THE HISTORY AND PRESENT STATE OF ELECTRICITY.

PART I.
THE HISTORY OF ELECTRICITY.

PERIOD I.
EXPERIMENTS AND DISCOVERIES IN ELECTRICITY PRIOR TO THOSE OF MR. HAWKESBEE.

THE hiſtory of philoſophy contains nothing earlier than the obſervation, that yellow amber, when rubbed, has the power of attracting light bodies. Thales of Miletus, the father of the Ionic philoſophy, who flouriſhed about ſix hundred years before Chriſt, was ſo much ſtruck with this property of amber, that he imagined it was animated. But the firſt writer who expreſſly mentions this ſubſtance is Theophraſtus, who flouriſhed about the year 300 before Chriſt. He ſays, in his book concerning precious ſtones, ſect. 53, that amber (which he ſuppoſes to be a native

 foſſil)

foſſil) has the ſame property of attracting light bodies with the lyncurium; which, he ſays, attracts not only ſtraws, and ſmall pieces of ſticks, but even thin pieces of copper and iron. What he ſays farther of the lyncurium will be related under the article of the *tourmalin*, which Dr. Watſon has, in a manner, proved to be the ſame ſubſtance.

FROM ηλεκτρον, the Greek name for amber, is derived the term ELECTRICITY, which is now extended to ſignify, not only the power of attracting light bodies inherent in amber, but other powers connected with it, in whatever bodies they are ſuppoſed to reſide, or to whatever bodies they may be communicated.

THE attractive nature of amber is occaſionally mentioned by Pliny, and other later naturaliſts; particularly by Gaſſendus, Kenelm Digby, and Sir Thomas Brown; but excepting the electricity of the ſubſtance called *jet*, the diſcovery of which was very late (though I have not been able to find its author) no advances were made in electricity till the ſubject was undertaken by William Gilbert, a native of Colcheſter, and a phyſician at London; who, in his excellent Latin treatiſe *de magnete*, relates a great variety of electrical experiments. Conſidering the time in which this author wrote, and how little was known of the ſubject before him, his diſcoveries may be juſtly deemed conſiderable, though they appear trifling when compared with thoſe which have been made ſince his time.

To him we owe a great augmentation of the liſt of electrical bodies, as alſo of the bodies on which electrics can act; and he has carefully noted ſeveral capital circumſtances relating

lating to the manner of their action, though his theory of electricity was very imperfect, as might be expected.

AMBER and jet were, as I obſerved before, the only ſubſtances which, before his time, were known to have the property of attracting light bodies when rubbed; but he found the ſame property in the *diamond*, *ſapphire*, *carbuncle*, *iris*, *amethyſt*, *opal*, *vincentina*, *Briſtol ſtone*, *beryl*, and *chryſtal*. He alſo obſerves that *glaſs*, eſpecially that which is clear and tranſparent, has the ſame property; likewiſe all *factitious gems*, made of glaſs or chryſtal; *glaſs of antimony*, moſt *ſparry ſubſtances*, and *belemnites*. Laſtly, he concludes his catalogue of electric ſubſtances with *ſulphur*, *maſtic*, *ſealing wax* made of gum lac tinged with various colours, *hard roſin*, *ſal gem*, *talk*, and *roche alum*. Roſin, he ſaid, poſſeſſed this property but in a ſmall degree, and the three laſt mentioned ſubſtances only when the air was clear and free from moiſture.

ALL theſe ſubſtances, he obſerves, attracted not only ſtraws but all metals, all kinds of wood, ſtones, earth, water, oil, in ſhort, whatever is ſolid, and the object of our ſenſes But he imagined that air, flame, bodies ignited, and all matter which was extremely rare was not ſubject to this attraction. Groſs ſmoke, he found, was attracted very ſenſibly, but that which was attenuated very little.

FRICTION, he ſays, is, in general, neceſſary to excite the virtue of theſe ſubſtances; though he had one large and ſmooth piece of amber which would act without friction. But with reſpect to this he probably deceived himſelf. The moſt effectual friction, he obſerved to be that which was light and quick; and he found that electrical appearances

were ſtrongeſt when the air was dry, and the wind north or eaſt, at which time electric ſubſtances would act ten minutes after excitation. But he ſays, that a moiſt air, or a ſoutherly wind almoſt annihilates the electrical virtue. The ſame effect he alſo obſerved from the interpoſition of moiſture of any kind, as from the breath, and many other ſubſtances, but not always from the interpoſition of ſarſnet. He ſays that light and pure oil ſprinkled upon electrics, after excitation, did not obſtruct their virtue, but that brandy, or ſpirit of wine did. He alſo ſays, that chryſtal, talk, glaſs, and all other electrics loſt their virtue after being burned or roaſted. But this was, in ſome meaſure, a miſtake. The heat of the ſun, collected by a burning glaſs, he ſays, is ſo far from exciting amber, and other electrics, that it impairs the virtue of them all; though, when electrics have been excited, they will retain their virtue longer in the ſun-ſhine than in the ſhade.

MOST of the experiments of this author were made with long thin pieces of metal, and other ſubſtances, ſuſpended freely on their centers, to the extremities of which he preſented the electrics he had excited. His experiments on water were made by preſenting a round drop of water upon a dry ſubſtance to the excited electric; and it is remarkable, that he obſerved the ſame conical figure of the electrified drops which Mr. Grey afterwards diſcovered, and which will be related more at large in its proper place. Gilbert concluded, that air was not affected by the electric attraction, becauſe the flame of a candle was not: for the flame, he ſays, would be diſturbed if the air had the leaſt motion given to it.

GILBERT

GILBERT imagined that electrical attraction was performed in the ſame manner as the attraction of coheſion. Two drops of water, he obſerved, ruſh together when they are brought into contact, and electrics, he ſays, are virtually brought into contact with the bodies they act upon, by means of their effluvia, excited by friction.

AMONG other differences between electric and magnetic attraction, ſome of which are very juſt, and others whimſical enough, he ſays, that magnetic bodies ruſh together mutually; whereas in electrical attraction it is only the electric that exerts any power. He obſerves alſo particularly, that in magnetiſm there is both attraction and repulſion, but in electricity only the former, and never the latter.*

SUCH were the diſcoveries of our countryman Gilbert, who may juſtly be called the father of modern electricity, though it be true that he left his child in its very infancy.

SIR FRANCIS BACON, in his Phyſiological Remains, gives a catalogue of bodies attractive and not attractive; but it differs in nothing worth mentioning from that of Gilbert, and he does not ſeem to have made any obſervations of his own relating to the ſubject.

THESE remarkable phenomena relating to amber, and other electric ſubſtances did not eſcape the attention of the inquiſitive and ſagacious Mr. Boyle, who flouriſhed about the year 1670. He made ſome addition to the catalogue of electric ſubſtances, and attended to ſome circumſtances relating to electric attraction which had eſcaped the obſervation of philoſophers who lived before him.

* Gilbert de magnete, Lib. 2. Cap. 2.

HE

HE found that the hard cake which remains after evaporating good turpentine was electrical, as alſo the hard maſs which remains after diſtilling petroleum and ſpirit of nitre, glaſs of lead, the caput mortuum of amber, and the cornelian but he could not find that property in the emerald, and he thought that glaſs poſſeſſed it but in a very low degree.

HE found, that the electricity of all bodies capable of having it excited in them was increaſed by wiping, and warming them, previous to their being rubbed. By this means he made an electric body no bigger than a pea, move a ſteel needle, which was freely poiſed, three minutes after he had left off rubbing it. He alſo found, that it was uſeful to have the ſurfaces of electric bodies made very ſmooth, except in the caſe of one diamond on which he tried ſome experiments; which, though it was rough, was, he ſays, poſſeſſed of a ſtronger electrical virtue than any poliſhed one he had met with.

HE obſerved that excited electrics would attract all kinds of bodies promiſcuouſly, whether electric or not; that excited amber, for inſtance, would attract both powder of amber, and ſmall pieces of it; differing, as he takes notice, from the property of the load-ſtone, which acts only on one kind of matter. He found, that his electrics would attract ſmoke very eaſily, and takes ſome pains to account for their not ſenſibly attracting flame, which Gilbert excepted from the bodies attracted by electricity.

THESE attractions, he found, did not depend upon the air: for he obſerved that they took place in vacuo. He ſuſpended a piece of excited amber over a light body in a glaſs receiver, and

and ſaw, that when a vacuum was made, and the amber let down near the light body, it was attracted, as if it had been in the open air.*

MR. BOYLE made an experiment to try whether an excited electric was acted upon by other bodies as ſtrongly as it acted upon them, and it ſucceeded: for, ſuſpending his excited electric, he ſaw that it was ſenſibly moved by the approach of any other body. We ſhould now be ſurpriſed that any perſon ſhould not have concluded *a priori*, that if an electric body attracted other bodies, it muſt in return be attracted by them, action and reaction being univerſally equal to one another. But it muſt be conſidered, that this axiom was not ſo well underſtood in Mr. Boyle's time, nor until it was afterwards explained in its full latitude by Sir Iſaac Newton.

THESE few experiments of Mr. Boyle's, we ſee, relate only to a few circumſtances attending the ſimple property of electric attraction. The neareſt approach that he made to the diſcovery of electrical repulſion was his obſerving, that light bodies, as feathers, &c. would cling to his fingers, and other ſubſtances, after they had been attracted by his electrics. He had never ſeen the electric light, and little imagined what aſtoniſhing effects would be afterwards produced by the ſame wonderful power, and how large a field he was opening for philoſophical ſpeculation in future time.

MR. BOYLE's theory of electrical attraction was, that the electric emitted a glutinous effluvium, which laid hold of ſmall bodies in its way, and, in its return to the body which

* Hiſtoire de l'electricité, p. 6. Boyle's Mechanical production of electricity.

emitted

emitted it, carried them back with it. One James Hartman, whoſe account of amber is publiſhed in the Philoſophical Tranſactions,* pretends to prove by experiment, that electric attraction was really owing to the emiſſion of glutinous particles. He took two electric ſubſtances, viz. pieces of colophonia, and from one of them made a diſtillation of a black balſam, and thereby deprived it of its attractive power. He ſays, that the electric which was not diſtilled retained its fatty ſubſtance, whereas the other was, by diſtillation, reduced to a mere *caput mortuum*, and retained no degree of its bituminous fat. In conſequence of this hypotheſis, he gives it as his opinion, that amber attracts light bodies more powerfully than other ſubſtances, becauſe it emits oily and tenacious effluvia more copiouſly than they do.

CONTEMPORARY with Mr. Boyle was Otto Guericke, Burgomaſter of Magdebourgh, and the celebrated inventor of the air-pump, who is likewiſe intitled to a diſtinguiſhed place among the firſt improvers of electricity.

THIS philoſopher made his experiments with a globe of ſulphur, made by melting that ſubſtance in a hollow globe of glaſs, and afterwards breaking the glaſs from off it. He little imagined that the glaſs globe itſelf, with or without the ſulphur, would have anſwered his purpoſe as well. This globe of ſulphur he mounted upon an axis, and whirled it in a wooden frame, rubbing it at the ſame time with his hand; and by this means he performed all the electrical experiments which were known before his time.

HIS was the diſcovery, that a body once attracted by an excited electric was repelled by it, and not attracted again

* Abridgment, Vol. 2. p. 473.

till

till it had been touched by ſome other body. In this manner he kept a feather a long time ſuſpended in the air above his ſulphur globe; but he obſerved, that if he drove it near a linen thread, or the flame of a candle, it inſtantly retreated to the globe, without having been in contact with any ſenſible body.

NEITHER the ſound, nor the light produced by the excitation of his globe eſcaped the notice of this accurate philoſopher, though he ſeems not to have obſerved them in a very great degree: for he was obliged to hold his ear near the globe to perceive the hiſſing ſound of the electric fire; and he compares the light which it gave in the ſame circumſtances to that which is ſeen when ſugar is pounded in the dark.

BUT the moſt remarkable experiments of this philoſopher were two, which depend upon a property of the electric fluid that has not been illuſtrated till within theſe late years; viz. that bodies immerged in electric atmoſpheres are themſelves electrified, and with an electricity oppoſite to that of the atmoſphere. Threads ſuſpended within a ſmall diſtance of his excited globe, he obſerved to be often repelled by his finger brought near them, and that a feather repelled by the globe always turned the ſame face towards it like the moon with reſpect to the earth. This laſt experiment ſeems to have been wholly overlooked by later electricians, though it is a very curious one, and may be made with ſo much eaſe. *

A MUCH finer appearance of electric light than that which Otto Guericke's ſulphur globe exhibited was obſerved by

* Experimenta Magdeburgica, Lib. 4. Cap. 15.

Dr. Wall. The account of it is publiſhed in the philoſophical tranſactions. *

MAKING experiments upon artificial phoſphorus, which he took to be an animal oil coagulated with a mineral acid, he was led to conjecture that amber, which he ſuppoſed to be a mineral oil coagulated with a mineral volatile acid, might be a natural phoſphorus; and with this view he began to make experiments upon it, the reſult of which, being very curious and ſurpriſing, it will be moſt agreeable to my readers to ſee in the very words of the obſerver himſelf.

" I FOUND," ſays he, " by gently rubbing a well poliſhed " piece of amber with my hand in the dark, that it pro- " duced a light: whereupon I got a pretty large piece of " amber, which I cauſed to be made long and taper, and " drawing it gently through my hand, being very dry, it " afforded a conſiderable light.

" I THEN uſed many kinds of ſoft animal ſubſtances, and " found that none did ſo well as wool. And now new phe- " nomena offered themſelves: for, upon drawing the piece " of amber ſwiftly through the wollen cloth, and ſqueezing " it pretty hard with my hand, a prodigious number of little " cracklings were heard, and every one of theſe produced a " little flaſh of light; but when the amber was drawn gently " and ſlightly through the cloth, it produced only a light " but no crackling; but by holding ones finger at a little diſ- " tance from the amber, a large crackling is produced, with " a great flaſh of light ſucceding it. And, what to me is

* Abridgment, Vol. 2. p. 275.

" very