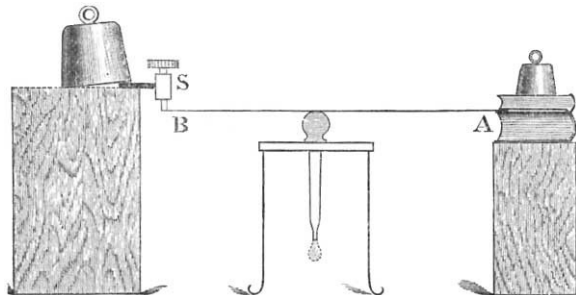


periment on surface tension. A drop of water hanging from the end of a vertical glass tube is regulated in size until it is just on the point of falling away from the tube. On dipping the end of a penholder in ether, and bringing the wet end within a few millimetres from the drop, the latter promptly falls. The drops may be produced and adjusted in the following manner:—

A piece of glass tube, about 8 cms. long and .8 cms. in diameter, is made into a pipette with an orifice about .15 cms. diameter, and fitted with a small india-rubber ball at the other end. The tube is then passed through a hole in a piece of wood large enough to rest on the top of a common tripod stand, as shown in the figure. A strip of wood, or a paper-



knife, about 30 cms. long, is placed with its centre resting on the top of the ball, one end (A) being held between the two uppermost of a pile of books, and the other end (B) passing under a screw (S). The ball is squeezed, a beaker of water brought under the end of the pipette, and the tube allowed to fill by the expansion of the rubber. By working the screw S, a drop is formed at the end of the tube, and since one complete turn of the screw I use only lowers the end of the rod (B) $\frac{1}{8}$ inch, it is possible to adjust the drop with great nicety. As the ether is brought up, the absorption of its vapour diminishes the surface tension over a small area of the drop of water, and currents, made visible by suspended dust, appear to pass from the interior towards the weakened spot. Bringing the ether still nearer, the drop often becomes much agitated, and finally, when the distance is reduced to about 4 mm., it falls away from the tube.

E. D. FRIDLANDER.

Mason College, Birmingham, February 29.

The Orientation of Ancient Monuments.

The deeply interesting results obtained by Mr. Norman Lockyer with regard to the orientation of Egyptian temples, and by Mr. F. C. Penrose with regard to the Greek, tempt me to call attention to an extract from the *Century Magazine*, May 1883, from an article by Frank Cushing, describing a visit to the Zuñis, a typical tribe of the Pueblo Indians of New Mexico, in 1879:—

"Each morning just at dawn, the Sun priest, followed by the master priest of the Bow, went along the eastern trail to the ruined city of Ma-tsa-ki by the river side, where, awaited at a distance by his companion, he slowly approached a square open tower, and seated himself just inside upon a rude ancient stone chair, and before a pillar sculptured with the face of the sun—the sacred hand—the morning star and the new moon. There he awaited, with prayer and sacred song, the rising of the sun. Not many such pilgrimages are made ere the 'suns look at each other,' and the shadows of the solar monolith, the monument of Thunder Mountain, and the pillar of the Gardens of Zuñi lie along the same trail; then the priest blesses, thanks, and exhorts his father, while the warrior guardian responds as he cuts the last notch in his pine-wood calendar, and both hasten back to call from the house-tops the glad tidings of the return of spring. Nor may the Sun priest err in his watch of Time's flight; for many are the houses in Zuñi with scores on their walls or ancient plates embedded therein, while opposite a convenient window or small port-hole lets in the light of the rising sun, which shines but two mornings of the 365 on the same place. Wonderfully reliable and ingenious are these rude systems of orientation, by which the religion, the labours, and even the pastimes of the Zuñis are regulated."

In like manner, we read in Prescott that at Quito the festival of the Sun-god was held when "he sat upon the pillar," i.e. a pillar cast no shadow.

Might not this Zuñi ceremonial be a description of one enacted at some primitive astronomical temple such as Stonehenge? and do we not gain the best insight into the minds of those who in the Archaic period first orientated—the Babylonian and Assyrian ziggurats, the pyramids and temples of Egypt, the temples of Greece, and our own Stonehenge—by seeing how a people in a similar stage of intellectual and scientific development are acting to-day?

FRED. F. GRENSTED.

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The Nickel Heat Engine.

MR. KARAMATE, in a letter which appears in your issue of March 3 (p. 416), alludes to a new form of heat engine described by me in your issue of January 28 (p. 294). He states that my device is similar to one by Prof. Stefan. I wish to point out that the two heat engines are quite different in design. The engine of Prof. Stefan has a step by step action; that described by me is under certain conditions absolutely continuous in its action. The contrast is shown by Mr. Karamate's description of Prof. Stefan's engine; he writes:—"Nickel plates were fixed on a wheel, like that of a water-mill, and a magnet was placed before it. By heating a nickel plate before the magnet, it was repulsed by the magnet, and a succeeding plate was attracted, so that the wheel commenced to rotate." From this it seems clear that the action of the machine must be step by step, since the different pieces of nickel must come successively under the influence of the magnet and the flame. In my disk form of engine, the action, when the disk has a *certain thickness*, is continuous. Mr. Croft has recently shown that when the disk is not so thick as mine was the disk starts in one direction, then stops, and sets off in the opposite direction. It will also be noticed that the distribution of the magnetic field due to two poles is entirely different from that in the machine of Prof. Stefan. Mr. Karamate writes: "By heating a nickel plate before the magnet, it was repulsed by the magnet." I hardly see how this *repulsion* takes place. Faraday, writing about the behaviour of nickel, states ("Experimental Researches," vol. iii., 2346): "Upon being heated the nickel soon became indifferent to ordinary magnets, but, however high the temperature, still it pointed to and was attracted by the electro-magnet." Surely the action of the engine is due to one piece of nickel becoming partly non-magnetic owing to a rise of temperature, thus upsetting equilibrium, and allowing the next piece of nickel to approach the magnet and consequently the flame.

I may add that E. Berliner in 1885, and Edison in 1887, patented magnetic heat machines on the step by step principle.

FREDERICK J. SMITH.

Trinity College, Oxford, March 4.

The Limpet's Power of Adhesion.

I WOULD like to call the attention of your readers to the results of some experiments, which, I think, are original, referring to the power of adhesion of the common limpet (*Patella vulgata*).

The experiments were carried out as follows, with the assistance of my friend J. Sinel, of the Biological Laboratory here. The shell of the limpet *in situ* was perforated, so as to allow of the attachment of a delicate spring balance, by means of which a gradually increasing strain could be put upon the animal, in a direction normal to the foot. The pull was increased until the animal became detached, and the final weight and the greatest and least diameters of both foot and shell noted.

The following figures are compiled from a series of twenty consecutive experiments, and are typical of other similar series. The individuals operated on were not chosen in any way.

Averages of Twenty Consecutive Experiments.

| | | |
|--|------|---------|
| Area of shell, in square inches | 1.07 | |
| Pressure per square inch of shell | 22.5 | pounds. |
| Area of foot, in square inches | .45 | |
| Pressure per square inch of foot... .. | 54.3 | pounds. |
| Gross weight | 23.9 | " |
| Maximum pressure per square inch of shell area | 31.3 | " |
| Minimum " " " " " " " " | 13.9 | " |
| Maximum " " " " " " " " | 71.1 | " |
| Minimum " " " " " " " " | 37.1 | " |
| Maximum gross weight | 32 | " |
| Minimum " " " " " " " " | 12 | " |