

The source of heat must therefore have been in the nest itself. In bees-hives the temperature rises sometimes as high as 38° C. (*teste* Newport, as cited in Girdwoyn, "Anat. et Physiol. de l'Abeille," p. 23). We may be allowed to suppose that something similar happens occasionally also in wasps' nests. Such a heat might be caused by an alteration beginning in the wax, hydrocarbons being formed, which, on being absorbed by the paper-like, porous substance of the cell-walls, must get still more heated; so that a comparatively-small access of oxygen would be sufficient to set the whole nest on fire.

I have been assured that the spontaneous combustion of wasps' nests is a well-known fact in the interior of Venezuela, and as I do not recollect having found it mentioned in books, it appeared to me worth while to inquire whether something similar has been observed in other parts of the world, and if so, whether my explanation will hold good in all cases.

Caracas, July 15

A. ERNST

Observations on a "Dust-Whirl"

WHILE making magnetic determinations at Kirksville, Mo., several "dust-whirls," or small whirlwinds, were observed, which, although not destructive in their effects, were unusually violent. The dust was carried by strong surface-winds, which rushed inward to the centre of the whirl, rising in a vast column 200 feet high.

One of these whirls crossed a pond of water, moving very slowly, and in a zigzag path. The water immediately became agitated, a depression was formed, which extended to the bottom of the pond (which was about five feet in depth). The top of the cup-shaped depression was about six feet in diameter, the bottom about four or five feet. There was no water drawn up from the pond, so far as could be observed, although a little of the rapidly whirling water at the edge of the depression was thrown outwards upon the surface of the pond.

Kirksville is situated in the northern part of the State of Missouri, and on the summit of the divide between the Mississippi and Missouri Rivers. During the present summer it has had the least rain in the State, and is yet parched by excessive drought.

FRANCIS E. NIPHER

August 5

The Telephone

ON to the centre of a telephone vibrating disc, and perpendicular to its plane, a light needle $\frac{1}{2}$ inch long was soldered, the disc held in a holder, mouth-piece, &c., the same as a telephone, and so arranged that the needle would vibrate in a small cylindrical ebonite cup, $\frac{1}{4}$ inch in diameter and $\frac{1}{2}$ inch long, the top of the ebonite cup just free from touching the vibrating disc; a copper wire was let into the centre of the bottom of the cylinder, flush with the bottom; the cylinder was filled full with the finest dust of iron filings well shaken down.¹ A battery circuit was then completed with connecting wires, through the vibrating disc, iron filings, the copper wire let into the bottom of the cylinder, and through a pair of telephones in a distant room; after finding out by experiment the distance off the speaker ought to stand when speaking to this transmitter, and the proper degree of loudness he ought to give to his words, the voice came as clearly (and louder) as if a telephone had been used for a transmitter. If the speaker came too close or spoke too loudly the words were indistinct, and mixed up with a fizzing sound. In the experiment which was most successful the speaker was about 18 inches from the transmitter and spoke in an ordinary tone of voice. But this distance I found to vary with the thickness of the vibrating disc; a thin disc transmitted clearly only when the speaker was 3 feet off.

The ebonite cylinder was also filled with water (distilled) as an experiment, instead of iron filings. I thought that possibly the resistance of the circuit would be altered through the water, as the needle vibrated to and from the copper wire opposite to it; but no sounds were found to be transmitted. If the resistance of the circuit was altered when the disc vibrated in this experiment, it might tend to support the idea that alteration in the resistance of a circuit was not the only thing required to cause sound to be transmitted, but that "false contact" was necessary, such as would take place when the needle vibrated in the iron filings.

G. R. R. SAVAGE

Roorkee, July 8

¹ The disc well tapped with the hand so as to loosen the filings round the needle.

The Electro-Magnet a Receiving Telephone

THE result I have arrived at whilst experimenting in this direction seems so interesting, and at the same time, I believe, novel, viz., that a good receiving telephone can be made from electro-magnets alone without any vibrating diaphragm, that I hope by prior publication, to prevent the possibility of a string of those patents which nowadays so greatly hamper true scientific invention.

In my earlier experiments I made an electro-magnet out of a piece of $\frac{3}{4}$ -inch iron gas pipe $\frac{3}{4}$ inch long, filed flat on one side, and split sufficiently only to allow the wire (No. 24) to be wound on, which was done till it was full inside. The poles were therefore together about $\frac{3}{4}$ inch square. This was fixed inside a small cigar box, under a ferrotyp plate, covering a rectangular hole cut in the lid $2\frac{1}{2}$ inch by $1\frac{1}{2}$ inch. With a Hughes' carbon-pencil-microphone tilted to an angle of 45° as a transmitter, a small musical box as a source of sound, in a distant part of the house, and one of Leclanché's cells in circuit, this box gave out tunes plainly heard by all sitting in the room.

Whilst experimenting with another similar magnet, I stood it loose, poles downwards, but still connected with the line wires on a flat tin gunpowder canister with the ends cut off, but still retaining the paper label on which the magnet lay; the tune of the musical box was given out loudly and resonant, but buzzing and jangling; also words spoken to the transmitter were heard, but confused together.

Now this was a very interesting result, which led to the next discovery; for, having a small ordinary electro-magnet with its armature in front (as used in electric bells), fixed to a piece of board, I was about to unship it to try experiments in various tin cans, &c., when it occurred to me to connect it as it was, to the line wires, placing only a slip of paper between the poles and armature to prevent actual contact. To my astonishment, on putting the ear close to the board at any part, the music of the box was heard clearly, every note from highest to lowest being distinctly given. Now here seemed to be a telephone without a vibrating diaphragm; but, to make more sure, the armature was unscrewed from its support and attached to the magnet only by an india-rubber band, with the slip of paper between it and the poles, so that it touched no other part of the apparatus. On listening to the supporting board, the sounds were heard as distinctly as before.

But even here forensic ingenuity might claim and attempt to prove that this ordinary armature was a vibrating diaphragm; therefore, an armature being itself nothing but an induced magnet, it was replaced by another electro-magnet, thus:—

Two ordinary electro-magnets (unscrewed from a couple of large electric bells) were fastened, by means of two little wooden saddles and a screw each, to a small piece of deal board about $4\frac{1}{2}$ inches square and $\frac{5}{8}$ inch thick, in such a way that the poles were all but touching. Their wires were then joined so that poles of opposite denominations faced each other, i.e., north opposite south and vice versa. This placed on an empty cigar-box and four Leclanché cells in circuit, gave out the tune of the musical box clearly and loudly in the room. When both poles were made to touch, the sound ceased; but with a thin piece of paper or stout tin-foil between them, without any intervening air space, the sound was heard. On gradually separating the magnets, the sounds grew fainter and fainter, till they became inaudible.

By putting the base-board close to the ear, whistling and singing to the microphone were very clearly and loudly heard, also the voice of the person speaking could be recognised; but words were hardly sufficiently defined to distinguish all that was said, though now and then parts were intelligible.

One of the electro-magnets was afterwards replaced by a small permanent steel horse-shoe magnet fastened to the board in a similar manner, the result was the same, but, I imagined, slightly louder, probably from there being less resistance.

By varying the strength of battery, size, or mode of mounting magnets, or adjustment of the microphone, I have no doubt that perfect definition can be obtained. The loudness and volume of the sound are ample; but before making further experiments, for which I have at present little time, I hasten to communicate the fact that the electro-magnet, without any diaphragm whatever, can be made a reproducer of sounds transmitted by a Hughes' microphone, and thus a complete and practical telephone system produced without the possibility of infringing anybody's patent.

I must add that the same arrangement is also a feeble transmitter, using a good Bell's telephone as a receiver, which is a very strange fact. I abstain at present from all theory on the subject.

F. G. LLOYD