

CI. *Some Suggestions concerning the preventing the Mischiefs, which happen to Ships and their Masts by Lightning; being the Substance of a Letter to the late Right Honourable George Lord Anson, first Lord of the Admiralty, and F. R. S. by William Watfon, M. D. F. R. S.*

My Lord,

Read Dec. 16,  
1762. **A**S I am well apprized of your Lordship's attention to the public service, more particularly to what relates to that department, over which you preside, I cannot omit transmitting to your Lordship some observations, which occurred to me upon what lately happened to the Harriot packet, in her passage to New York. We are informed, " that this vessel was struck with lightning, which split the main mast, main top mast, and main top gallant mast in pieces, ripped up the partners of the main mast, broke down the bulk-head between the steerage and the hold, tore off the locks from the cabin doors, burnt the tarpaulin off the main hatches, made several holes between the coomings of the hatches and the deck, rendered all the compasses useles, broke one of the beams between decks, stove the boat, wounded one of the men very much, and the rest were stunned for some time. Most of the rigging was burnt off the mast head. The whole caused such a smoke in the ship, that,

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taking her to be on fire below, they threw water a considerable time into the cabin; but providentially no other damage was done”.

A few years since a ship, belonging to capt. John Waddel, was almost beat to pieces by thunder and lightning, of which a particular account is published in the Philosophical Transactions \*. And very lately the main mast of the *Bellona*, a 74 gun ship, was split in pieces by the lightning, which happened in January 1762. I make no doubt but that in the course of your Lordship's observation, the knowlege and information of many accidents of the like kind may have occurred to you; more particularly in low latitudes, where mischiefs from lightning are much more frequent than in parts more distant from the equator.

What happened to the *Harriot* packet is no more than what usually happens to a ship at sea, or to a church, house, or other edifice on land, when the lightning has entered into it, and cannot procure an easy passage out of it. The attempting to procure this easy passage, and thereby avert the mischiefs attending the want of it, is the more particular occasion of my troubling your lordship at this time.

A very few years ago the nature of thunder and lightning, which are both to be considered as different appearances of the same meteor, was very little understood. Our predecessors in all ages regarded it as an instrument of divine vengeance. They stood too much in awe of it to consider it closely; and

\* Vol. 46. page III.

though the Greeks and Romans \* were in possession of some observations which might have led them to a more intimate knowlege of it, they were not apprized, that what they saw, had any relation therewith. It was not, till by experiments and observations upon the nature and properties of electricity, and comparing them with the phenomena of thunder and lightning, we were informed, that electricity and thunder arose from the same cause; or, to speak nearer the truth, were different modifications of the same meteor; that they varied in nothing essential, and only differed in being in degree *greater* or *less*.

The same means, which taught us the management of one, give us great reason to believe that many of the mischiefs may, by a proper and well disposed apparatus, be prevented of the other. A quantity of electricity, accumulated to a degree sufficient to destroy a large animal, will innocently discharge itself through the smallest wire. And Mr. *de Romas* in France has found that one of his kites, when flown with a cord composed of hemp and wire, will silently and without any report bring down the matter of thunder from a cloud; though, when the apparatus has been altered and an easy passage has been denied to it, *the streams of fire have been seen an inch thick, and ten feet long, and the report has been equal to that of a pistol*. It was owing to this easy passage of lightning being interrupted, that occasioned the death of professor *Richmann* at Petersburg by his own appa-

\* See Plutarch in the life of Lyfander, Pliny, Seneca, Cæsar, Livy, &c.

tus, of which I formerly gave an account to the Royal Society.

I have great reason, my lord, to think that the mischiefs arising from thunder and lightning, happen always near the place, where the explosion is made; as those persons, who have been present, when great mischiefs have been done, univervally agree, that when these accidents have happened, the report of the thunder has instantly succeeded the flash of the lightning. As the progress of light is nearly instantaneous, and that of sound somewhat more than 1100 feet in a second of time, the thunder and lightning happening in the same instant proves the explosion to have been very near.

We are therefore to guard against the thunder clouds, which are near us. The mast of every ship, which is beset on its tops with those bright lights, which our mariners call comazants, and are the *feu St. Elme* of the French, and were the *Castor and Pollux* of the ancients, is within the sphere of action of a thunder cloud. Anciently, when these were seen, they were only considered as the attendants of a storm, and no consequence was drawn from them; but now, (since Dr. *Franklin's* admirable discovery of conducting lightning from the clouds, we know them to be no other than a modification of the same meteor, which constitutes thunder and lightning) they demonstrate that danger is near, and therefore we should do our utmost to prevent its effects. This in my opinion would be done, if a wire of iron or any other metal were connected with the spindles and iron work at the tops of masts of ships, and conducted down the sides of the masts, and from thence in any con-

venient direction so disposed as always to touch the sea water. By these means the accumulation of the matter of thunder and lightning, will be prevented to a considerable distance from the ship, by its being discharged silently by the wire, which will not be done by the masts; as these from their height, figure, and constituent parts, without an apparatus of this kind, tend to direct and conduct the lightning into the ship. But for a further explanation upon this head, I beg of your Lordship to cast your eye upon volume 48. page 215 of the Philosophical transactions, where I have considered this matter more at large.

The applying wire to the masts of ships will be neither difficult nor expensive; as a brass wire of the thickness of a large goose quill, I am of opinion, will in most cases be large enough to answer this purpose. I prefer brass wire to iron, as the former is less liable to rust than the latter; and any metal corroded by rust to the center, ceases to be of any use, in directing the lightning in the degree hoped for and expected by this apparatus. The entering into a minute detail of the *rationale* of this process would take up too much of your Lordship's time; from analogy only I will mention to your Lordship, that the same quantity of gunpowder, which confined in a close place, will throw down a tower, or rend a rock, will, when fired loose in the open air, be almost inoffensive.

Thunder storms are very frequent and severe in Pennsylvania, and great mischiefs often happen from them; but I am informed by Dr. Franklin, that since an apparatus of the kind above mentioned, placed at the tops of the houses has been generally used at Philadelphia,

not a single instance of mischief from lightning had happened in that city. He informs me further, that at Philadelphia in a thunder storm, the lightning was seen to strike the ridge of a house, upon which an apparatus of this sort was erected. The lightning, like a ball of fire, ran from the ridge of the house to the apparatus; and in running down, it melted the conducting wire, without doing any damage to the house. This shews the expediency of applying either large wires, or small rods, in which the melting will most probably be prevented; notwithstanding it has been repeatedly found, that, though the wire has been melted, it has never failed of first answering the purpose of a conductor, and preventing the mischiefs threatened by the lightning.

Though the mischiefs arising from lightning are not very frequent in Great Britain, yet at times they are severe enough to be very alarming. The damage occasioned by a thunder storm in July 1759 in London, and in various other places at no great distance from it, are very fresh in our memories. I submit it therefore to your Lordship, how far it would be attention misapplied to think of an apparatus of this sort in his Majesty's powder magazine, erecting at Purfleet. The expence would be trifling; and every argument, which is produced of their expediency in preventing mischiefs arising from lightning on board of ships, will have more force in this instance; where frequently an immense quantity of gunpowder must be collected within a comparatively very small space.

As motives of humanity, and the hopes of public utility, are the cause of my troubling your Lordship

ship with this letter, I shall make no apology to your Lordship upon this head; and only take the liberty of assuring you, that I am, with the most profound respect,

my Lord,

your Lordship's most obliged

and obedient servant,

William Watson.

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CII. *An Account of the Case of the late Rev. James Bradley, D. D. Astronomer Royal: in a Letter to the Right Honourable George Earl of Macclesfield, President of R. S. from Daniel Lyfons, M. D.*

My Lord,

Read Dec. 16, 1762. **T**HE respect, with which the late Dr. Bradley astronomer royal, and Savilian professor of astronomy in this University, was treated by the learned of all countries, and the esteem, in which he was held by your Lordship, and the Society over which you preside, must naturally make the world desirous to be acquainted with the circumstances of that illness, which occasioned his death, especially as his disorder was in itself rather uncommon.

Under these circumstances I flatter myself, that I shall do what will be very agreeable to your Lordship,  
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