

Force and Energy

YOUR correspondent, Mr. R. H. Smith (NATURE, vol. xix. p. 194), speaks of "the fine old crusty Newtonian maxim . . . 'force is any CAUSE which,' &c." Now Newton's words are these: "Definitio IV.—Vis impressa est ACTIO IN CORPUS EXERCITA, ad mutandum ejus statum vel quiescendi vel movendi uniformiter in directum." It will be observed that Newton avoids the use of the obnoxious word CAUSE. I suppose that some translator, or commentator on Newton, adopted the word "cause" (in the sense, probably, not of an efficient cause in itself, but, by a common figure of speech, of the action of some cause), and that other writers transcribed the expression.

Prof. Tait, who is specially referred to by your correspondent, seems to have overlooked the above definition when he wrote ("Recent Advances," ed. i. p. 16): "the definition of force in physical science is implicitly contained in Newton's 'First Law of Motion,' and may thus be given: *Force is any cause*," &c. Newton, in that law, speaks of "vires impressæ," but forbears there to define, or explain, "vis." Clearly he refers back to Def. IV., where, as I have shown, he defines "vis impressa" by "actio," not by "causa."

In justice to Prof. Tait, however, it should be pointed out that in the passage referred to he proceeds at once to discuss the difficulty introduced by the word "cause." He has, in fact, anticipated your correspondent in the idea of his definition of force. Prof. Tait writes thus: "In every case in which force is said to act, what is really observed . . . is either a transference or a tendency to transference of what is called energy from one portion of matter to another. Whenever such a transference takes place there is relative motion of the portions of matter concerned, and the so-called force in any direction is merely the rate of transference of energy per unit of length for displacement in that direction." J. G. H.

Electrical Phenomena

MR. GREEN, in his letter to NATURE, vol. xix. p. 220, omits to state the route by which he ascended Monte Rosa "not long since." This is a detail of interest, because the rocks of that range are decidedly magnetic, and much hidden on the north side by ice.

In 1875, much out of sorts, I was training by short climbs, and at the Kiffleberg, well known for its effect upon the magnet, strolling up the Gorner Grat in company with three other members of the Alpine Club, and several more, the sky quickly clouded over, it thundered, and the axes of the Alpine men fizzed in most orthodox fashion, especially when held up, and the long sticks of the non-climbing men also crackled. A transitory but vivid lightning storm followed.

Several days later, during an attempt to ascend the Stockhorn, in company with a young Englishman, from the north side, by the Triftje glacier, the same fizzing, concurrently with snow, thunder, and lightning, took place, and half up the last glacier a violent storm came upon us, and throwing caution to the winds, we both skeltered down the snow and ice slopes with scant respect for crevasses seen and hidden. But for the mountaineer's axiom, "never part with your axe," we were much inclined to throw ours on one side. Soon we got below this critically charged stratum of air and earth, and the fizzing ceased. I shall never forget that terrible half-hour, only to be imagined by mountaineers or seafarers. Forbes, in his splendid work on glaciers, relates a similar incident somewhere in this same range.

Positive and negative changes of earth and air, conductivity of these and of axes, and involuntary experimenters suggest themselves. In our latter case all were more than damp!

I have not Forbes' book here, and can therefore quote no details. Thunderstorms are characteristic. In 1849 (I think it was) I made a new pass, called the Neue Weiss Thor. Overhead it was fine. A mile below was a thunderstorm, and during our descent on the Italian side, we came into it, and were refreshed first by snow, then by rain, till we reached Macugnaga.

MARSHALL HALL

Vernex-Montreux, Canton Vaud, Switzerland, January 27

Ear Affection

SEVERAL years ago, during an attack of whooping-cough, I found that one of my ears was so affected as to cause sounds heard by that ear to seem flatter than their true pitch as heard

by the other ear. The difference was about a semitone, as I ascertained by holding a tuning-fork to each ear alternately; and when I whistled I heard two notes in discord. The affection lasted about ten days.

Will one of your readers kindly render me an explanation.
Adelaide, November, 1878 P.

RELATION OF METEORITES TO COMETS*

I HOLD in my hand a stone that weighs about two and a half pounds. Over a part of its surface is a thin black crust. A part of its corners are cracked off, showing a gray interior, and on looking closer you see small points of iron all through it. It is heavy—about one half heavier than granite, or marble, or sandstone. Altogether it is a very curious stone, totally unlike any of our rocks.

That stone was once a part of a comet.

Do you want my reasons for saying it? Or, does any one doubt it? I propose to-night to give those reasons; to set in order, as clearly and simply as I can, the facts and lines of thought that lead me to say as I did—that *stone was once a part of a comet.*

It came to us from Iowa. Three years ago, on February 12, about ten o'clock in the evening, the light of a bright meteor was seen by nearly everybody then in the open air in the south-east part of that state. I will quote from a vivid description of the meteor given by Mr. Irish, a civil engineer of Iowa City, who has collected and published many facts about it: "The observers," he says, "who stood near to the line of the meteor's flight, were quite overcome with fear, as it seemed to come down upon them with a rapid increase of size and brilliancy, many of them wishing for a place of safety, but not having the time to seek one. In this fright the animals took a part, horses shying, rearing, and plunging to get away, and dogs retreating and barking with signs of fear. The meteor gave out several marked flashes in its course, one more noticeable than the rest. . . . Thin clouds of smoke and vapour followed in the track of the meteor. . . . From one and a half to two minutes after the dazzling, terrifying, and swiftly moving mass of light had extinguished itself in five sharp flashes, five quickly recurring reports were heard. The volume of sound was so great that the reverberations seemed to shake the earth to its foundations; buildings quaked and rattled, and the furniture that they contained jarred about as if shaken by an earthquake; in fact, many believed that an earthquake was in progress. Quickly succeeding, and blended with the explosions, came hollow bellowsings and rattling sounds, mingled with clang, and clash, and roar, that rolled away southward, as if a tornado of fearful power was retreating upon the meteor's path."

From accounts collected from eye-witnesses by Prof. Leonard and Mr. Irish, I conclude that the meteor when first seen was not less than sixty miles high over Northern Missouri; that it descended at an angle of about 25° with the horizon, in a right line, and disappeared at a height of five or ten miles. Those in the east, as at Kiokuk, saw it low in the west. From St. Louis it was seen in the north-west. In the western part of Iowa it was seen to pass north across the eastern sky. To persons in the north it passed straight down on the southern sky, while to those under the path named it passed nearly overhead, rising in the south and south-west and descending in the north north-east. The path thus determined is at least 120 miles long, and was passed over in a few seconds, probably not over ten. The country near the explosion was prairie or alluvial, where stones on the surface are rarities, and about 800 lbs. of stones like this one, nearly 200 in number, have been picked up in a region seven miles by four, a little east of the end of the

* A lecture delivered in the Mechanics' Course at the Sheffield Scientific School of Yale College, U.S., by Prof. H. A. Newton.