

It is best to keep a preliminary field-book for the above, keeping it in diagram form, showing direction of lines, intersections, and all small pegs put in to hold lines; mean offset to sides of roads, and enough offsets to find intersection pegs. When the above has been completed of a few lines, the blocks are carted out and put in.

The bearings are taken with a 5 in. or 6 in. micrometer instrument with an extra powerful telescope (my 5 in. micrometer has a telescope with a focal length of 12 in., and $1\frac{1}{2}$ in. object-glass). The amount of time devoted to this work must vary with the class of work. In rural standard surveys I generally take a round of eight readings at each block, and sometimes observe inner angle, starting at 360° and shift to 90° ; this gives four readings. I then observe the outer angle in the same manner, and if the sum of the two angles does not differ more than 2 or 3 seconds from the 360° I consider that sufficient for rural standard surveys. At important corners where check-shots are taken to trigs., &c., I often take the reading by means of eight readings, also included angle by means of eight readings and mean results.

One very important point in laying out standard traverses for towns is to get true right angles. In a town of 100 chains square, or thereabouts, if two roads cross at right angles near the centre, a good plan is to observe the right angles with an ordinary Vernier instrument reading to 20 in., and put in four pegs; obtain the distances to these pegs from centre-peg by rough measurement; now repeat the angles eight times and divide the result by 8, and the difference of each angle from 90° in seconds reduced to fractions of a link can be set off at each peg, and gives angles very close to the truth. Now observe the angles over again by different methods with a micrometer instrument. Care should be taken that the signals are perfectly flat and well shown up by screens behind them. No calico should be attached to the signals. In case these are the main streets of a town it is well to observe them morning and evening, or on two different days, or half one day and half another time, according to light, so as to get the angle within a second. Once the main lines are exactly determined the others will not give much trouble.

An important point is the standard blocks and covers. The covers often stick and are hard to remove; they should always be well greased before being put on. The trouble is, surveyors working with only one man cannot carry all the tools required. In my opinion a visible mark which does not attract attention, but which could be readily found, even if not quite so accurate, would be better than having men set up over the centre of the cover to save time of opening, when hard to open, taking it for granted that the centre of the cover represents the centre of the block. This I know has often been done. I think the following would be quite accurate enough for all practical purposes: The covers are generally made nearly 2 ft. square and have from 8 in. to 10 in. opening. Being of this size, when once rammed and set they take great force to shift them—ten times what a block or pipe does, and are practically immovable. The ironwork is supposed to be carefully made, the opening true to $\frac{1}{16}$ in. A skeleton lid is made having a small hole exactly in its centre, the size of a small plummet, string. When a cover is being put on, the skeleton lid is put on and the plummet string passed through the small hole and the cover shifted until the plumb-bob is exactly over the centre of the block, care being taken to see that it maintains this position while the cover is firmly rammed. When finished the skeleton cover is removed and the ordinary lid put on the opening. The ordinary lid has $\frac{1}{4}$ in. hole in it drilled $\frac{1}{2}$ in. in depth exactly in its centre. The hole in the cover would be exactly over the centre of the block, and its use would never cause an error of more than 0.01 link. It would be quick in use and cause no danger to traffic. An inspecting officer could test the blocks from time to time, by raising the lid with proper tools, inserting the skeleton cover and testing the block with plumb-bob, which would show if any movement had taken place. The above might fail in streets paved with wooden blocks, but a yard of tar macadam put round each cover, the wooden blocks having first been removed, might prevent those remaining shifting either cover or block.

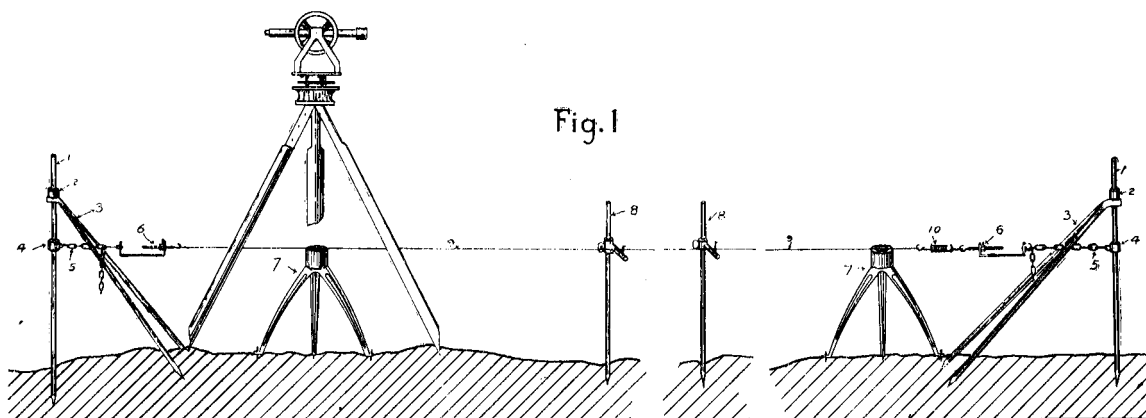


FIG. 1.—METHOD OF CHAINING: STANDARD SURVEY.

1. Steel chaining-rod.
2. Fixed collar.
3. Forked prop (see Fig. 8 for detail of head).
4. Sliding-collar to adjust measuring-band to height of table (7).
5. Brass chain to which adjusting-screw is hooked.
6. Adjusting-screw.
7. Chaining-table (see Fig. 7).
8. Steel supports with adjustable arms and spring clips. These supports are placed 50 links apart for $\frac{1}{4}$ in. band and 100 links apart for $\frac{1}{2}$ in. band.
9. Steel band, $\frac{1}{4}$ in. or $\frac{1}{2}$ in.
10. Spring balance.