water, — I examined all of the data since 1870, to correct, so far as possible, all other errors of the same kind. The record of snow for the winters of 1870–71 and 1871–72 were found to be given in this way, and comparison with the Signal Service observations also indicated that the reduction had been neglected in a few instances in subsequent years. This critical examination of the original observations has led to the construction of the accompanying table of monthly totals: —

MONTHLY PRECIPITATION AT FORT LEAVENWORTH, KAN.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1870.....	—	—	—	—	—	—	—	—	—	—	—	1.27*	41.70
1871.....	1.12	3.37	1.70*	1.22	2.00	5.44	1.63	4.66	1.85	4.00	3.94†	0.46	31.39
1872.....	0.20	0.87†	2.30	4.50	8.15	3.64	9.99†	6.83	4.05	0.83	0.00	2.85	44.21
1873.	0.98	1.35	1.80	4.30	5.03	3 11	3.12	1.40	2.53	0.91	0.87	5.24†	30.64
1874.....	1.44	1.07	1.50	1.40	1.00	3.55	2.95	1.69	4.76	0.37	3.46†	1.02	24.21
1875.....	0.05	1.25†	1.70	2.23	4.17	2.34	6.72	3.15	0.78	0.74	0.40	1.98	25.51
1876.....	1.20	0.44	5.71	6.19	6 17	4.81	2.28	4.21	3.62	3.00	1.91	0.66	40.20
1877.....	1.65	0.58	4.14	5.16	7.61	7.59	4.36	2.15	1.88	4.36	1.71	2.82	44.01
1878.....	1.36	2.88	1.95	2.76	3.96	4.36	1 89	2 38	2.61	0.54	2 28	2 40	29.37
1879.....	0.12	0.35	0.06	3.44	2.05	7.89	3.59	0.62	2.79	3.85	6.26	1.85	32.87
1880.....	2.14	1.55	2.53	1.46	3.90	0.96	5.86	6.68	1 68	2.40	1.80	0.40†	31.36
1881	0.15	4.61	2.20	1.67	3.14	3 73	2.00	1.92	5.23	4.46	1.40	0.96	31.47
1882.....	1.07	0.88	0.76	3.84	2.61	2.82	3.00	0.65	1.18	2.28	1.92	1.06	22.07
1883.....	0.48	2.05	0.72	1.27	6.65	12 16	2.25	1.97	0.85	8.31†	2.02†	0.65†	39 38

* Observations by Mr. F. Hawn. † Observations by Signal Service.

Important changes in the values for April, May, July, and August, 1871, are corrections of serious errors existing in the published observations, the corrected values having been furnished by Major Woodhull. For those months in which the record at the fort is missing, namely, February and July, 1872, and October to December, 1883, the Signal Service observations have been inserted to complete the series.

The Signal Service record has also been substituted in November, 1871, and December, 1880, — months in which the fort record is manifestly recorded improperly, but for which the correct record cannot safely be inferred; and also in December, 1873, November, 1874, and February, 1875, for portions of which the fort record of snow is apparently measured carelessly, or recorded without reduction, but of whose error the evidence now at hand is not entirely conclusive.

Although in these several instances the fort record has been completed by the use of Signal Service observations, the series still remains essentially homogeneous and comparable from 1837 to 1883.

Combining the whole series in ten-year means, we have the material for ascertaining the existence of any secular change: —

Period.	No. of Years.	Amount.
1837-46.....	10	30.4
1847-56..... ..	10	32.3
1857-65.....	9	33.7
1867-76	10	33.2
1877-83.....	7	32.9

The increase of seven inches shown by the combined Fort Leavenworth and Signal Service records has largely disappeared. Examining, now, the average annual rainfall from 1872 to 1883 given by the Signal Service record and the record at the fort, we find that the former is 38.5 inches, and the latter 33.0 inches, showing a discrepancy between the two of five and a half inches.

To what this discrepancy is due, — whether to differences in the rules of observation or to an error of ten per cent in the Signal Service gauge (as was the case at Providence, R.I.), or to some other cause, — I do not know; but it is fairly manifest that the conclusions based on the assumed comparability of the two series are quite worthless.

GEO. E. CURTIS.

Birmingham, Conn., June 30.

Photographs of Lightning-Flashes.

POSSIBLY some of your readers may be interested in the following report: —

In the month of June, 1887, a committee of the Royal Meteorological Society, London, issued about two hundred circulars to the secretaries of photographic societies in various parts of Europe and America, and also to other likely persons, requesting them to furnish the society with photographs of lightning-flashes.

About sixty photographs of lightning-flashes were received in answer to this invitation; and these were exhibited at the meeting of the society in March, 1888, where they received much attention.

From the evidence now obtained, it is evident that lightning assumes various typical forms, under conditions which are at present unknown.

The following appear to be some of the most typical forms of lightning-flashes: —

1. Stream lightning, or a plain, broad, rather smooth streak of light. Only two or three specimens of this form have been received. The committee are disposed to consider this a distinct type of a single stream-like character, without distinct irregularities or branches, and not merely the result of bad focusing, because other objects, such as trees, are extremely sharp.

2. Sinuous lightning, when the flash keeps in some one general direction, but the line is sinuous, bending from side to side in a very irregular manner. This is by far the commonest type.

It is very noticeable that the thickness of the line varies during the course of discharge. Sometimes the thinnest part of the white streak is the highest, and the flash appears to get thicker as it approaches the earth; at other times a flash in the air begins thin, broadens out in the middle, and fines away again at the farther extremity.

The committee can offer no explanation of this at present, but they would call attention to the fact, that, in some photographs of electric sparks taken from an induction-coil, those of high tension are thinner than those of low tension.

3. Ramified lightning, in which part of the flash appears to branch off from the main streak like the fibres from the root of a tree. Of course, there is no evidence as to whether these fibres branch off from, or run into, the main flash.

4. Meandering lightning. Sometimes the flash appears to meander about in the air without any definite course, and forms small, irregular loops. The thickness of the same flash may vary considerably in different parts of the course, as mentioned above; and a flash may go pretty straight in one portion of its path, but meander considerably in another.

5. Beaded or chapleted lightning. Sometimes a series of bright beads appear in the general white streak of lightning on the photographic plate. Occasionally these brighter spots appear to coincide with bends in a meandering type, but often the beads appear without any evident looping of the flash.

But as a flash is moving in space, while two directions only can be shown on the plane of the paper, there is every reason to believe that the brighter spots on the positive picture may be points where the flash was zigzagging, either directly towards, or away from, the observer, and thereby giving a somewhat longer exposure to these spots.

6. Ribbon lightning. Nearly one-sixth of the photographs received by the society show flashes exhibiting more or less of a ribbon-like form. One edge of the ribbon is usually much whiter and firmer than the other.

Occasionally in the same picture some flashes appear normal, and others ribboned; but the flashes in a picture need not have occurred simultaneously. The committee have not yet in their possession any conclusive evidence as to whether the same flash may be normal in one portion, and ribboned in another portion, of its course.

In one picture there is a bright streak on the top of the flash; then about an eighth of an inch of ribbon-like light, the folds fol-

lowing the sinuosities of the bright streak; then a dark band, parallel to, and following, every irregularity of the bright streak; and then nearly another eighth of an inch of ribbon-like light. In another picture a very thin beaded flash has a precisely similar beaded streak, rather fainter than itself, running parallel to it, at a distance of about a sixteenth of an inch on the paper.

It might be suggested that the second fainter image was formed by internal reflection from the back surface of the glass plate; but it should be noticed that sometimes very thin flashes, which are not particularly bright, are so duplicated.

A far more probable cause is the double image formed by the internal reflections of doublet photographic lenses. All doublets are essentially two meniscus lenses, mounted with their concave surfaces facing one another. The greater portion of a strong point of light, passing through both lenses, forms the usual image on the plate; but a smaller portion is reflected from the concave surface of the rear meniscus on to the concave surface of the front lens, and from thence back through the rear lens to the sensitive plate. The amount of displacement depends on the angle formed between the direction of the bright point and the optical axis of the lens.

M. C. Moussette of Paris showed some photographs of the sun in which this double reflection image was very conspicuous; and there is not the slightest doubt that some lightning-flashes are bright enough to give this secondary image. M. Moussette also showed the photograph of a flash in which the centre of the flash was whitest, with a darker edge on either side. This may have been produced either by double reflection from the lens, or by internal reflection from the back of the glass plate. Two bands of light — the primary and secondary images — slightly overlapping would form an extra bright band where the overlap took place.

In the majority of cases, the folds of the ribbon formation are most obvious when the course of the flash is square to the width of the folds, and they are but slightly pronounced when in a line with them. This would suggest the idea of a shaking of the camera in the direction of the folds of the ribbon; but, if this is so, the duration of a lightning-flash must be much longer than is usually supposed.

The committee hope to have the opportunity of making some experiments on the photography of sparks from a coil or electrical influence machine. In the mean time they defer expressing an opinion as to whether lightning ever really takes a ribbon-like form till further evidence is available, but would point out that both sources of error — the duplication of the image either by reflection inside the lens, or by reflection from the back of the plate — would be avoided by the use of single lenses, and of paper instead of glass supported films. The committee also forbear for the present from publishing a reproduction of a ribbon-like flash, till they are satisfied that such a form of lightning really exists, and that the whole appearance is not due to photographic causes.

In one picture, sent by Mr. Shepherd, there are five ordinary white flashes, and one dark streak of precisely the same character as the bright streaks. M. Moussette has suggested that this may be the result of a very bright flash, so over-exposing the plate as to produce the well-known inversion of a negative by over-exposure, as when the ball of the sun appears black on the positive print, instead of white. This is no doubt a possible explanation; but the committee would like further examples of this same appearance of dark flashes before expressing an opinion on the matter.

The committee call attention to the fact that there is not the slightest evidence in the photographs of lightning-flashes of that angular zigzag or forked form so commonly seen in pictures.

In connection with this, they would call attention to a remarkable paper, communicated to the British Association in 1856, by James Nasmyth, F.R.S. Mr. Nasmyth says that he has never seen forked lightning of the angular zigzag form, and asserts that "the true natural form of a primitive flash of lightning appears to Mr. Nasmyth to be more correctly represented by an intensely crooked line, and on several occasions he has observed it to assume the forked or branched form, but never the zigzag dovetail."

The Council of the Royal Meteorological Society are desirous of obtaining more photographs of flashes of lightning, as they believe that a great deal of research on this subject can only be pursued by means of the camera, and would esteem it a great favor if any one would give them any assistance in this matter, either by sending them copies of any photographs of flashes of lightning that may have already been taken, or by endeavoring to procure them, or to interest others in so doing.

It may perhaps be well to mention that the photography of lightning does not present any particular difficulties. If a rapid plate, and an ordinary rapid lens with full aperture, be left uncovered for a short time at night during a thunder-storm, flashes of lightning will, after development, be found in some cases to have impressed themselves upon the plate. The only difficulty is the uncertainty whether any particular flash will happen to have been in the field of view. A rapid single lens is much more suitable than a rapid doublet; and it is believed that films on paper would effectually prevent reflection from the back.

The focus should be that for a distant object; and, if possible, some point of landscape should be included to give the position of the horizon. If the latter is impossible, then the top of the picture should be distinctly marked. Any additional information as to the time, direction in which the camera was pointed, and the state of the weather, would be very desirable. The council hope, now that the thunder-storm season is approaching, many photographers, both amateur and professional, may be found willing to take up this interesting branch of their art. A. F. N.

New York, July 2.

The Name of America.

WILL you permit us to correct some erroneous ideas in your note on our work? Your reviewer, referring to the origin of the name 'America,' says that our account derives it from a Peruvian tribe, although the name was in use long before Peru was discovered. This, no doubt, is an unintentional misrepresentation, as no such tribe ever existed, the name 'Peru' having been given by the Spaniards to the kingdom of the Aymaras of Aymaraca, whose subjects, according to some authors, were also the chief race in the West Indies. Your reviewer also wonders if the author ever knew that the Indies was the recognized Spanish name of the continent during the age of its discovery.

It seems to us incredible that any one could make such a remark, seeing that every schoolboy knows the story of the naming of the West Indies, while our work refers over and over again to the fact that the continent was officially known in Spain as the Indias, — a general term including the East and West Indies, which contained a large number of countries.

When a work bases a discovery on the evidence of standard authorities, the impartial critic who is not convinced will point out where the evidence is defective. This is the law of logic, which a scholar cannot ignore. But when an author who translates his original evidence from Italian, Spanish, French, German, and Latin, finds himself designated under the clownish epithets of 'half-learned wanderers,' 'happy enthusiasts,' 'erratic followers,' etc., we will leave it to the public to say whether that is an impartial, fair, or scholarly critique, or whether it does not look like the work of some little publisher, whose history — always for sale — tells another story.

The great Baron de Humboldt says that Amaraca-pana was the first Spanish settlement on the mainland. This was in 1502, five years before the pamphlet of St. Die proposed the name of 'Amerigo Vespucci,' who sailed into Amaraca-pana on his first visit, under command of Ojeda, to the New World, and which was the only place where they were favorably received, and treated as if they were angels. So says the royal Spanish historian Herrara, in quoting Ojeda himself; and the Isle of Tamaragua, on the first standard map of the continent, published in 1508, was evidently intended for Amaraca or America, which was long considered an isle. Here is positive evidence, by well-known authorities; and whoever is not convinced should point to evidence of a better explanation, or show cause why ours is insufficient; doing so in the language — to use your reviewer's own words — of a "sober historian." T. DE ST. BRIS.

New York, June 30.

[Our correspondent has evidently failed to read the review carefully. — ED.]