

without any condensation, and the other phenomenon requiring a greater density in matter than exists in free space, may, perhaps, receive other explanations that do less violence to our ideas. Ether, in which the complex molecules of matter are entangled, certainly might act as if it were more dense without really being so.

What the experiment of Michelson and Morley seems to show is that the ether is swept along by the water, but lags behind. The question of density appears to me still to be an open one. Maxwell's experiment with a prism which was, as was then supposed, moving through ether at a speed of 18.6 miles per second, seems to have a very different relation to Fresnel's theory if the ether at the earth's surface is moving with it.

It does not seem hopeless to repeat the experiment of Michelson and Morley on a railway coach, with water or carbon bisulphide at rest in the tube, if the road-bed and the car selected are of the best construction, and the apparatus is elastically supported.

It would be necessary, probably, to rigidly connect the observer's seat and the water tube, and to support them, with the observer, by helical steel springs surrounded by rubber tubes filled with glycerine to dampen the vibrations.

A speed of forty miles per hour will more than compensate for the suppression of one water column, which will be replaced by air. This is precisely the form of experiment upon which Eisenlohr's analysis is based. In this form the conditions of the experiment are capable of great variation. The car becomes really the moving body, and the transparent region within through which the light passes, may be shielded by any kind of opaque matter. Whatever the results may be, they can hardly fail to add greatly to our knowledge of the effect of moving masses upon the luminiferous ether.

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.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Jugglery.

IN *Science* for Aug. 14 there was an inquiry, quoted from *Illustrated News of the World*, as to the source of a certain statement regarding the apparently marvellous feats of Indian jugglers. In this statement it had been suggested that the spectators had been hypnotized by the performer, and hence imagined they saw something which the "snap-shot" of a kodak proved did not exist at all. I remember reading this very circumstantial account in an evening paper, and cut it out to send to India. After some search I have found the original reference. The story, as a quotation from the *Chicago Tribune*, was published in the *Evening Star* of Washington, D.C., on Aug. 30, 1890. Its author, Frederick S. Ellmore, purported to be a graduate of Yale College, and to have travelled extensively in India with an artist friend, a Mr. Lessing. It has since transpired that no person by this name is a graduate of Yale.

To my mind the story shows a good many signs of being on the Mulhatton style, and could easily have been written by some one who had never been in India. It is very plain that no juggler could by any possibility hypnotize a mixed audience all the time changing. Those who have seen the original growth of the mango-tree under the manipulations of the performer, who was stark naked except for a *lungooti* (breech cloth), will be inclined to smile at Hermann's explanation given in *Science*. My father has spent twenty years in India, and has seen this performance repeatedly. He has noted one singular coincidence, in that the tree is never made to grow except in the season when the leaves and fruit of the mango-tree are in proper order for the exhibition.

H. A. HAZEN.

Washington, D.C., Aug. 18.

The Rain-Makers.

EVERY reader of *Science* has seen the recent telegram from Midland, Texas, Aug. 11, "Preliminary explosions made yesterday; raining to-day." It may be well, with the apparent brilliant success of this remarkable undertaking before us, to examine this question at length.

Ever since the time of Plutarch the idea has been prevalent that great battles are invariably followed by rain. In the earliest times, before the introduction of gunpowder, it was thought that exhalations from the dead bodies might assist in precipitating the moisture, but in more recent times there has been a well-nigh universal belief among soldiers that heavy cannonading or firing will produce rainfall. Whence comes this common thought were there not a fact to originate and back it up? We may as well ask, whence comes the well-nigh universal belief that the moon has a marked influence upon the weather? Now it is well known that in the latter case, most careful researches extending over a century have shown either no effect at all, or one that was either contradictory in different periods, or almost inappreciable.

Now since the moon's influence must be almost infinitesimal, as every one can readily see, it would be difficult, perhaps, to determine its exact relation to weather changes which are so complex, but it would seem far otherwise as to the determination of the exact effect of explosions upon the atmosphere. A careful study of this question has been made by Mr. Edward Powers, who has found that 158 of the smaller and larger battles of the Rebellion were followed by rain, usually twenty-four hours afterward. It might be asked, is it possible that this list comprises all the cases? While some of the battles may have been omitted, yet it seems highly probable that a diligent search must have revealed most if not all there were. It is a most remarkable fact that no mention whatever is made of the battles that were not followed by rain, and yet in an inquiry of this kind it is very essential to examine both sides of the question. During the war of the Rebellion there were over 2,200 battles, on an average probably as severe as the average of the 158 above mentioned; that is to say, about seven per cent of the battles were followed by rain. Is it at all incredible that seven per cent of these battles were followed by natural rain? In the case of the battle of Bull Run, which Mr. Powers especially picks out as a bright and shining example of his theory that explosions produce rain, it has been ascertained that there was a heavy rain in South Carolina on the first day of the battle. This rain had been previously noted farther south, and this was the rain felt at Bull Run. It would be very interesting to look up the question of how many of these 158 apparent successes were due to natural causes, but unquestionably almost all, if not all, may be ascribed to that cause. It is interesting to note that it is thought this influence may extend twenty-four hours after the explosions cease. This inference, however, is hardly tenable, for the reason that the current in which these explosions take place is borne along at the rate of 20, and, in higher strata, at 30, 40, 50, and more, miles per hour, so that the specific influence from them will be carried at least 500 miles away in twenty-four hours. If we wished to determine the effect, we would need to go to that distance from the spot where the explosions were made, and the rain that came in twenty-four hours at that spot could not by any possibility be due to the explosions.

There is only one other point to be noted here. It has been stated that while the Central Pacific Railroad was being built across the Sierra Nevada Mountains, it was necessary to explode hundreds of kegs of gunpowder every day, and this tremendous fusillade was accompanied by torrents of rain, which had never been noted before in that region, and have not been noted since. If this is a fact, it was a most remarkable phenomenon, and it would seem as though it might be established by indubitable evidence. It is a little singular that no dates or definite statements which could be verified have been given. Present rainfall reports show an abundance of rain except in two or three of the hottest months, and it seems entirely probable that persons who had been accustomed to the remarkable and long continued dryness of the plains were struck by what appeared like most abundant moisture in the mountains just at a time when there was none on the plain.