sounds, if they happen to be present. Especially when these loud sounds occur fifty or one hundred or more times per second, the effect is that of a continuous sound; and as the persistence of hearing is something like the tenth of a second, it follows, *a priori*, that such rates of vibration as from two hundred to a thousand per second might be present, yet too weak to be heard in the presence of such overpowering sounds that have an appreciable persistent effect. These loud magnetic clicks are heard only when there is a sudden break in the current in the receiver. If, then, some way can be devised for preventing these extraneous sounds in the receiver without interfering at all with the transmitter or its 'mode of operation,' one may experimentally determine whether the Reis transmitter does or does not act mechanically so as to vary the current in correspondence with speech or other sound-vibrations. I therefore conceived, that, if there was a short-shunt circuit between the terminals of the transmitter, some of the current would traverse the coil of the receiver the whole time, no matter whether the circuit through the transmitter was open or closed. The loud clicks would be suppressd without interfering in any way with the 'mode of operation' of the transmitter; and, if the latter really did follow the motions of the diaphragm, the variations in the current strength would correspond, and the speech would be heard. This I found to be truly the case: for with a transmitter thus provided with a shunt circuit of about two ohms, which could be switched in or out with a key, it was at once possible to hear a large part of what was spoken when the shunt was in; when it was out of circuit, the sounds were generally inarticulate.

This experiment is an *experimentum crucis*, and proves that the inefficiency of the Reis telephone is much more due to the extraneous sounds in the receiver than to the lack of appropriate motions of the platinum terminals of the transmitter. It proves that the transmitter does and must always have worked in the proper mechanical way, and that the current theory of its mode of operation is not correct. It proves, too, that when carbon is substituted for the platinum terminals, there is an improvement in efficiency, but not in its mode of operation.

A. E. DOLBEAR.

College Hill, Mass., Jan. 14.

Queries.

23. DROPS OF WATER. — Will some reader of *Science* explain the floating of drops of water upon the general surface? It is a very common phenomenon, not to be confused with the formation of bubbles, though often produced by the same sort of agitation; for example, the breaking of a wave. In still water they may be produced by an oblique blow with an oar or with the hand, but will disappear as soon as their original momentum has been lost. Recently on Lake Pontchartrain, with a brisk wind which kept them in motion, I observed some which exceeded an eighth of an inch in diameter, and lasted more than two minutes. The depression, like that of a floating needle, which surrounded each one, was also plainly visible. Their behavior was in striking contrast with that of the bubbles with which they were mingled, the drops moving much more rapidly with the wind, and also rolling under the influence of gravity towards the trough of each successive wave.

E. J. POND.

New Orleans, Jan. 9.

Answers.

21. GLOBULAR LIGHTNING. — The note on globular lightning in the issue of Dec. 30 recalls to mind a phenomenon of the kind I witnessed some years ago. While walking upon the Worcester and Norwich Railroad track about a mile south of Worcester Junction, I suddenly saw a ball of fire, or what looked like it, about the size of a large marble, running along on top of one of the rails just ahead of me. It was going at so slow a rate that I could have overtaken it in a few seconds, and my first impulse was to do so; but the sober second-thought warned me against making the attempt. I, however, watched it move until it came to the end of a rail separated from the adjacent one by something like half an inch, when it stopped, and in a second or two vanished, when there was a clap of thunder in a cloud overhead which I had not before noticed as being a thunder-cloud. The brightness of this small ball was not excessive, nothing to be compared with an electric arc. It was more like that of a red-hot bullet. It did not scintillate or make any noise, that I noticed. Now, while this was an accompaniment of a thunder-cloud, as are such manifestations generally, I think there is some reason for not calling the phenomenon itself an electrical one in the same sense as lightning is electrical. If electricity can gather itself up into a spherical form as if it was subject to some sort of cohesion, and if it can roll along on top of a good conductor instead of traversing the body of the conductor subject to Ohm's law, then there are some exceptions to this latter law. Other observers have seen still larger balls roll slowly upon the ground, or move with great deliberation in the air, apparently without exhibiting the property of attraction or repulsion. Some years ago an acquaintance in southern New Hampshire told me that such a fire-ball came down to the ground near his house, and rolled slowly about near where a hog was. The hog walked up to it as if to root it along, and touched it with its snout, when it exploded with a great noise, killing the hog instantly, blowing it to pieces. In this case, and in other similar ones, it appears that the luminosity is not caused by high temperature. Babinet reports a case that he investigated, where a globe of fire came into the room of a tailor who was eating his dinner. It was about the size of a child's head, and moved about upon the floor, approaching his legs as a kitten might have done; but he prudently drew his feet away, and watched it. It appeared bright, but the tailor said he felt no sensation of warmth. After remaining several seconds upon the floor, it rose vertically five or six feet in the air, and then moved towards a pipe-hole in the chimney, which was covered with paper, which it tore off, and went up the chimney. Near the top it exploded, and did considerable damage to the chimney and the roof of the house. Such a performance is entirely unlike electrical phenomena. It exhibits none of the characteristics of electricity, either in form, in motion, in heat, in attraction, and why should it be called an electrical phenomenon? It is true, in most of the cases reported the disruption of the globe resulted in electrical phenomena, sudden and destructive; but so would a charged secondary cell, that might have relatively a very large amount of potential electricity in it: that is, the stored chemism may be transformed into electricity at a very rapid rate, but we do not now consider that electricity is stored in the cell, because we can get a large amount of electrical energy out of it. The charged secondary cell is the result of electrical work; but, so long as the energy is stored in such a way as to manifest none of the properties of electricity, it is improper to speak of it as other than chemism. In like manner, if energy be stored in such a globular form as is called 'globular lightning,' which does not exhibit any of the properties of electrical energy, it seems to me that we are not justified in calling it an electrical phenomenon. We have in physics already too many *ex post facto* terms, such as 'heat' rays, 'light' rays, and 'actinic' rays; and it is a pity to call this 'globular lightning' if the only appropriate part of the name is 'globular.' If we don't know what specific form the energy exists in, we know that it is globular energy; and 'globular vim' would be better than 'globular lightning.'

A. E. DOLBEAR.

College Hill, Mass., Jan. 12.

22. WASP-STINGS. — In answer to Mr. Ames's query in *Science* for Jan. 13, I will say that I have picked up hundreds of lively wasps, holding my breath at the moment when the wasp was grasped, and have never been stung under such circumstances. I have frequently been stung by wasps when I have disturbed them unawares, which shows that there is nothing in my make-up which would prevent wasps from stinging me if they had the power and were so disposed. I have captured a dozen wasps, one after the other, until I had a handful, which I have held as long as I chose, without receiving a single sting. I cannot say that I would have been stung had I not held my breath at the moment of contact with the wasps, but can only testify that I was not stung in a single instance when I did hold my breath. As to the explanation of the phenomenon, I have none to give. I have tried the experiment on hornets, honey-bees, and bumblebees, and a single trial with each was sufficient to prove that the plan did not work with either of these species.

FAYETTE SAFFORD.

Willimantic, Conn., Jan. 16.