

XL. *Description of a most effectual Method of securing Buildings against Fire, invented by Charles Lord Viscount Mahon, F. R. S.*

Read July 2, 1778.

§ 1. **T**HE new and very simple method which I have discovered of securing every kind of building (even though constructed of timber) against all danger of fire, may very properly be divided into three parts; namely, *under-flooring*, *extra-lathing*, and *inter-securing*, which particular methods may be applied, in part or in whole, to different buildings, according to the various circumstances attending their construction, and according to the degree of accumulated fire, to which each of these buildings may be exposed, from the different uses to which they are meant to be appropriated.

§ 2. The method of *under-flooring* may be divided into two parts; *videlicet*, into *single* and *double under-flooring*.

The method of *single under-flooring* is as follows. A common strong lath, of about one quarter of an inch thick

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(either of oak or fir) should be nailed against each side of every joist, and of every main timber, which supports the floor intended to be secured. Other similar laths ought then to be nailed the whole length of the joists, with their ends butting against each other: these are what I call the *fillets*. The top of each fillet ought to be at one inch and a half below the top of the joists or timbers against which they are nailed. These fillets will then form, as it were, a sort of small ledge on each side of all the joists.

§ 3. When the fillets are going to be nailed on, some of the rough plaster hereafter mentioned (§ 9.) must be spread with a trowel all along that side of each of the fillets, which is to lay next to the joists, in order that these fillets may be well bedded therein when they are nailed on, so that there should not be any interval between the fillets and the joists.

§ 4. A great number of any common laths (either of oak or fir) must be cut nearly to the length of the width of the intervals between the joists.

Some of the rough plaster referred to above (§ 3.) ought to be spread, with a trowel, successively upon the top of all the fillets, and along the sides of that part of the joists which is between the top of the fillets and the upper edge of the joists.

The short pieces of common laths just mentioned ought (in order to fill up the intervals between the joists that support the floor) to be laid in the contrary direction to the joists, and close together in a row, so as to touch one another, as much as the want of straitness in the laths will possibly allow, without the laths lapping over each other; their ends must rest upon the fillets spoken of above (§ 2.) and they ought to be well bedded in the rough plaster. It is not proper to use any nails to fasten down either these short pieces of laths, or those short pieces hereafter mentioned (§ 7.)

§ 5. These short pieces of laths ought then to be covered with one thick coat of the rough plaster spoken of hereafter (§ 9.), which should be spread all over them, and which should be brought, with a trowel, to be about level with the tops of the joists, but not above them. This rough plaster in a day or two should be trowelled all over, close home to the sides of the joists; but the tops of the joists ought not to be any wise covered with it.

§ 6. The method of *double under-flooring* is, in the first part of it, exactly the same as the method just described. The fillets and the short pieces of laths are applied in the same manner; but the coat of rough plaster

ought to be little more than half as thick as the coat of rough plaster applied in the method of *single under-flooring*.

§ 7. In the method of *double under-flooring*, as fast as this coat of rough plaster is laid on, some more of the short pieces of laths, cut as above directed (§ 4.), must be laid in the intervals between the joists upon the first coat of rough plaster; and each of these short laths must be, one after the other, bedded deep and quite sound into this rough plaster whilst it is soft. These short pieces of laths should be laid also as close as possible to each other, and in the same direction as the first layer of short laths.

§ 8. A coat of the same kind of rough plaster should then be spread over this second layer of short laths, as there was upon the first layer above described. This coat of rough plaster should (as above directed § 5. for the method of *single under-flooring*) be trowelled level with the tops of the joists, but it ought not to rise above them. The sooner this second coat of rough plaster is spread upon the second layer of short laths just mentioned (§ 7.) the better.

What follows, as far as § 13. is common to the method of *single* as well as to that of *double under-flooring*.

§ 9. Common coarse lime and hair (such as generally serves for the pricking-up-coat in plastering) may be used for all the purposes before or hereafter mentioned;

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but it is considerably cheaper, and even much better, in all these cases, to make use of *hay* instead of *bair*, in order to prevent the plaster-work from cracking. The hay ought to be chopped to about three inches in length, but no shorter.

One measure of common rough *sand*, two measures of flacked *lime*, and three measures (but not less) of chopped *hay*, will prove, in general, a very good proportion, when sufficiently beat up together in the manner of common mortar. The hay must be well dragged in this kind of rough plaster, and well intermixed with it; but the hay ought never to be put in, till the two other ingredients are well beat up together with water.

This rough plaster ought never to be made thin for any of the work mentioned in this paper. The stiffer it is the better, provided it be not too dry to be spread properly upon the laths.

If the flooring boards are required to be laid very soon, a fourth or a fifth part of *quick* <sup>(a)</sup> *lime* in powder, very well mixed with this rough plaster just before it is used, will cause it to dry very fast.

(a) I have practiced this method in an extensive work with great advantage. In *three weeks* this rough plaster grows perfectly *dry*. The rough plaster, so made, may be applied at *all times of the year* with the greatest success. The easiest method, by much, of reducing the *quick lime* to powder is, by dropping a *small* quantity of water on the lime-stone, a little while before the powder is intended to be used: the lime will still retain a very sufficient degree of heat.

§ 10. When the rough plaster-work between the joists has got thoroughly dry, it ought to be observed, whether or not, there be any small cracks in it, particularly next to the joists. If there are any, they ought to be washed over with a brush, wet with *mortar-wash*, which will effectually close them; but there will never be any cracks at all, if the *chopped hay* and the *quick lime* be properly made use of.

§ 11. The mortar-wash I make use of is merely this. About two measures of quick lime, and one measure of common sand, should be put into a pail, and should be well stirred up with water, till the water grows very thick, so as to be almost of the consistency of a thin jelly. This wash, when used, will grow dry in a few minutes.

§ 12. Before the flooring boards are laid, a small quantity of very dry common sand should be strewed over the rough plaster-work, but not over the tops of the joists. The sand should be struck smooth with an hollow rule, which ought to be about the length of the distance from joist to joist, and of about one eighth of an inch curvature; which rule, passing over the sand, in the same direction with the joists, will cause the sand to lay rather rounding in the middle of the interval between each pair of joists.

The flooring boards may then be laid and fastened down in the usual manner; but very particular attention

must be paid to the rough plaster-work and to the sand being most perfectly dry before the boards are laid, for fear of the *dry-rot*; of which however there is no kind of danger, when this precaution is made use of.

§ 13. The method of *under-flooring* I have also applied, with the utmost success, to a wooden stair-case. It is made to follow the shape of the steps, but no sand is laid upon the rough plaster-work in this case.

§ 14. The method of *extra-lathing* may be applied to ceiling joists, to sloping roofs, and to wooden partitions. It is simply this :

As the laths are going to be nailed on, some of the above mentioned rough plaster ought to be spread between these laths and the joists (or other timbers) against which these laths are to be nailed. The laths ought to be nailed very close to each other.

When either of the ends of any of the laths laps over other laths, it ought to be attended to, that these ends be bedded sound in some of the same kind of rough plaster.

This attention is equally necessary for the second layer of laths hereafter mentioned (§ 15.).

§ 15. This first layer of laths ought to be covered with a pretty thick coat of the same rough plaster spoken of above (§ 9.). A second layer of laths ought then to be nailed on, each lath being, as it is put on, well squeezed

and bedded found into the soft rough plaster. For this reason, no more of this first coat of rough plaster ought to be laid on at a time than what can be immediately followed with the second layer of laths.

The laths of this second layer ought to be laid as close to each other as they can be, to allow of a proper clench for the rough plaster.

The laths of the second <sup>(b)</sup> layer may then be plastered over with a coat of the same kind of rough plaster, or it may be plastered over in the usual manner.

§ 16. The third method, which is that of *inter-securing*, is very similar, in most respects, to that of *under-flooring*; but no sand is afterwards to be laid upon it. *Inter-securing* is applicable to the same parts of a building as the method of *extra-lathing* just described; but it is not often necessary to be made use of.

§ 17. I have made a prodigious number of experiments upon every part of these different methods. I caused a wooden building to be constructed at Chevening, in Kent, in order to perform them in the most natural manner. The methods of *extra-lathing* and *double under-flooring* were the only ones made use of in that building.

(b) If a third layer of laths be immediately nailed on, and be covered with a third coat of rough plaster, I then call the method *treble-lathing*; but this method of *treble-lathing* can almost, in no case, be required.



On the 26th of September last year I had the honour to repeat some of my experiments before the President and some of the Fellows of the Royal Society, the Lord Mayor and Aldermen of the City of London, the Committee of City Lands, several of the foreign ministers, and a great number of other persons.

§ 18. The first experiment was to fill the lower room of the building (which room was about twenty-six feet long by sixteen wide) full of shavings and faggots, mixed with combustibles, and to set them all on fire. The heat was so intense, that the glass of the windows was melted like so much common sealing wax, and run down in drops, yet the flooring boards of that very room were not burnt through, nor was one of the side timbers, floor-joists, or ceiling-joists, damaged in the smallest degree; and the persons who went into the room immediately over the room filled with fire, did not perceive any ill effects from it whatever, even the floor of that room being perfectly cool during that enormous conflagration immediately underneath.

§ 19. I then caused a kind of wooden building (of full fifty feet in length, and of three stories high in the middle) to be erected, quite close to one end of the secured wooden house. I filled and covered this building with above eleven hundred large kiln faggots, and several loads of dry shavings; and I set this pile on fire.

The height of the flame was no less than eighty-seven feet perpendicular from the ground, and the grass upon a bank, at a hundred and fifty feet from the fire, was all scorched; yet the secured wooden building, quite contiguous to this vast heap of fire, was not at all damaged, except some parts of the outer coat of plaster-work.

This experiment was intended to represent a wooden town on fire, and to shew how effectually even a wooden building, if secured according to my new method, would stop the progress of the flames on that side, without any assistance from fire-engines, &c.

§ 20. The last experiment I made that day, was the attempting to burn a wooden stair-case, secured according to my simple method of *under-flooring*. The under side of the stair-case was *extra-lathed*. Several very large kiln faggots were laid, and kindled, under the stair-case, round the stairs and upon the steps; this wooden stair-case notwithstanding resisted, as if it had been of fire-stone, all the attempts that were made to consume it.

I have since made five other still stronger fires upon this same stair-case, without having repaired it, having, moreover, filled the small place in which this stair-case is entirely with shavings and large faggots; but the stair-case is, however, still standing, and is but little damaged.

§ 21. In most houses it is necessary *only to secure the floors*; and that according to the method of *single under flooring* described above, in § 2, 3, 4, and 5. The extra-expence of it (all materials included) is only about nine pence *per square yard*, unless there should be particular difficulties attending the execution, in which case it will vary a little. When *quick lime* is made use of, the expence is a trifle more.

The extra-expence of the method of *extra-lathing* is no more than six pence *per square yard* for the timber side-walls and partitions; but for the ceiling about nine pence *per square yard*. No *extra-lathing* is necessary in the generality of houses.

§ 22. I purpose giving to the world, before it is very long, a detailed account of many other experiments I have made upon this subject, and of the various advantages arising from my method, with several particulars relative to the different parts of each of the methods above described, and relative to their joint or separate application to different kinds of buildings, and to the different constituent parts of an house; to which I shall add a full explanation of the principles upon which they are founded, and the reasons for their certain and surprising success. In the mean time I have taken the liberty of troubling the Society with this short account.

