thoſe Inſtances only excepted, which I have mention'd in the Relation; and the firſt Shock of it was greater with us than any-where elſe in *New-England*; and the Tops of Chimneys, and Stone-fences, were thrown down only in theſe Parts.

XII. *An Account of Mr.* Sutton's *Invention and Method of* Changing the Air *in the* Hold, *and other cloſe Parts of a* Ship; *communicated to the* Royal Society *by* Richard Mead, *M. D.* Phyſician *to His* MAJESTY, *Fellow of the* Royal Society, *and of the* Royal College *of* Phyſicians, LONDON.

Read Feb. 11. 1741-2.

IT is found by daily Experience, that Air ſhut up and confined in a cloſe Place, without a Succeſſion and freſh Supply of it, becomes unwholſome, and unfit for the Uſe of Life.

This is more ſenſibly ſo, if any ſtagnating Water be pent up with it.

But it grows ſtill worſe, if ſuch an Air as this is made uſe of in Reſpiration, that is, becomes moiſter and hotter, by paſſing and repaſſing through the Lungs.

Theſe bad Effects, in different Degrees, according to the different Manner in which Air is incloſed, are obſerved in many Caſes; particularly in deep Wells and Caverns of the Earth, in Priſons or cloſe Houſes, where People are ſhut up with Heat and Naſtineſs: But moſt of all in large Ships, in which, with

with the Stench of Water in the Hold, many Men being crouded up in Cloſe-quarters, all the mentioned Circumſtances concur in producing greater Miſchief than would follow from any of them ſingle.

The Reaſon of theſe bad Effects is this: It is that Property of the Air which is called its Elaſticity or Springineſs, which makes it ſo uſeful to our Life. When any Part of it is incloſed and kept from the Communication of the outward Air, it expands itſelf, and, in Proportion to the Cloſeneſs of the Place, loſes its Spring; and if any Heat or Moiſture comes to it, the elaſtic Force may be quite loſt and deſtroy'd: And not only ſo, but if it happens to be impregnated with noxious *Effluvia*, either from unwholſome Subſtances of any kind, or from the infectious Breath of diſeaſed Bodies; it will become quite poiſonous and deadly, in a manner ſuitable to the original Cauſe.

It is propoſed at preſent to find out a Remedy for this Evil in Ships only: But by making Alterations according as particular Places require, the ſame may be applied to any Houſes or Parts of them, as Priſons, the ſick Wards in Hoſpitals, *&c.*

Now it is a natural Conſequent of the Elaſticity of the Air, that when it is rarefied in any Part, (which is moſt effectually done by Heat) the neighbouring Air will ruſh that way, till this Part is brought to be of an equal Denſity and Elaſticity with itſelf; and this again will be followed by the Air next to it: So that, if a Conveyance for Air be laid from the Hold or Well of the Ship, and a Rarefaction of the Air therein be made; the foul Air from this Place will

run or be drawn out that way, and freſh Air from the adjacent Parts will ſucceed in its room.

It is upon theſe Principles that the following Scheme is moſt humbly offered to the Right Honourable the Lords of the Admiralty, and Commiſſioners of the Navy, which it is hoped will be found effectual for clearing the bad and corrupted Air from the Holds and other cloſe Parts of his MAJESTY's Ships; and thereby prove beneficial to the Public, by preſerving the Healths of many of his MAJESTY's good Subjects ſerving on board the ſame; the whole thing being indeed eaſy to be executed, and what will no ways incumber, or be troubleſome, in any of the Veſſels where it ſhall happen to be applied; the ſame being, in ſhort, no more than this: That whereas in every Ship of any Bulk there is already provided a Copper or Boiling-place proportionable to the Size of the Veſſel, it is propoſed to clear the bad Air by means of the Fire already uſed under the ſaid Coppers or Boiling-places, for the neceſſary Uſes of the Ship.

It is well known, that under every ſuch Copper or Boiler, there are placed two Holes ſeparated by a Grate; the firſt of which is for the Fire, and the other for the Aſhes falling from the ſame; and that there is alſo a Flue from the Fire-place upward, by which the Smoke of the Fire is diſcharged at ſome convenient Place of the Ship.

It is alſo well known, that the Fire once lighted in theſe Fire-places, is only preſerved by the conſtant Draught of Air through the forementioned two Holes and Flue; and that if the ſaid two Holes are cloſely ſtopp'd up, the Fire, though burning ever ſo briskly before, is immediately put out.

But

But if after the ſhutting up the above-mention'd Holes, another Hole be opened, communicating with any other Room or airy Place, and with the Fire; it is clear, the ſaid Fire muſt again be raiſed and burn as before; there being a like Draught of Air through the ſame, as there was before the ſtopping up of the firſt Holes: This Caſe differing only from the former in this, that the Air feeding the Fire will now be ſupplied from another Place.

It is therefore propoſed, that in order to clear the Holds of Ships of the bad Air therein contained, the two Holes above-mentioned, that is, the Fire-place and Aſh-place, be both cloſed up with ſubſtantial and tight iron Doors; and that a copper or leaden Pipe, of ſufficient Size, be laid from the Hold into the Aſh-place, for the Draught of Air to come in that way to feed the Fire. And thus it ſeems plain from what has been already ſaid, that there will be from the Hold a conſtant Diſcharge of the Air therein contained; and conſequently, that that Air ſo diſcharged muſt be as conſtantly ſupplied by freſh Air down the Hatches, or ſuch other Communications as are open into the Hold; whereby the ſame muſt be continually freſhen'd, and its Air render'd more wholſome, and fit for Reſpiration.

And if into this principal Pipe ſo laid into the Hold, other Pipes are let in, communicating reſpectively either with the Well or lower Decks, it muſt follow, that Part of the Air conſumed in feeding the Fire, muſt be reſpectively drawn out of all ſuch Places, to which the Communication ſhall be ſo made.