the mere conversion of fuel energy into mechanical work is not the most important function, and the machine is very complex. Still, in it we have no heat engine, but the sort of thing we are looking for. I do not wish to set capitalists and patent lawyers against me, and so I will not give my reasons for saying that there is no sufficient temptation for any scientific man to take up the quest. Unless it is taken up as a matter generally recognised to be of national or world-wide importance, there is no more use in tackling the problem than in hunting De Wet with a small army. Many scientific men must combine their efforts in an organised way, freely communicating their ideas to one another and consulting each other as to their experiments. They must be made free from pecuniary cares and assured of great rewards in case of success. I feel sure that if one or two chiefs like Lord Kelvin or Lord Rayleigh were entrusted with the expenditure of a million a year for two or three years by the English nation for the benefit of the world, with power to impress the services of all scientific workers likely to be of use, to make their operations as extended as they pleased, they would bring the invention within reach of the ordinary engineer.

JOHN PERRY.

Birds attacking Butterflies and Moths.

IT was inevitable that the question of birds attacking butterflies would lead to some account of their attacks upon moths. Although I do not believe that any doubt has been thrown upon the keenness and frequency of the pursuit of moths by birds, a few examples of unusual interest deserve permanent record.

About the year 1887 I saw a fine specimen of the Lobster Moth (*Stauropus fagi*) at rest on the lamp-post at the entrance to Norham Gardens, Oxford. So far as I was aware, it was the first specimen which had been noticed in Oxford, and I was anxious to secure it. The moth was gently touched by a stick tied to an umbrella and came fluttering down feebly towards the ground, when, as I ran to catch it, a sparrow dashed across and seized it before it had reached the ground. I chased the sparrow, encumbered with the heavy moth, for some distance, and at first thought it would relinquish the prize. But it soon flew up to the roof of a house and ate the moth in the rain-water gutter.

I am indebted for the second and very remarkable example to Mr. W. Eagle Clarke, of the Edinburgh Museum of Science and Art. He writes, March 1:—"I send you an account of what I think is a somewhat unusual instance.

"In June last, as I was walking at midday along the road which runs close to the shore of Loch Assynt, in north-west Sutherland, a male Oak Eggar Moth (*L. quercus*) dashed past me with the swift irregular flight characteristic of that species. Suddenly a wheatear, a male, gave chase and, after several failures at capture, succeeded, after a clever but trying pursuit, in securing its prey. The body, &c., of the moth was eaten on the road, where I found the wings, the only remains.

"If I had not seen this 'flight' from start to finish, I should not have thought it possible that a wheatear could have been so swift and smart on the wing, for, as you know, an Oak Eggar is not an easy quarry to secure when in flight.

"I have seen a great titmouse capture the white butterfly—*Pieris rapae*—on the wing."

I am sure that any naturalist who is familiar with the flight of the male Oak Eggar will feel all the astonishment which Mr. Clarke expresses at the success of the bird.

The two remaining examples deal with attacks upon the pupæ of moths.

In July, 1900, Mr. A. H. Hamm, of the Hope Department, showed me a number of cocoons of the Lackey Moth (*C. Neustria*), which had just been opened, probably by sparrows, and the pupæ extracted.

The cocoon is tolerably dense, and is probably still further protected by an abundant sulphur-coloured powder which consists of minute crystals of aragonite (calcium carbonate), secreted by the malpighian tubercles of the larva and extruded from the anus before pupation. The cocoons were spun upon the under sides of leaves of black currant and apple, and it was of the highest interest to observe that every one had been opened by the bird pecking a hole in the leaf from the upper side and thus making an aperture in by far the thinnest part of the cocoon. The observation was made in Mr. Hamm's garden in St. Mary's Road, Cowley Road, Oxford.

The last example is equally interesting, but does not deal with the attacks of birds.

Colonel J. W. Yerbury informs me that when collecting on Beown Mountain, Macgillicuddy Reeks, Kerry, on July 21–22, 1901, he found under a stone, at the height of more than 2000 feet, the old winter store of a mouse or possibly a shrew, consisting of eight to ten cocoons of the Emperor Moth (*Saturnia carpini*). Every cocoon had been gnawed through at the base, viz. the end opposite to that from which the moth emerges, and the pupa extracted.

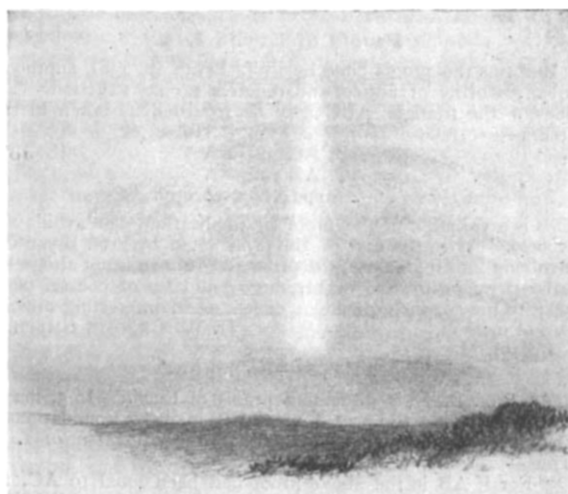
EDWARD B. POULTON.

Oxford, March 6.

Sun Pillars.

ON Thursday the 6th inst. a very fine display of this phenomenon was observed over a considerable area in the west of England, and having regard to Prof. Herschel's interesting letter on the same subject published in NATURE on July 4 last (No. 1653, vol. lxiv. p. 232), perhaps the few facts I have been able to collect may be of interest to some of your readers.

For several days the weather had been exceedingly fine and dry, with hot sunshine and a wind following the sun. The wind on the evening in question had almost died away at sunset; the latter was at 5h. 46m. Greenwich time, and would be about 6h. 5m. here. Close upon 5h. 30m. the light-beam first appeared rising vertically from the sun, which was still visible above a violet-coloured bank of haze; its base did not extend below the sun.



The beam had the appearance of a tall column of very beautiful orange-coloured light brighter in the centre than at the edges; its top must have been quite 20° above the horizon. The sun sank into the haze about 5h. 45m.; the column remained just as bright though reddening gradually until 6h. 20m., and was still distinctly visible at 6h. 40m. It had faded away by 6h. 50m. Faint bands of cloud were visible round the sun, and these sloped from the top of the light-column obliquely downwards in a northerly direction; I also noticed a repetition of the beam on either side of it, though this may have been purely an optical illusion.

I have ascertained that the effect was seen over the whole of Cornwall and Devon, as far east as Salisbury and Taunton, and north as far as Pendine in Carmarthen Bay. Snow has not fallen here for several weeks.

W. H. GRAHAM.

Fowey, March 11.

IN reply to Mr. Knight's inquiry in last week's NATURE (p. 439), he may be referred to many old books, as, for instance, to Moigno's "Répertoire d'Optique Moderne," published in 1847, in the first volume of which he will find a whole section devoted to meteorological optics. The explanation of most of the phenomena of meteorological optics had, I believe, been worked out by Babinet about ten years earlier.

As to the vertical pillar of light frequently observed in high latitudes after sunset and before sunrise, and occasionally seen in latitudes as low as ours, it may be attributed to spiculæ of ice which, whether isolated or radiating from a centre as in crystals of snow, will assume a horizontal position if they subside through a portion of the atmosphere which is quite free from convection currents. Those of the horizontal spiculæ which are vertically over the cone connecting the spectator's eye and the sun will include some that can directly reflect solar light to his eye, and it is these that produce the phenomenon which was seen by Mr. Knight. The pillar may be expected to be white till the sun gets some distance below the horizon, when it will in succession assume the colours due to the absorption and dispersion of light by the atmosphere.

It can easily be shown experimentally that if the air be free from the minute convection currents which so trouble astronomers (which it seldom is), then subsiding spiculæ of ice will be horizontal. To show this, cut from a sheet of stiff paper a straight, long and narrow strip, and let it fall through the air. The experiment is a pretty one when the strip of paper is thrown out of an upper window on a calm day. The strip falls not lengthwise, but sideways, and spins round its long horizontal axis. The dynamics of this phenomenon have not, I think, as yet been worked out. The explanation would require an investigation of the stream lines surrounding a body rotating as well as progressing through a fluid. It seems to be a problem which might with advantage be proposed to the mathematical research scholars of our Universities.

30 Ledbury Road, W., March 16. G. JOHNSTONE STONEY.

Proofs of Euclid I. 5.

BESIDES the proofs cited by Prof. Bryan (p. 438), another is equally worthy of notice, and requires no construction. The sides of the triangle ABC may be regarded as taken in two orders—

$$\begin{aligned} &AB, AC \text{ and } \angle A \\ = &AC, AB \text{ and } \angle A \\ \therefore\ &\angle \text{ opp. } AB = \angle \text{ opp. } AC. \end{aligned}$$

This is a variation of the proof by duplication, but avoids this process. As in the case of the proof cited by Prof. Bryan and involving limiting values, the proof given above is not altogether satisfactory for the use of beginners, and is, of course, of no value to the advancing student except as an interesting illustration of method. H. W. CROOME SMITH.

Bristol, March 15.

As Prof. Bryan is discussing proofs of Euclid's I. 5, may I call attention to the way I proved it in my "Foundations of Geometry," namely as a corollary to the equivalent of I. 4? Thus—

"For if AB in the above proof had been equal to AC, the triangle ABC might also have been moved so that AB fell on DF, and AC on DE, and the triangles would have been congruent so. Hence both the angles ABC and ACB would be shown to be equal to DEF, and therefore to each other."

This seems to me far and away simpler than any other proof I know of, and it has the advantage of directing attention to the fact that the proof of I. 4 as often as not involves turning the triangle over in the air, while moving it; so that, for example, the proof would not apply as it stands to spherical triangles. EDWARD T. DIXON.

Racketts, Hythe, Hants, March 16.

THE NATIONAL PHYSICAL LABORATORY.

SOME further account of the National Physical Laboratory, which is being opened by H.R.H. the Prince of Wales, accompanied by H.R.H. the Princess, as these lines go to press, may be of interest to readers of NATURE. A description of Bushy House, with plans, has already appeared; the alterations required to fit it or a laboratory are now complete, and the new buildngs erected for the engineering department are ready or use. The following extracts from the report of the executive committee will indicate what has been done:—

The basement and ground floor of Bushy House have been transformed into a physical laboratory, while the upper floors form offices and a residence for the director. The basement is covered with a brick groining, on which the main building rests, but the more important laboratories are in four large wings, one at each corner, and these have no basement below, thus steady supports are everywhere possible.

One wing, containing the original dining-room and library, has been fitted as an electrical and magnetic laboratory. All iron has been, as far as possible, removed from the structure, and, with a view of preventing a stray magnetic field from any currents which may be used, concentric wiring has been employed for all large currents, while the wires for smaller currents have been twisted.

In this room will be placed the Lorenz apparatus which the Drapers' Company has recently with great generosity given to the Laboratory in memory of the distinguished services to science and to education of the late Principal J. V. Jones, F.R.S., of Cardiff. Along with this there will be other apparatus for the absolute measurement of current and of electromotive force.

Another wing has been fitted for thermometric work. A special study will be made of high-temperature thermometers, and the laboratory owes to the generosity of Sir A. Noble the means for installing a number of electric ovens for testing thermopiles and other instruments for the measurement of temperature up to 1000° or 1200° Centigrade.

In a third wing a metallurgical laboratory has been fitted in which to continue the work begun at the Mint by Sir William Roberts-Austen and the Alloys Research Committee. For this purpose apparatus for cutting and polishing sections and further photomicrographical examination has been obtained. The committee has to thank Mr. Stead for his assistance in arranging this. The fourth wing is fitted as a chemical laboratory. In the basement are a number of constant temperature rooms.

Sir Andrew Noble's fund, referred to in the last report, has provided a measuring machine, a dividing engine and a comparator, which will be placed in some of the basement rooms. In an adjoining room the resistance measurements of the British Association Committee will be continued, while in another, apparatus for the production of liquid air is being set up. The testing of pressure gauges will form an important branch of the work, and for this a mercury column some fifty feet in height has been erected in one corner of the house.

Gas and water have been laid on freely throughout the building—also electricity. A 100-volt circuit is connected to the main dynamo and battery in the powerhouse, and supplies light. Numerous plug points enable a supply to be taken off for lights for experimental purposes or for small motors. For experimental work a special battery of fifty-five cells has been installed. This is divided into groups of five. Wires run from the switchboard to the various rooms in such a way that one or more of these groups can be switched on to any circuit. Thus voltages between 2 and 110 volts can be obtained as required.

The house is heated on the Webster low-pressure system by steam from a Lancashire boiler in the boilerhouse at a distance of about 100 yards. The boiler also supplies steam to one of Parson's 60-kilowatt turbogenerators, which is the main source of power. The power-house also contains an 18-h.p. Crossley gasengine, driving a 12-kilowatt dynamo by T. Parker and Co. This serves as a stand-by and for charging the main battery of fifty-eight chloride cells.

The engineering laboratory, a building eighty feet by fifty feet, adjoins the power-house. This is divided into two bays; a shaft, driven by a motor supplied by Mather