appearances which render them doubtful. When with a lens of an inch in diameter we form a focus on a piece of black unpoliſhed marble of an inch diameter, the ma­thematician muſt allow that no more rays fall on the marble than if the lens were away : therefore the marble ſhould be equally warmed in either caſe. But it is by no means ſo, as we have repeatedly found by exposing it during equal times, and then dropping it into water. The water which is heated by the marble on which the focus has been formed will be found to have acquired from it much more heat than from the other. The tops of lofty mountains which are never ſhaded by clouds, but enjoy perpetual ſunſhine and ſerenity, instead of being warmer than the valleys below, are covered with never-melting ſnow ; and we have ſome grounds to ſuſpect that the genial influence of the ſun requires the co-operation of the atmoſphere, and to doubt whether there is any warmth at the moon, on which no atmoſphere like ours can be obſerved. Per­haps the heat which cheers us, and fertilizes our earth, is chemically ſeparated from our atmoſphere by its elec­tive attraction for the light of the ſun. Our ſucceſſors in the ſtudy of meteorology need not fear that the ſubject of their reſearch will be soon deprived of ſcientific allurements. We know but little of it after all the progreſs we have made during this laſt century, and it ſtill preſents an ample field of diſcuſſion.

We ſaid that the accompanyment of light is not demonſtrably necessary. We are certain that heat may be imparted without any ſenſible light, in a manner which we can hardly ſuppoſe any thing but radiation. If a piece of very hot iron be placed a little without the principal focus of a metallic concave ſpeculum, and a very ſenſible air-thermometer be placed in its conjugate focus, it will inſtantly ſhow an elevation of temperature, although the iron is quite imperceptible to an eye which has even been along while in the dark. No ſuch riſe of tempe­rature is obſerved if the thermometer be placed a little to one side of the focus of the ſpeculum ; therefore the pheno­menon is preciſely ſimilar to the radiation of light. We are obliged therefore to acknowledge that the heat is ra­diated in this experiment in the ſame way that light is in the common optical experiments.

Although this is the moſt uſual way that we in this country employ fuel for warming our apartments, it is by no means the only way in which the heat diffuſed from this fuel may be imparted to diſtant bodies. It is not even the moſt effectual method ; it is diffuſed alſo by immediate communication to bodies in contact. The air in immediate contact with the burning fuel is heated, and imparts ſome of its heat to the air lying beyond it, and this is partly ſhared with the air which is ſtill farther off ; and this diffuſion, by communication *in contactu,* goes on till the remote air contiguous to the walls, the floor, the ceiling, the furniture, the company, all get a ſhare of it in proportion to their attrac­tions and their capacities. And as the air is thus con­tinually supplied, and continually gives out heat, the walls, &c. become gradually wanner, and the room becomes comfortable and pleaſant. But we apprehend that no great proportion of the heat actually acquired by the room is communicated in this way. This dif­fuſion by contact is but flow, eſpecially in air which is very dry ; ſo flow indeed, that the air in the immediate neighbourhood of the fuel is burned up the chimney before it has time to impart any of the heat received in contact. We know that the time employed in diffuſing itſelf in this way through ſtagnant air to any mo­derate diſtance is very conſiderable. We imagine there­fore that the heat communicated to our rooms by an open fire is chiefly by radiation, but in a way ſome­thing different from what we mentioned before. We imagine, that as the piece of glaſs in Dr Hooke’s ex­periment abſorbs the heat, ſo the whole maſs of air which fills the room intercepts the radiated heat in every part of the room where the fire is ſeen, and is as it were ſaturated with it throughout, and ready to impart it to every body immerſed in it... We cannot otherwiſe account for the *equability* of the heat in the different parts of the room. Mere radiation on the ſolid bodies would warm them in the inverſe duplicate ratio of their diſtances from the fire ; and diffuſion by contact, if compatible with the rapid current up the chimney, would heat the room ſtill more unequably. Recollect how ſlowly, and with what rapid diminution of intensity, the colour of blue vitriol is communicated to water even to a very ſmall diſtance. But becauſe all parts of the air of the room abſorb radiated heat, what is saturated at a higher temperature, being nearer to the fire, rises to the ceiling, ſpreads outwards along the ceiling, and has its place ſupplied by the air, which is thus puſhed towards the fire from the places which are not directly illuminated.

Far different is the method of warming the room by a ſtove. Here the radiation, if any, is very feeble or ſcanty ; and if a paſſage were allowed up the chimney for the warmed air, it would be quickly carried off. This is well known to the Engliſh who reſide in the cold cli­mates of St Peterſburgh, Archangel, &c. They love the exhilarating flutter of an open fire, and often have one in their parlour ; but this, ſo far from warming the room during the extreme cold weather, obliges them to heat their ſtoves more frequently, and even abſtracts the heat from a whole fuite oſ apartments. But all paſſages this way is ſhut up when we warm a room by ſtoves. The air immediately contiguous to the ſtove is heated by contact, and this heat is gradually, though ſlowly, diffuſed through the whole room. The diffusion would however be very slow indeed, were it not for the great expansibility of air by heat. But the air ſurrounding the ſtove quickly expands and rises to the ceil­ing, while the neighbouring air slides in to ſupply the place, nay is even puſhed in by the air which goes outwards aloft. Thus the whole air is ſoon mixed, and the room acquires almoſt an equal temperature throughout.

The warming by ſtoves muſt therefore be managed upon very different principles from thoſe adopted in the employment of open fires. The general principle is, 1st*,* To employ the fuel in the moſt effectual manner for heating the external part of the ſtove, which is im­mediately efficient in warming the contiguous air; and, 2d, To keep in the room the air already warmed, at leaſt as much as is conſiſtent with wholesomeneſs and cleanlineſs.

The firſt purpoſe is accompliſhed by conducting the flue of the furnace round its external parts, or, in ſhort, by making every part of the flue external. Of all forms, that of a long pipe, returned backwards and for­wards, up and down (provided only that the place of