if, instead of considering merely the absolute quantities either of organic matters or of nitrogen contained in these matters, we seek the relative proportions of the nitrogen and carbon which enter into their composition, we find that 100 of carbon corresponed in the good spring to at least 11 of nitrogen, and, for the bad spring, to 4 of nitrogen at the most, whence we see that the fertilising properties of our good springs correspond completely to a proportion three times stronger of nitrogen considered relatively to the carbon."

The researches of M. Barral, in Paris, prove to us, that the amount of fertilising matter conveyed to the soil by the rain, must exercise a constant and most important influence on the vegetation of a country. His researches show that in the last six months in the year, the rain which fell on a space of ground at the Observatory at Paris, equal in area to an English acre, contained, as nearly as possible,

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|---|---|---|
| 7.73 | pounds of | Ammonia. |
| 36.50 | ,, | Nitric Acid. |
| 5.56 | ,, | Chlorine. |
| 12.60 | ,, | Lime. |
| 4.81 | ,, | Magnesia. |

A writer in *The Critic*, referring to these experiments recently, says,—

"From July to December, is usually the drier half of the year, as well as that in which the less fuel is consumed, so that we may safely double these quantities, in estimating the annual supply per acre of nitrogenous compounds, gradually distributed over a country by the rain. For the sake of illustration, I have calculated the amount of the solid constituents of the rain, falling on an area equal in extent to Great Britain; and, balancing the various causes likely to lessen or to increase the quantity of these matters, which would so fall on this island, we may venture to set the one against the other, and apply the above statement to our own country, as the basis of an estimate, which singularly manifests the 'power of littles,' as well as the grand scale on which even the minutest of natural phenomena proceed. Thus, on the Parisian data, the weights of these fertilising materials annually supplied to the soil of this island by the rain, amount to about

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|---|---|---|
| 400,000 | tons of | Ammonia. |
| 1,850,000 | ,, | Nitric acid. |
| 279,000 | ,, | Chlorine. |
| 640,000 | ,, | Lime. |
| 244,000 | ,, | Magnesia. |

The later opinions, entertained by Liebig, of the superior value of the alkaline and earthy constituents of manures, i. e. the potash, soda, lime, magnesia, and the phosphates and sulphates of these bases, to that of their nitrogenous compounds, derive much weight from these experiments of M. Barral, which show that a vast amount of nitrogenous fertilising matter is distributed by the rain, but none of the fixed alkali."

This inquiry, however, would lead us too far. We cannot expect our farmers generally to attend to involved questions of this sort, while in so many cases the simplest and best known improvements are not adopted. On some farms water runs to waste, which might be led to turn a wheel, and provide all the motive power required in the establishment. Every means of lessening the cost of production should be resorted to. The stacks, for example, may be placed on a tramway, in such a position that they may be pulled in for thrashing by the steam-engine or the mill. We hear of a "Portable Farm Produce Mill," made by Mr. Crosskill, of Beverley, which promises to be useful. At a private trial of it near Chelmsford recently, the mill crushed oats at the rate of thirty bushels per hour, and split beans at the rate of sixty bushels per hour, and ground barley to fine meal at the rate of eight bushels per hour, besides grinding bones, and crushing flint stones and bricks.

From New York comes an account of a steam ploughing-machine now being exhibited there. It is intended for driving twelve ploughs, and performing the operations of ploughing, sowing, and harrowing simultaneously.

In conclusion, we would say, the average addition which putting a farm into an efficient state for working will make to the cost of the fee-simple of the land may be called, under ordinary circumstances, 16*l.* per acre, or 4*l.* per acre for drainage; 5*l.* for buildings and steam-engine; 4*l.* for irrigation with liquid manure; and say 2*l.* per acre for contingencies. The main question for owners is, not what a thing will cost, but what it will pay; and if they will consider what would be a fair *per centage* on the money spent (rather than what will be the actual first outlay), and compare it with the probable consequent increase in the annual returns, they will be encouraged to proceed. The *per centage* view of expenditure we look upon as one of the great features of the day, and which, when thoroughly understood and acted on, will do great things for England.

## ON THE TOWERS AND SPIRES OF THE CITY CHURCHES—THE WORKS OF SIR CHRISTOPHER WREN.*

No church seems complete without a tower or spire. Wren, writing on this subject, observes: "Handsome spires or lanterns, rising in good proportion above the neighbouring houses (of which I have given several in the city, of different forms) may be of sufficient ornament to the tower, without great expense for enriching the outward walls of the churches, in which plainness and duration ought principally, if not wholly, to be studied. When a parish is divided, I suppose it may be thought sufficient if the mother church has a tower large enough for a good ring of bells, and the other churches smaller towers for two or three bells, because great towers and lofty steeples are sometimes more than half the charge of the church."

The distinction between a spire and a lantern may be said to depend on the form and outline, and more particularly on the proportion which each respectively bears to the supporting substructure or tower. In a spire, this proportion is about that of equality: in a lantern, the superstructure is about one-half the height of the tower beneath. The towers, without the spire or lantern, will be found to vary from four to five times their breadth in height. It is hardly possible to conceive a greater variety than Wren has exhibited in the designs of his towers and spires, all of which are based on principles distinctly laid down in his writings.

With reference to the skill displayed, both in the design and in the construction, it will be seen that St. Bride's is a composition of equalities, in which there is a pleasant succession of vertical and horizontal lines; beauty being obtained by agreeable repetitions, and not, as in most of the other instances, by harmonious varieties. The spire, which is formed of a series of open arches rising in succession above each other, shows how well Wren could repeat forms without at the same time rendering them monotonous. The construction of this spire materially differs from any other, Italian or Gothic. The arches form vaults or cells within, which are firmly bound together by the central spiral cord or staircase, and thus equally distribute the pressure over the surface below, imitating in a beautiful manner some of the strongest forms of nature. The provision made for carrying this spire is excellent.

The spire of Bow Church on the other hand, is a composition of varieties, the solid and the open, the square and the circular, the vertical, the horizontal, and the flowing. The solid square tower and the light circular spire with its beautiful peristyle, where the columns are lost in succession, the flowing lines of the open arches above, the return to columns on the next story, and the finish by repeating the flat forms of the tower, the play of light and shade, and the elegance of the outline, render it a masterpiece of its kind, which will probably never be surpassed.

St. Vedast's spire, too, is a charming composition of varieties: the square, the concave, the convex, and the square repeated in the pyramidal termination, give hard and soft shadows most agreeably distributed.

Christchurch spire is a composition of light work contrasted with solid, on the square plan throughout.

St. Antholin's spire is an octagonal composition of a solid character, being a skilful adaptation of the ordinary Gothic spire to the Italian style.

The manner in which the towers, supporting the spires, are treated has great influence on the effect of the whole composition or steeple. In the examples mentioned it will be seen that the number of apertures, their forms and proportions, the subdivision by bands and cornices, and especially the decoration of the belfry story, are so arranged as to form a suitable substructure to the upper portion or spire.

Among the stone lanterns, those of St. Stephen's, Walbrook; St. James's, Garlick-hill; and St. Michael Royal, are fine specimens. The two first are square in plan, and present the peculiarity in their construction of being carried on domes springing from piers in the internal angles of the belfry, which piers are built independent of the walls, and transmit the weight to the thicker work below.

The lantern of St. Michael Royal is octagonal in plan, and is supported on a dome resting on deep corbels in the angles of the belfry. In this instance, the assistance of strong iron tie-rods is required to resist the outward thrust of the arches beneath the dome.

The lantern of St. Dunstan's in the East is a remarkable production, both for construction and symmetry. That of St. Nicholas's, Newcastle-upon-Tyne, almost the only ancient example remaining since the destruction of old St. Mary-le-Bow, would not be worthy of mention if placed by its side.* In St. Nicholas's the wide span across the tower, and the low rise of the lantern and flying buttresses above the battlements, appear to overpower the resistance to their thrust. On the other hand, St. Dunstan's stands easy and graceful, every portion appearing to be at rest, and conveying the full impression of enduring, as an undoubted masterpiece of its kind. From each angle of the parapet, but fairly within the pinnacles, rise the graceful flying buttresses which support the lantern. These measure 2 ft. 5 in. by 1 ft. 8 in. and rise with the same dimensions to the curve immediately below the lantern, where they are gathered round a circular aperture 3 ft. 6 in. diameter. The lantern externally is not less than 6 feet across, and the distribution of the joints of the masonry at this point is the most delicate part of the construction. The flying buttresses, the joints of which slightly radiate in the upper part above the battlements, are carried on long flat corbels 28 feet deep, reaching to the bottom of the belfry and to the thicker walls of the story below.

St. Dunstan's is a remarkable edifice, though it cannot be praised for what is called good Gothic detail, for Gothic was a style little understood or cared about in Wren's time: it nevertheless possesses so many compensating qualities, as to be well worthy the attention of the most refined mediæval critic. Wren has been censured for building in a style of which he was not perfect master: it must, however,

* On the 26th of April, Mr. Clayton continued his remarks on the City Churches, at the Institute of British Architects. The following are further extracts from his paper.

* We are not to be understood as concurring in this opinion.—Ed.

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