III. DESCRIPTION of a MERCURIAL LEVEL, *invented by* *ALEXANDER KEITH, Esq; F.R. S. & A. S. EDIN.*.*

FIGURE 1. is a section of the instrument formed of mahogany or boxwood. AA are two oblong square cavities connected together by a narrow close channel, running from the bottom of the one to the other. BB are two grooves hollowed out of the wood, in order to contain the sights, &c. They are shut up by a lid, which turns upon a screw-nail at the centre C, as may be seen more distinctly from fig. 4.

FIG. 2. DD are the two sights, the one with a small hole, the other with a cross-hair. These sights are erected upon two pieces of ivory or hard wood, which are shaped nearly of the dimensions of the cavities AA, but so much smaller as to enter without touching or rubbing on the sides. Mercury is poured into the two holes AA till they are about half full; the two pieces of ivory which support the sights, are put into the cavities, and float on the surface of the mercury.

FIG. 3. is a perspective view of the instrument when the sights are floating upon the mercury; and fig. 4. is another view of it, when the sights are taken out and the lid is open.

As the two cavities communicate with each other, the surface of mercury in both are always upon the same line of level; and consequently, if the two sights are once accurately adjusted, they will ever after point out the true level, without requiring any after adjustment.

WHEN this instrument is to be used, it may be laid on any horizontal surface, and the sights will immediately become an exact

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exact level. It may also be fixed on a tripod as the spirit-level ; or it will answer equally well, if it is affixed to the top of a single stake, which is sharpened at the point so as to be pushed into the ground. If it is to be used as a pocket-instrument, it may be made of seven inches length, being about double the dimensions of the annexed draught. A common walking cane forms a very convenient support. It is affixed to the cane by means of a brass pin E, which passes through the hole G, and through the eye or hole of the walking stick ; and a brass nut F, screwing to the male-screw of the brass pin, keeps them firm together. The two grooves BB, contain the two sights and brass pin, when not in use. Two corks, covered with thin leather, fitted into the holes AA, confine the mercury, when the instrument is to be transported ; or, in case the mercury is found to escape, it may be poured into a small case, made of lignum vitæ, like a tooth-pick case ; and this may be stopped with a cork, and made to fit into one of the grooves.

THE advantages of this instrument over the spirit-level are :
1st, It requires no adjustment, consequently two observers, though otherwise not equally accurate, must make the same observation. *2^{dly}*, With this, the level of twenty different places may be taken during the time required to adjust the spirit-level for one observation. *3^{dly}*, The nicety of the spirit-level depends upon the small curve of the glass-tube, in the choice of which no rule can be laid down ; neither is any thing gained, in point of exactness, by lengthening the spirit-tube above three or four inches. But every instrument of this kind is of one standard ; and the further the two sights are removed from one another, the more any error is diminished. *4^{thly}*, This instrument can be made perfectly just, without taking any observation, or comparing it with another level. In order to do this, let the floats on which the sights rest, be of the same dimension and weight, and let the cross-hair and eye-hole be of one height, and, without farther adjustment, they will point out the true level.

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THE following is a proof of the exactness of this method. JOHN MILLER, the mathematical instrument-maker, has a line drawn upon the opposite side of the Parliament-square, fronting his shop, by which he has been in use to adjust his spirit-levels. We placed the mercurial level upon the spot known to be upon an exact level with the line. Both he and I looked through the sights ; but could not perceive the line. We suspected there was some fault in the sights ; but, on making them vibrate, we found that the hair had covered the line ; so soon as they settled, the line was again covered by the hair.

WHEN there is a strong wind, the sights vibrate too much. In order to remedy this, there is a case of tin'd plate or paste-board made to inclose the instrument when not in use. *Vid.* fig. 5. When used, the case covers only about one half of it, leaving room for the sights to float within the case. There are two oval holes at each end of the case through which the observations are made.

Fig. 1.

Fig. 2.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.