſnow and ice produced in the Hungarian machine, when the air condenſed in the receiver is allowed to blow through the cock (ſee Pneumatics), ſhows this to be the caſe in moiſt air, that is, in air holding water in a ſtate of chemical ſolution. We ſee something very like it in a thunder-ſtorm. A ſmall black cloud ſometimes appears in a particular ſpot, and in a very few se­conds ſpreads over many hundred acres of ſky, that is, a precipitation of water goes on with that rapid diffuſion. We imagine that this increaſe of capacity or de­mand for heat, and the condenſation that muſt enſue if this demand is not ſupplied, is much more remarkable ia pure watery vapours, and that this is a capital distinction of their conſtitution from vapours dissolved in air.