their quieſcent ſituations: but if they are ſeparated by ſtretching the body, they endeavour (pardon the figurative expreſſion) to come together again. If they are brought nearer by compreſſion, they endeavour to recede. This endeavour is manifeſted by the neceſſity of employing force to maintain the extension or condenſation ; and we repreſent this by the different poſition of our lines. But this is not all : the par­ticle B, which is repelled by A when in the ſituation F or D, is neutral when at B, and is attracted when at C or E, may be placed at ſuch a diſtance A G from A greater than AB that it ſhall be again repelled, or at ſuch a diſtance AH that it ſhall again be attracted ; and these alterations may be repeated again and again. This is curious and important, and requires ſomething more than a bare aſſertion for its proof.

In the article Optics we mentioned the moſt curious and valuable obſervations of Sir Iſaac Newton, by which it ap­pears that light is thus alternately attracted and repelled by bodies. The rings of colour which appear between the ob­ject glaſſes of long teleſcopes ſhowed, that in the ſmall inter­val of 1/1000th of an inch, there are at leaſt an hundred ſuch changes obſervable, and that it is highly probable that theſe alternations extend to a much greater diſtance. At one of theſe diſtances the light actually converges towards the ſolid matter of the glaſs, which we expreſs ſhortly, by ſaying that it is attracted by it, and that at the next diſtance it de­clines from the glaſs, or is repelled by it. The ſame thing is more ſimply inferred from the phenomena of light paſſing by the edges of knives and other opaque bodies. We refer the reader to the experiments themſelves, the detail being too long for this place; and we requeſt the reader to conſider them minutely and attentively, and to form diſtinct no­tions of the inferences drawn from them. And we deſire it to be remarked, that although Sir Iſaac, in his discuſſion, always conſiders light as a ſet of corpuſcles moving in free ſpace, and obeying the actions of external forces like any other matter, the particular concluſion in which we are juſt now intereſted does not at all depend on this notion of the nature of light. Should we, with Des Cartes or Huy­gens, ſuppoſe light to be the undulation of an elaſtic me­dium, the concluſion will be the ſame. The undulations at certain diſtances are diſturbed by forces directed towards the body, and at a greater diſtance, the diſturbing forces tend *from* the body.

But the ſame alternations of attraction and repulſion may be obſerved between the particles of common matter. If we take a piece of very flat and well poliſhed glaſs, ſuch as are made for the horizon glaſſes of a good Hadley’s qua­drant, and if we wrap round it a fibre of ſilk as it comes from the cocoon, taking care that the fibre nowhere cross another, and then press this pretty hard on ſuch another piece of glaſs, it will lift it up and keep it ſuſpended. The particles therefore of the one do moſt certainly attract thoſe of the other, and this at a diſtance equal to the thickneſs of the ſilk fibre. This is nearly the limit ; and it ſometimes re­quires a conſiderable preſſure to produce the effect. The preſſure is effectual only by compreſſing the ſilk fibre, and thus diminiſhing the diſtance between the glaſs plates. This adheſion cannot be attributed to the preſſure of the atmo­sphere, becauſe there is nothing to hinder the air from inſinuating itſelf between the plates, ſince they are ſeparated by the ſilk. Beſides, the experiment ſucceeds equally well under the receiver of an air-pump. This moſt valuable ex­periment was firſt made by Huygens, who reported it to the Royal Society. It is narrated in the Philoſophical Transactions, n⁰ 86.

Here then is an attraction acting, like gravity, at a di­stance. But take away the ſilk fibre, and try to make the glaſſes touch each other, and we ſhall find a very great force neceſſary. By Newton’s experiments it appears, that unleſs the prilmatic colours begin to appear between the glaſſes, they are at leaſt 1/890th of art inch aſunder or more. Now we know that a very conſiderable force is neceſſary for produ­cing theſe colours, and that the more we press the glaſſes together the more rings of colours appear. It alſo appears ſrom Newton’s meaſures, that the difference of diſtance be­tween the glaſſes where each of theſe colours appear is about the 89,000th part oſ an inch. We know farther, that when we have produced the laſt appearance of a greaſy or pearly colour, and then augment the preſſure, making it about a thouſand pounds on the ſquare inch, all colours vaniſh, and the two pieces of glaſs ſeem to make one tranſparent undiſtinguiſhable maſs. They appear now to have no air between them, or to be in mathematical contact. But another fact ſhows this concluſion to be premature. The ſame circles of colours appear in the top of a ſoap bubble ; and as it grows thinner at top, there appears an unreflecting ſpot in the middle. We have the greateſt probability therefore that the perfect tranſparency in the middle of the two glaſſes does not ariſe from their being in contact, but becauſe the thickneſs of air between them is too ſmall in that place for the reflection of light. Nay, Newton expreſsly found no reflec­tion where the thickneſs was 2/5ths or more of the 1/89000th part of an inch.

All this while the glaſſes are ſtrongly repelling each other, for great preſſure is neceſſary for continuing the appearance of thoſe colours, and they vaniſh in ſucceſion as the preſſure is diminiſhed. This vaniſhing of the colours is a proof that the glaſſes are moving off from each other, or repel­ling each other. But we can put an end to this repulſion by very ſtrong preſſure, and at the ſame time sliding the glaſſes on each other. We do not pretend to account so this ef­fect of the sliding motion ; but the fact is, that by ſo doing, the glaſſes will cohere with very great force, ſo that we ſhall break them by any attempt to pull them aſunder. It commonly happens (at leaſt it did ſo with us), that in this sliding compreſſion of two ſmooth flat plates of glaſs they ſcratch and mutually deſtroy each other’s ſurface. It is alſo worth remarking, that different kinds of glaſs exhibit different properties in this reſpect. Flint glaſs will attract even though a ſilk fibre lies double between them, and they much more readily cohere by this sliding pressure.

Here then are two diſtances at which the plates of glaſs attract each other ; namely, when the ſilk fibre is interpoſed, and when they are forced together with this sliding motion. And in any intermediate ſituation they repel each other. We ſee the ſame thing in other ſolid bodies. Two pieces of lead made perfectly clean, may be made to cohere by grinding them together in the ſame manner. It is in this way that pretty ornaments of ſilver are united to iron. The piece is ſcraped clean, and a ſmall bit of ſilver like a fiſh ſcale is laid on. The die which is to ſtrike it into a flower or other ornament is then ſet on it, and we give it a ſmart blow, which forces the metals into contact as firm as if they were ſoldered together. It ſometimes happens that the die adheres to the coin ſo that they cannot be ſepara­ted : and it is found that this frequently happens, when the engraving is ſuch, that the raiſed figure is not complete­ly ſurrounded with a ſmooth flat ground. The probable cauſe of this is curious. When the coin has a flat ſurface all around, this is produced by the moſt prominent part of the die. This applies to the metal, and completely confines the air which filled the hollow of the die. As the preſſure goes on, the metal is ſqueezed up into the hollow of the die ; but there is ſtill air compressed between them, which cannot eſcape by any paſſage. It is therefore prodigiously