

following averages: one pound of anthracite burned under a good boiler yields, in the incandescent system of lighting, about 40 candles; the same weight of coal gives from the naked arc-light about 158 candles; ordinarily arc-lights are shaded so as to lose about one-half their intensity, so that only 80 candles per pound of coal are available; one pound of bituminous coal will yield from five to six cubic feet of illuminating-gas; this gas will, in the standard argand burner, yield from 14 to 17 candles. Illuminating-gas is burned at once in the simplest manner, and the amount of machinery and care required by electric lighting offsets its greater economy of fuel, light for light. There is little room for improvement in dynamos, but the most important economies will arise from more skilful use and design of the steam-engines required to drive the dynamos. The steam-engine, although much the senior of the dynamo in the list of inventions, is not nearly so well understood. It is but very recently that the laws of condensation and expansion of steam in the engine actually at work have been grasped, and our limitations so clearly defined as to point out the logical way to greater economies, and prevent us from attempting economy under impossible conditions.

—The photograph of the normal solar spectrum, made by Prof. H. A. Rowland at the Johns Hopkins university, Baltimore, is now complete from wave-length 3680 to 5790; and the portion above 3680 to the extremity of the ultra-violet, wave-length about 3100, is nearly ready. Negatives have also been prepared down to and including *B*, and it is possible they may be prepared for publication. The plates, seven in number, all contain two strips of the spectrum, except No. 2, which contains three. They are three feet long and one foot wide. These can now all be furnished to order except No. 2, the negative of which is being made. The plates will be delivered in Baltimore or New York, or will be sent by express or mail, securely packed, at the charge and risk of the purchaser, at the following net prices: the set of seven plates, unmounted, \$10; mounted on cloth, \$12; single plates, \$2 each; mounted on cloth, \$2.25.

—A telegram from Guayaquil, of Jan. 20, announces that indications of an earthquake were observed in Chimbo contemporary with a renewed outbreak of the Cotopaxi volcano.

—There are good reasons for supposing that a bill will pass both houses of congress, appropriating fifteen thousand dollars annually to Cornell university for the establishment of an agricultural experiment-station at that institution.

—The Norwegian ship *Ferdinand* at Philadelphia reports that near midnight of Jan. 8, in latitude 38° 20' north, longitude 71° 20' west, during a severe storm of rain and wind, the night being very dark, all the yard-arms and mastsheads were suddenly lighted up with St. Elmo's fire, having the appearance of bright lanterns. The phenomenon lasted about three minutes.

—The opening of the third electrical exhibition at St. Petersburg, which took place on Jan. 1, is attracting much attention among the people, especially that portion devoted to the telephone. The exhibition is said to be noteworthy for the novelty, variety, and number of its objects. For illumination, all the known systems of electrical lighting are employed.

—The *Kölnische zeitung* for Jan. 14 states that at the preceding meeting of the Vienna geographical society was announced the discovery, by Dr. Stapf, of a hitherto unknown lake in the Persian desert. The lake, according to Dr. Stapf, is at least forty kilometres long, and is probably of recent origin. According to information obtained from Mohammedan sources, it appears that the lake dried up after a previous existence, and later re-appeared. The water is to a very considerable degree alkaline.

LETTERS TO THE EDITOR.

, Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The competition of convict labor.

THE two articles which have appeared in *Science* on this problem (vii. Nos. 153 and 155) by Mr. N. M. Butler treat this subject after the manner of that system or school of political economy which is taught in the colleges, and which rules in business. Its aim and end is profit. It is science 'for revenue only,' and it ignores morality or humanity. It judges all human activity by the standard of profitableness. In reference to this particular question, Mr. Butler formulates that stand-point very characteristically by the following initiatory axiomatic phrase: "That convicts should be employed, if possible, in a manner profitable to the state, is a proposition that no sane man controverts."

To be sure, any thing humane is sentimental nonsense to this school; and any thing so 'unbusinesslike' as the greatest of virtues, charity, is insanity. But this form of 'insanity' is increasing rapidly in the world, and developing a new school of political economy, whose central principle is to further the welfare of all men. From the stand-point of that school, a prison should not be a slave-pen for grinding out 'profit' to the state, but either a refuge for moral cripples or a school for those who lack the moral training necessary to make them good citizens.

About the cause of the agitation of this question among workingmen, Mr. Butler makes some state-

ments which are apt to be misleading. He ascribes it to a few isolated individuals and to sustenance-seeking agitators. The facts are, that whole groups, trades, have directly been affected wherever prison labor has entered the market. The statement which contractors are said to make, that convict labor at fifty cents a day is not cheaper than free labor, is not to be believed except upon the most positive evidence, for the prisoners are driven and tortured to daily perform a set task; and that this is not an average half-day work is pretty safe to surmise.

As to the selfish 'agitator,' he is the great bug-aboo of those who do not know him, or whose interests are threatened by him. The truth is, that his is a losing business: he is persecuted, blacklisted, hunted, and misunderstood and denounced; and that he still remains true to what he deems his duty is a trait that should be honored by all who can appreciate an unselfish action.

The real stand-point of the humane school and its agitators is, that 'prison labor must go,' in so far as it is directed to the production of wares for the general market. The piece-price plan and similar tub-to-the-whale measures will not stop this agitation. The employment of prisoners towards their own support directly, as food-raising, prison-building, etc., or their employment on public improvements, is the only thing that will divert the rapidly increasing political activity of workmen as a class from this 'agitation.'

E. LANGERFELD.

Your correspondent misses entirely the tenor of the articles referred to. They were not written from the stand-point of any school of political economy whatsoever, but from the stand-point of practical ethics. That convicts are to be subjected to reformatory and ennobling influences is a truism which my articles took for granted. That idleness is an ennobling influence, that productive labor on the part of convicts is of no injury to the community, were the two points which I was concerned to establish. Dogmatic statements in regard to competition of convict with free labor cannot stand in the face of the figures adduced in the second article (*Science*, vii, p. 68), which were in every case official. Having established the fact that convicts are best employed in productive industries, it only remains to determine from the facts, not theories, which of the systems is the best. This is, I claim, the contract system, when it is properly administered. The question of prison labor is a large one, and, in the articles criticised by your correspondent, but a small portion of it was touched upon.

NICHOLAS MURRAY BUTLER.

A tornado brood in Hampshire county, Mass.

The facts recently published, showing the wide distribution of tornadoes along the south-eastern border of a stormy area of low barometer, and the further evidence that they occur with special frequency but at no fixed points in certain regions, throw no light on observations made incidentally by me during a residence at Amherst, Mass., from 1870 to nearly 1880. I write this with the hope that persons in the central and western parts of Hampshire county, Mass., will for several years make and record observations of a storm breeding-place to be now described, and note the day and hour, so that the results can be compared with a series of signal-service weather-maps. Some immediate comparison can also be made by noting

down at the time the newspaper signal-office report. I have something to say, also, of the peculiar storm or wind-gust that destroyed Northampton bridge in 1877.

My house at Amherst, on 'Mount Pleasant,' commanded the Connecticut River valley for nearly the entire width of Massachusetts. Directly west of me, on a line with the foot of the steepest northern slope of Mount Warner, but west of the river, was what I may term a 'cloud nursery'; not that I remember it as conspicuously originating clouds in a fair sky, but rather and very often as strengthening, enlarging, darkening, any floating cumulus or cumulo-stratus, and seemingly arresting and holding it there until it became sometimes a rain-cloud, and, in three or four instances, a tornado. It seemed to be over or little beyond the hills west of Hatfield. My impression was, that it must be somewhat beyond; namely, over the Mill River valley in the vicinity of Williamsburg. The hills thereabout are not high, not as high as others visible in the Green Mountain range, beyond and to the north. My theory is, that warm, moist, southerly winds all the way from Connecticut, through the wide valley of Southwick, Westfield, Southampton, were thrown upward in the narrowing Mill River valley, which runs north-north-west from Northampton, and so moisture was condensed in the upper air, the upward current at times inviting toward it a tornado inrush of colder air.

Certainly it was just there that two tornadoes by day, and probably one in the evening, originated, Sept. 4, 1873. The apparently stationary cloud had been for some time increasing and darkening, when, soon after noon, I noticed a portion of it hanging down like the inverted crown of a low-crowned hat; and, not long after, the cloud seemed to begin a movement towards the north-east, until, as it approached Whately, the increasing downward projection became ragged at the edges, and two opposite motions of the wisps indicated a whirl. For a moment an ascending funnel from the Connecticut River, near Sunderland, met the descending one from the cloud; and, soon after, the now large and wild whirl struck a shoulder of Mount Toby, levelling a strip of forest, and doing much damage in the village of Long Plain, bounded up the hills east of that, and nothing more was seen or heard of it. The second tornado, an hour later, starting from the same centre, was less threatening in appearance, passed over North Amherst, about seven miles south of the first, and reached the earth only as a harmless gust of wind. A third fell on Northampton at 8 p.m., prostrating many of its grandest elms. There was a fourth, somewhat destructive, at Granby, Mass., just south of the Holyoke range, at 3 p.m., simultaneous with the one that moved over North Amherst. This one at Granby, originating at another point in Hampshire county, and the fact that my pocket-diary notes a storm and violent wind visible in the far north on the following day, suggest some general conditions in the atmosphere favorable to tornadoes, but do not alter the fact that I saw ordinary clouds increase on a day of seemingly ordinary weather, at the spot mentioned, and convert themselves into tornadoes at 1 and 3 o'clock on the day named.

That there may be another local centre south of the Holyoke range, in the region of Granby, is probable from the fact that in 1872, Aug. 16, there was an isolated tornado at Wilbraham and Longmeadow. My note-book, in this connection, only speaks of