Experiments and observations made with a view to point out the errors of the present received theory of electricity and which tend in their progress to establish a new system, on principles more ...

Lyon, John

London, 1780

ETH-Bibliothek Zürich

Shelf Mark: Rar 2291

Persistent Link: https://doi.org/10.3931/e-rara-15218

Chapter II. Containing the principal theories which have been advanced by different philosophers [...].

CHAPTER II.

Containing the principal theories which have been advanced by different philoſophers, to ſolve the phænomenon of electric attraction.

THE firſt appearance which attracted the notice of philoſophers, in this branch of ſcience, was a certain power, which they diſcovered in ſeveral bodies, of drawing other light ſubſtances towards themſelves, after excitation. To ſolve this phænomenon many conjectures have been offered, and many hypothetical ſyſtems advanced, by different perſons, and in different periods of time, which have regularly given place to each other, as we have extended our knowledge in this intricate path of natural philoſophy.

[1] The firſt theory I ſhall mention, is that of the learned F. Cabeus, who ſuppoſed that excited amber emitted effluvia from it, which expelled the neighbouring air at ſmall diſtances, and they made as it were a little whirlwind by the reſiſtance they met with from the remoter air, which was not affected by the electric ſteams. When this ſubtile effluvia could not advance any farther, by reaſon of the reſiſtance of the diſtant air, he imagined they ſuddenly returned to the excited amber, and carried ſuch light bodies with them as they met with in their way.

2. [2] Sir Kenelm Digby, Mr. Boyle, Hartman, and others, ſuppoſed that excited amber emitted certain unctuous effluvia, which

[1] Shaw's Boyle's Works, vol. i. p. 506.

[2] Idem, as before. Prieſtley's hiſtory, p. 8.

being cooled and condenſed by the circumambient air, were deprived in part of their agitations, and ſhrinking back to the body from whence they iſſued, took with them ſuch light ſubſtances as happened to adhere to their extreme particles at the time of their retractions.

3. The learned Gaſſendus approved of the foregoing theory, but he thought proper to add, that the electric rays being emitted in ſeveral directions, interſected each other, and getting into the pores of light bodies, by means of their interſections, had the faſter hold, and they drew with them chaff and ſtraws, and other ſubſtances, in their returning to the amber from whence they were emitted.

Theſe theories had each their advocates in that age of philoſophy, in which they ſuppoſed that the effluvia emitted from an electric, returned to it again. After Sir Iſaac Newton [3] demonſtrated the extreme ſubtilty of the rays of light, and proved, that ſeveral bodies might emit light copiouſly without any diminution of their weight; the doctrine of the return of effluvia was found unneceſſary, and conſequently was ſoon univerſally given up.

There was very little more diſcovered in this branch of na-

[3] Sir Iſaac Newton's optics.——Qu. 22. If any one aſks, &c.

—— Let him tell me, how an electric body can, by friction, emit an exhalation ſo rare and ſubtile, and yet ſo potent, as by its emiſſion to cauſe no ſenſible diminution of the weight of the electric body, and to be expanded through a ſphere whoſe diameter is above two feet, and yet to be able to agitate and carry up leaf copper, or leaf gold, at the diſtance of above a foot from the electric body? And how the effluvia of a magnet can be ſo rare and ſubtile, as to paſs thro' a pane of glaſs without any reſiſtance or diminution of their force, and yet ſo potent as to turn a magnetic needle beyond the glaſs?

tural philoſophy previous to Sir Iſaac Newton's death : but philoſophers having now ſeen the errors of their former theories, began to ſubſtitute new hypotheſes, to explain the phænomenon of electric attraction and repulſion.

About the year 1733, Mr. Du Faye, intendant of the French King's gardens, and member of the Academy of Sciences at Paris, diſcovered, as he thought, two oppoſite and diſtinct ſpecies of electricity, which he termed the vitreous and reſinous electricities, repulſive with reſpect to themſelves, and attractive of each other. [4] "Chance," ſays he, "has thrown in my way an "univerſal principle, which caſts a new light upon the ſubject "of electricity. The principle is, that there are two diſtinct kinds "of electricity, very different from one another; one of which "I call vitreous, the other reſinous electricity. The firſt is "that of glaſs, rock cryſtal, precious ſtones, hair of animals, "wool, and many other bodies.

"The ſecond is that of amber, copal, gum lac, ſilk, thread, "paper, and a vaſt number of other ſubſtances. The cha-"racteriſtic of the two electricities is, that they repel them-"ſelves, and attract each other. Thus a body of the vitreous "electricity repels all other bodies poſſeſſed of the vitreous; and, "on the contrary, attracts all thoſe of the reſinous electricity. "The reſinous alſo, repels the reſinous, and attracts the vitre-"ous. From this principle, one may eaſily deduce the ex-"planation of a great number of other phænomena; and it "is probable, that this truth will lead us to the diſcovery of "many other things."

While but little more was known of electricity than attrac-

[4] Phil. Tranſact. abridged, vol. viii. p. 396.

tion

tion and repulſion, this theory was found both ſimple, and ſufficient to anſwer moſt of the difficulties which occurred in this branch of philoſophy; and it was looked upon as a diſcovery of ſome importance in the philoſophic world: but errors, however plauſible they may appear on the firſt view, have generally a weak, as well as a dark ſide, on which they are eaſily vulnerable, whenever they are attacked by a penetrating perſon. This was the caſe with this ſyſtem. It was ſoon found, upon examination, that both the vitreous and the reſinous electricity were not only repulſive, but attractive, and equally ſimilar in every electrical operation. This hypotheſis being found inſufficient to clear up many difficulties, it was in a few years juſtly exploded on the cleareſt proof.

The Abbe Nollet, in his theory of the affluent and effluent electricity, ſuppoſed that in all electrical appearances, the fluid is thrown into two oppoſite directions; that the electric matter emitted from a body carries any light ſubſtance with it, and in its return brings it back again. To obviate ſome difficulties which preſſed hard upon his hypotheſis, he was obliged to ſuppoſe, that every excited electric, and likewiſe every body which received the communicated electricity, had two ſets of pores, one for the emiſſion, and the other for the reception of the electric fluid. As this theory does not correſpond with the ſimple laws of nature, and has no better foundation to ſupport it than the invention of an ingenious man, let it be ſufficient to ſay, it did not gain that credit the author of it wiſhed; for he did not conſider it as an hypotheſis, but as a fact eſtabliſhed on clear proof [5].

The laſt ſyſtem I intend to mention is, the Franklinian hypo-

[5] Abbe Nollet's Lettres ſur l'Electricite, p. 98.

 theſis,

theſis, which has met with ſuch a favourable reception in the philoſophic world that it is now almoſt univerſally received, and, according to the opinion of ſome eminent electricians, it almoſt ceaſes to be a theory; and bids fair to be handed down to poſterity, as equally expreſſive of the true principles of electricity, as the [6] Newtonian philoſophy is of the true ſyſtem of nature. To prevent any miſrepreſentation, or miſtake, I ſhall lay before the reader the Doctor's hypotheſis in his own words [7]. In his letter to Peter Collinſon, F. R. S. dated Sept. 1, 1747, he ſays, "I "cannot forbear adding a few obſervations on M. Muſchen-"broek's wonderful bottle."

"1. The non-electric contained in the bottle differs when elec-"triſed from a non-electric, electriſed out of the bottle in this: "That the electric fire of the latter is accumulated on its ſur-"face, and forms an electric atmoſphere round it of conſider-"able extent; but the electric fire is crowded into the ſubſtance "of the former, the glaſs confining it.

"2. At the ſame time that the wire and inſide of the bottle "is electriſed poſitively, or plus, the outſide of the bottle is "electriſed negatively, or minus, in exact proportions; i. e. "whatever quantity of electric fire is thrown within the bottle, "an equal quantity goes off from the outſide of it. To under-"ſtand this, ſuppoſe the common quantity of electricity in each "part of the bottle, before the operation begins, is equal to 20, "and at every ſtroke of the tube ſuppoſe a quantity equal to "1 is thrown in, then after the firſt ſtroke, the quantity "contained within the bottle will be 21, on the outſide but 19.

[6] Becket's eſſay on electricity, p. 25. Prieſtley's hiſtory, p. 152.

[7] Franklin's letters, p. 13 and 14.

"After

" After the ſecond, the inſide will contain 22, the outſide " but 18, and ſo on till after twenty ſtrokes; then the inſide " will contain a quantity of electric fire, equal to 40, and " the outſide none: then the operation ends; for no more " can be thrown in the bottle, when no more can be driven off " from the outſide of it. If you attempt to throw more in, it " is ſpued back through the wire, or flies out in loud cracks " through the ſides of the bottle.

" So wonderfully are theſe two ſtates of electricity, the plus, " and minus, combined, and balanced in this miraculous bottle! " ſituated and related to each other in a manner that I can by " no means comprehend! If it were poſſible that a bottle " ſhould, in one part, contain a quantity of air ſtrongly com- " preſſed, and in another part, a perfect vacuum, we know the " equilibrium would be inſtantly reſtored within. But here we " have a bottle containing at the ſame time a plenum of elec- " tric fire, and a vacuum of the ſame fire; and yet the equili- " brium cannot be reſtored between them but by a communi- " cation without, though the plenum preſſes violently to ex- " pand, and the hungry vacuum ſeems to attract as violently in " order to be filled."

The Doctor, to ſtrengthen his hypotheſis, has been obliged to ſuppoſe glaſs impermeable to the electric fluid, [8] and he has ſupported his ſuppoſition with that ingenuity, candour, and diffidence, peculiar to a great and a noble mind.

In deſcribing the nature and properties of glaſs, ſo far as it is connected with electricity, he ſays, " I feel here a want of terms, " and doubt much whether I ſhall make this part intelligible. " By the word ſurface, in this caſe, I do not mean mere length

[8] Franklin's letters, p. 72, and 75, 76, 77.

" and

" and breadth without thickneſs, but when I ſpeak of the upper " or under ſurface of a piece of glaſs, the outer or inner ſurface of " the phial, I mean length, breadth, and half the thickneſs, and " beg the favour of being ſo underſtood." After adding to each ſurface half the thickneſs of the ſubſtance of the glaſs, he ſuppoſes, that the texture of the glaſs in cooling, when it is firſt blown, becomes cloſeſt in the middle, and forms a kind of partition, in which the pores are ſo narrow, that the particles of the electric fluid, which enter both ſurfaces at the time of the cooling of the glaſs, cannot go through, or paſs, or repaſs, from one ſurface to the other; yet notwithſtanding this, he ſuppoſes, the particles of the electric fluid act by a repelling property on each other through the pores of the glaſs.

The Doctor, in 1755[9], frankly confeſſes his error in the foregoing ſuppoſition, and ſays, he knows nothing of the nature of the pores of glaſs.

" My hypotheſis," ſays he, " that the pores were ſmaller in " the middle of the glaſs, too ſmall to admit the paſſage of elec- " tricity, which could paſs through the ſurface, till it came near " the middle, was certainly wrong;"—but as he could not, by any means he was then acquainted with, force the electric fluid through glaſs, it was concluded, that glaſs is impermeable to the electric effluvia; and upon this the preſent Franklinian ſyſtem reſts.

As I am not attached to any man, nor any theory, any farther than I think it conſiſtent with, and agreeable to the ſimple laws of nature, I ſhall beg leave to with-hold my aſſent for the preſent, and to give this hypotheſis a fair and candid examination, and to try if it can ſtand the teſt of a critical inquiry.

[9] Franklin's letters, p. 321.