of river, which is about 2 feet 9 inches above summer low-water level.

Yours truly,
WILLIAM BOWEN

The pier master (W. Mants) at Clevedon, near Weston-super-Mare, reports that he timed the rise of the tide there on March 10 from two hours flood, and found that it flowed thirty feet perpendicular in two hours and forty-five minutes. On March 24 the tide rose thirty-eight feet at the Clevedon Pier Head.

J. Y.

Ice Pearls

A PHENOMENON of singular beauty presented itself on the morning of March 24. A patch of meadow land, several acres in extent, had been inundated so far as to leave, pretty regularly distributed throughout, stalks of last year's grass projecting several inches above the surface of the pond. During the preceding night the temperature had been below freezing-point, but the wind which rippled its surface prevented the pool from freezing, while it alternately raised and depressed the stalks of grass. The water thus collected by the bending and rising grass-heads formed into large shining beads of ice which lay at the point of junction of the stalk and the pool. The effect was as if each projecting stalk had unfolded a white flower floating on the water, and when a gleam of sunshine smote the surface of the pool, the effect was resplendent. J. SHAW

Tynron, Dumfriesshire

Unscientific Art

MR. COPPOCK'S explanation (NATURE, vol. xix. p. 484) has occurred also to me; but may I be allowed to remind him that in consequence of the internal construction of the marine barometer (the pipette and the contraction in the tube), when it is sloped the mercury rises and falls very slowly. As it naturally rises and falls at a decreasing rate, if the barometer be sloped for a few seconds it takes a comparatively long time for the mercury to resume its original position. I have just sloped one of Adie's marine barometers at 30° from the vertical, and I find it takes more than ten minutes to recover itself. I do not know what may be the actual practice on board ship, but I cannot but think that a plan which renders a barometer useless for ten minutes to another or the same observer must be an unusual one. JOHN W. BUCK

New Kingswood, Bath, March 28

SCIENCE AND WAR—SIGNALLING BY SUNSHINE

THE use of the heliostat in the field adds one more to the many applications of science made by our soldiers and sailors. Signals by sunshine may be no novelty, but the present Afghan campaign and the Zulu war will henceforth be cited as the first in which the heliostat was employed as an implement of warfare. There can be little question as to its value to the soldier, for it affords at once a ready and far-reaching mode of signalling; but sunshine is an obvious *sine quâ non* to its use. In this country, where the Astronomer-Royal tells us the number of hours of sunshine in the week sometimes does not go beyond the units, the heliostat would furnish but an irregular means of telegraphing, and interruptions in the service would be both frequent and prolonged. But in India, on the other hand, at special seasons, at any rate, sunshine is the rule rather than the exception, and consequently the heliostat furnishes an excellent means of communication which our scientific soldiers have done well to make use of.

Heliostat stations are established at this moment throughout the Khyber Pass, and General Sir Sam. Browne, at Jellalabad, has his orders passed up to him by flashes of light from Peshawur and Ali Musjid. Lord Chelmsford has of late also been furnished with heliostats, in order to provide him with better means of commuication along the Tugela. The plan of working is very simple. The mirror of the heliostat is placed so as to reflect the sun's image to a distant station, and when the instrument has once been set the clockwork arrangement, it need not be said, suffices to maintain the mirror in its proper position. In this way the distant station in question always sees the dazzling ray reflected from the mirror, except when the latter is purposely obscured. The appearance and disappearance of the bright spot or flash constitute the signals. There is no need for any superintendence when once the apparatus has been put in working order, and a trained signalman suffices for the duty. The ordinary Morse alphabet supplies an intelligible code, and no one out of the line of signals can read or understand the message. As a substitute for the dot and dash, which go to make up the ordinary written Morse code, the light is shown for short and long intervals; thus the light shown for a short period followed by a long period signifies A, while B is represented by a long period followed by three short ones; in the case of C, long, short, long, short signals are made in turn, and to form E, the letter most frequently used, the light is permitted to shine for one single short period only.

The intensity of these sunshine signals can scarcely be imagined by any one who has not seen the heliostat in working order, and the distance to which they might be made to travel, could suitable stations be provided, is practically unlimited. But everybody has noticed at one time or another, just before sunset, the light striking vividly against the windows of a house. In this case the burning spot may be seen for miles away, and forms the most striking object in the whole landscape. The heliostat signal is obviously brighter still than this, and the appearance and non-appearance of the light is to be appreciated at ten or twenty miles distant without the aid of telescope or binocular.

Signalling by the aid of a mirror is among the earliest experiments of telegraphy, nor, if we are to believe travellers, is the use of a reflecting surface in this way new in warfare; it is only the heliostat, indeed, which we can claim to have been the first to employ in the field. Several instances are on record of polished metal surfaces being used in this manner by savage nations, and it is but two years ago that the United States forces captured a tribe of Indians to whom the use of the mirror was not unknown. These were the Nez Percés Indians, and, according to latest accounts, they were still confined by the American Government in a camp near Fort Leavensworth, where, however, they were left pretty well to their own devices. According to the *New York Daily Graphic* their chief carried with him a looking-glass, "used to direct military manœuvres in battle, by means of reflected rays of light. Their various significations, however, have never yet been found out by the white man," we are told. These are not likely to have been very complicated. The difficulty, in fact, is not so much in reading light-signals of this kind as to reflect the rays in precisely that direction in which the party for whom they are intended happens to be located. How the chief of the Nez Percés managed to do this with his hand-mirror is rather what "the white man" would like to understand.

One other incident in the history of light-signals deserves to be mentioned. When Admiral Sheriff was stationed at Gibraltar in 1835, he made a series of experiments with a view to employing light as a means of telegraphy. His signals were made by an ordinary toilet looking-glass from his bedroom window, that looked out upon the Mediterranean, and by the aid of this simple apparatus he was enabled to communicate with a friend at Tangiers. His light-signals travelled from "the Rock" right across to the African mainland, a distance of something like twenty miles, and were read and answered without difficulty by his colleague on the opposite shore.

Besides the heliostat, our troops in the field are provided with flags and lamps for signalling by day and night. The flags are made four feet square, so as to be