

# THE COUNTRY HOUSE.

EXPERIMENTS ON THE CONVEXITY OF WATER.

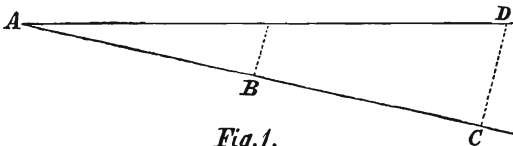
which it could not possibly do if the three signals were in a straight line.

Mr Hampden says also that Mr Wallace undertook to prove that the further signal was the lowest, or lower than the middle one; and he says that "Mr Wallace has utterly failed to show it, in consequence of the incontestably awkward fact that the more distant signal was higher still." Of course it was. But then the telescope was an inverting one! Fordingbridge, April 6.

THOMAS WESTLAKE.

SIR.—I must beg you to allow me to correct an error in my letter in your last number, which I discovered when it was too late, and in which I said that, if the signals had been equidistant, the line joining them would be straight. It would not be so.

The facts represented in my diagrams are as there stated; but they would only be seen so when viewed from the side, as in the diagrams. If seen from one end, say from A looking towards D (Fig. 1) (as was



the case in the experiment, the telescope line would appear to be projected to D, and the signals B and C would coincide. But, as the eye of the observer was at A, the three points A, B, and C coincide, or are in a straight line, as shown in the diagram.

If anyone does not believe this, let him strain a line perfectly tight, inclining downwards, and fasten pieces of white paper at intervals on the line, then with an opera glass repeat the experiment at the Bedford Canal; keeping the glass level, and arranging the incline so that the whole line is in the field of view. He will find that the centre of the opera glass will appear considerably above the end of the line, and all the pieces of paper will coincide.

If, however, they do not coincide (which will probably be the case if he is unable to strain the line perfectly tight), some of the points will fall below the line of sight (*i.e.*, the line joining his eye and the further end), which will show that the line curves downwards, or concavely—just the reverse of the case at the Bedford Bridge, which was convex; and if he then look at the line from the side, he will see that it curves downwards, and will have an ocular demonstration of the truth of his observations.


The whole question is so perfectly transparent in Mr Wallace's favour that it is difficult to find language sufficiently simple to express it; but it may be condensed into the following axioms, which are self-evident, and require no proof:

First, a straight line viewed from end to end must coincide with the line of sight.

Secondly, all points in that line must coincide.

Thirdly, a straight line may be either level as a tangent (at right angles to a plumb line), or it may incline upwards or downwards.

Fourthly, in any supposed straight line, if any points in it do not coincide with the line of sight that line is not straight, but deviates from it according to the divergence, either vertical or lateral, of the points from the line of sight.

Fifthly, such a line may be angular, thus , or curved.

In the experiments at Bedford Bridge the signals did not coincide with the line of sight—that joining the observer's eye with the farthest signal; therefore the line joining the signals with his eye was not straight. But, as the middle signal was above the line of sight (below in the inverting telescope), the line joining them either curved convexly or was angular. But water could not be angular: which would also have been shown if several more signals had been used.

Therefore the line joining the signals with the observer's eye was curved convexly, showing that the surface of the water of the canal was the same.

Mr Hampden, in his diagram explanatory of the observations, makes his three signals coincide with the line of sight; *i.e.*, the line joining the two ends passes through the middle signal. Surely, he will not deny that his eye was at the first signal in the experiment; how was it then that the line joining this and the further signal did not pass through the middle one, but that the middle one rose above that line (below in the inverting telescope), which must of necessity have been straight?

The notion that, if the hair line and the two signals are equidistant in the field of view of the telescope, the line joining them is straight, is a mere optical illusion, and is caused by the hair-line being slightly distant from the eye, which gives the appearance of the eye of the observer being under the line joining the signals; but it is not—it is on it. To show its fallacy it is only necessary to try to produce the same appearance on a line known to be straight, such as the strained cord named above, or signals set purposely and accurately in a straight incline. The equidistance of the hair-line and the middle and further signals will disappear at once.

If Mr Hampden wishes to arrive at the truth, let him try this, or let him repeat the experiment at the Bedford Bridge, and, when observing, bring the hair line No. 1 in his diagram in unison with the further signal No. 3. No. 2 will then rise above it (below in the inverting telescope),