

I have made this piston also in blowing machines and in air-pumps for sugar-works, and found it to answer very well.

Capt. Carlsund has made this piston for all kinds of steam engines for the last twenty years, but the English journals seem to think it best adapted only to locomotives and portable engines.

It is now over thirteen years since I first endeavored to introduce Carlsund's steam piston in America, but did not succeed. A steamship builder who ordered machinery to be made at one of the first establishments in Philadelphia, desired Carlsund's piston to be tried, for which I furnished a complete drawing; but the engineer of the establishment condemned it immediately. I was told that my drawing was shown to the workmen in the establishment, who joined in a hearty laugh and ridiculed the piston. The engineer then made a drawing of the ordinary complicated piston. I was not at the time familiar with the American system of introducing new things, neither would I feel disposed to follow such a course; but simply stated that the piston is very good and in operation in Sweden, and attempted to describe the manner in which it is made. I now regret that I did not give it out as the greatest wonder of the age.

Scientific Balloon Ascent.—The Lines in the Spectrum. By JAMES GLAISHER.

From the London Athenæum, No. 1850.

For the purpose of observing the black lines in the sky spectrum at different altitudes, and the sun spectrum if possible, an apparatus was employed consisting of a prism, a fine adjustable slit half an inch in length, placed in the focus of an object-glass, and a telescope directed to the prism, lent for the purpose by the Astronomer Royal, and is the same apparatus as that used by Prof. Smyth on the Peak of Teneriffe. No angular measure was prepared for or contemplated; only eye observations and comparison of differences between the spectrum as seen on the ground and at different heights during the journey. A careful examination of the spectrum between the hours of 3 and 4 P. M., before starting, showed B as the boundary at the red end, and a little beyond G at the violet end when looking at the sky; and when looking at the sun, I could not see quite to H. The lines C, D double, E, b, and F were very plainly shown, with many lines between them. At 4h. 20m., at the height of about half a mile, a cursory examination of the spectrum showed a close correspondence with that on the earth, showing lines B to G, but the extreme lines with, I thought, less distinctness. At 4h. 30m. at the height of about one mile, the spectrum was bright, but less in length, both at the violet and red ends. The line G was quite the limit, and I could not see B, and C was doubtful. At 4h. 35m., at the height of about 2 miles, G was lost entirely, and the violet was dull; I could see F and D, but not beyond. At 4h. 42m., at 3 miles high, I lost violet entirely, and could not see F. At 4h. 46m., between 3 and 4 miles high, the spec-

trum was very short. I could see from a little beyond D to E, I think b, but not F. At 5h. 10m. at 4 miles high, I could not see any spectrum, excepting a little yellow tinge. At 5h. 30m. at $4\frac{1}{2}$ miles high, I saw no spectrum and no color. At 5h. 43m., at the height of 3 miles, on descending there was no spectrum; I opened the slit and saw a faint tinge of color only.

Bearing in mind that the time available for this class of observations in the balloon is inadequate to take correct drawings, I only attended, with as much care as the shortness of the time admitted, to the general appearance, the limiting lines of visibility at both ends of the spectrum, and very little to the thickness, or number, or definition of the lines themselves. The general result is, that no lines were lost from the spectrum, excepting those by the shortening of the spectrum itself; but it must be borne in mind, that although it was very light with us, yet the sun was low, and the shortening of the spectrum itself may be attributable to the want of light. For this class of experiments, it will be necessary to have a balloon ascent starting either in the morning or about noon, to compare with the preceding observations, and to determine whether the spectrum does really shorten with elevation, as well as to determine whether any lines are lost by passing into a less dense atmosphere.

One of the principal subjects of research in the balloon experiments of last year was the determination of the law of decrease of temperature with increase of elevation. The results from my ascents last season were that when the sky was clear, a decline of 1 degree took place within 100 feet of the earth, whilst at the height of 30,000 feet a space of fully 1000 feet had to be passed for a change of 1 degree of temperature, and that between these limits a gradually increasing space was required for a change of temperature to the same amount, plainly indicating that the old theory of a decline of temperature of 1 degree for every 300 feet must be abandoned.

The previous ascents were made in the months of July, August, and September. It became of the highest importance to have similar experiments in the other months of the year, and the British Association at its meeting in Cambridge, voted £200 for experiments to be begun in the spring, and some of which, if possible, during the prevalence of east winds.

The balloon left the earth on March 31, from the crystal palace, at 4h. 16m. P. M., the temperature of the air being 50 degrees; at 4h. 25m. we were one mile high, with a temperature of $33\frac{1}{2}$ degrees; the second mile was reached at 4h. 35m., with a temperature of 26 degrees; the third mile at 4h. 44m., when the temperature was 14 degrees; at $3\frac{1}{2}$ miles high the temperature was 8 degrees. A warm current of air was met with, and it rose to 12 degrees at 4h. 58m.; at 5h. 2m. we passed out of the current, and when $4\frac{1}{2}$ miles high the temperature was just zero of Fahrenheit's scale.

In descending, the temperature increased to 11 degrees at about three miles high, at 5h. 38m.; then a cold current was met with, and it decreased to 7 degrees. We soon passed through it, and the tem-

perature increased to $18\frac{1}{2}$ degrees at two miles high, to $25\frac{1}{2}$ degrees at one mile, and to 42 degrees on the ground, which was reached at 6h. 30m.

When one mile high the deep roar of London was heard distinctly, and its murmuring noise reached us at a greater elevation. At heights of three and four miles high the view was indeed wonderful—the plan-like appearance of London and its suburbs; the map-like appearance of the country round; then running the eye down the winding Thames, to the white cliffs at Margate, and on to Dover, Brighton was seen, and the sea beyond, and all the coast line was clear up to Yarmouth. The north was obscured by clouds. Looking under us, and to the south, there were many detached cumuli clouds, resting apparently on the earth, like patches of shining wool, and in some places a solitary cloud thus apparently resting on the earth surrounded by a clear space for many miles.

Blackheath, April 6, 1863.

Scientific Balloon Ascent. By JAMES GLAISHER.

From the London Athenæum, No. 1852.

In the *Athenæum* of the 11th inst. are detailed the observations I made on the sky spectra in the Balloon Ascent on March 31. They were so different from what I expected that I could not avoid coming to the conclusion, that they were of little value in consequence of the ascent having been made so late in the day. I therefore resolved that the next ascent should be made when the sun was near the meridian, and that the spectrum examination should be a primary subject of investigation. The apparatus was the same as that used on the previous experiments. It was covered with black cloth to prevent any stray light falling on the prism, and whilst observing my head was also covered with black cloth. Between the hours of 11 A. M. and noon, I examined the solar and sky spectra with care. The sky was generally covered with cumuli, and there was a great mist. The solar spectrum extended from B to H nearly; and the sky spectrum from B to G, but these were quite its limiting lines.

We left the earth on April 18 at 1h. 17m. P. M.; within two minutes afterwards we were 3000 feet, and at 1h. 23m. we were one mile high. The second mile was passed at 1h. 29m.; the third at 1h. 37m.; the fourth at 2h.; and the highest point was reached at 2h. 30m.—at the height of four-and-a-half miles nearly. At 2h. 36m. we passed below four miles; the next mile downwards was passed at 2h. 40m.; and at 2h. 46m. we were two miles from the earth, which we reached at 2h. 50m. At 1h. 20m. looking close to the sun, the line G was very clear, as well as the two nebulous lines H, and the spectrum extended somewhat further; many lines were seen. At 1h. 21m. at the red end of the sky spectrum near the sun, the line B was very clear, and many lines between B and F were visible. At 1h. 28m. the sky spectrum under and close to the sun extended from A at the red end to beyond H; the lines were beautifully defined, and I thought somewhat more numerous