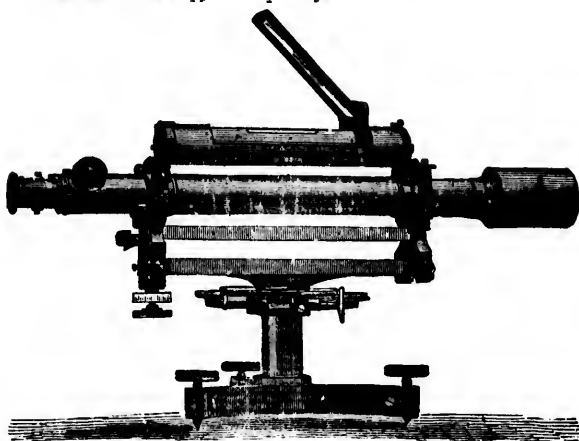


in less time, than adjust one bubble tube. This indirect method seems to me to have, for the purposes of ordinary levelling, no one point to commend it in preference to the direct method, and has the disadvantage that it does not guarantee correct adjustment, unless the pivots have, after careful examination, been ascertained to be equal; or the proper correction determined and applied. The wye is undoubtedly the most scientific instrument, and for precise work has some advantages,—such, for example, as the possibility of eliminating the error due to want of coincidence of the sliding tube with the line of sight. In a well constructed dumpy however this error must always be trifling. I have never been able to understand why the wye level should be used in ordinary levelling in preference to the dumpy. The wye form is more difficult of construction, more expensive, less rigid when constructed, and hence more liable to get out of repair. The most abominable instrument ever put in the hand of man is an old and shaky wye level. I submit that in the interest of good work, if not of economy, the construction of the wye form for ordinary levelling should be abandoned in favor of the more compact and rigid dumpy. The modification of the dumpy, such as Cushing's reversible level and other deviations from the type form, do not, for similar reasons, commend themselves to me. The adjustments for coincidence of the optical axes of the objective lens and the eye-piece with one another and with the axis of the tube, provided for in the wye but not in the dumpy, are really makers' adjustments, and except in the case in which the axis of the objective slide makes an angle with that of the tube are not essential to correct work. A very important point to be attended to in the construction of all levels, and in the examination of them from time to time by the Engineer, is that the object lens is not loose in its cell, and that the cell is not loose in the telescope tube. Both these defects are apt to occur through time. The tightening band at the back of the cell should screw into place in order to permit such a defect being rectified. An instrument having a loose objective is impossible of adjustment and fatal to good work.

The accompanying cut taken from Fauth's catalogue, represents an instrument of the form used in geodesic work. The pattern employed by the United States coast and Geodetic Survey differs slightly from this instrument, which is the one prescribed by the International Geodetic Commission, held in Berlin in 1864, and used in this country on the Lake and Mississippi River surveys.



The following description of the instrument is taken from Johnson's theory and practice of surveying:—

“The bubble is enclosed in a wooden case (metal case in the cut), and rests on top of the pivots or rings; it is carried in the hand when the instrument is transported. A mirror is provided which enables the observer to read the bubble without moving his eye from the eye-piece. There is a thumb-screw with a very fine thread under one wye, which is used for the final levelling of the telescope when pointed on the rod. There are three levelling-screws and a circular or box level for convenience in setting. The telescope