

two adjusting screws over a brass plate with a fine straight line on it; at the 100-foot end they were both attached to cords passing around two bicycle wheels with a twelve-pound weight attached to each. (See Fig. 3). The two 100-foot ends of the tapes rested on another brass plate with two scales on its face divided into thousandths of a foot; after the two zero ends had been placed exactly over the line on the first plate the readings on the scales at the other end were taken. The two tapes were then reversed and corresponding readings again taken. This process was repeated several times for each tape and an average taken.

All these preliminary arrangements being completed, the actual measuring was commenced, the method of procedure being as follows:—

First.—Two men would take the spiders and place them as nearly as possible with the cross marks vertically over the spider points. (Fig. 1). At the same time two other men would be setting up the tension wheel frame at a short distance to the rear of the rear spider. This frame is illustrated in Fig. 2, and needs no special description, except that it had adjustable legs and wheel so that it could always

momenter was also hung on each block in such a position that its bulb was as close to the tape as possible.

Fourth.—The chainman, having seen that there were no twists in the tape, they would take up their positions at the spiders, and the "recorder," who kept all the field notes, would take his position midway between them, calling out "ready to read" as soon as everybody had taken their place. On this signal the two chainmen would call out in turn the height of the top of the spider above the spider point on the ground which they measured with folding rules. This gave the correct elevations of the tops of the spiders, hence the slope of the tape. The head chainman then calls out the readings at his end of the tape at the intersection of the scratch on the spider, and the recorder enters it in his book, the rear chainman reads his end of the tape at the same instant as the head chainman, but does not call out until the recorder has had time to enter the first reading. The recorder then calls "change," and the tape is allowed to move bodily a very small amount one way or the other, so that a different reading is obtained at both ends, which are again called out to the recorder. This process is repeated until the

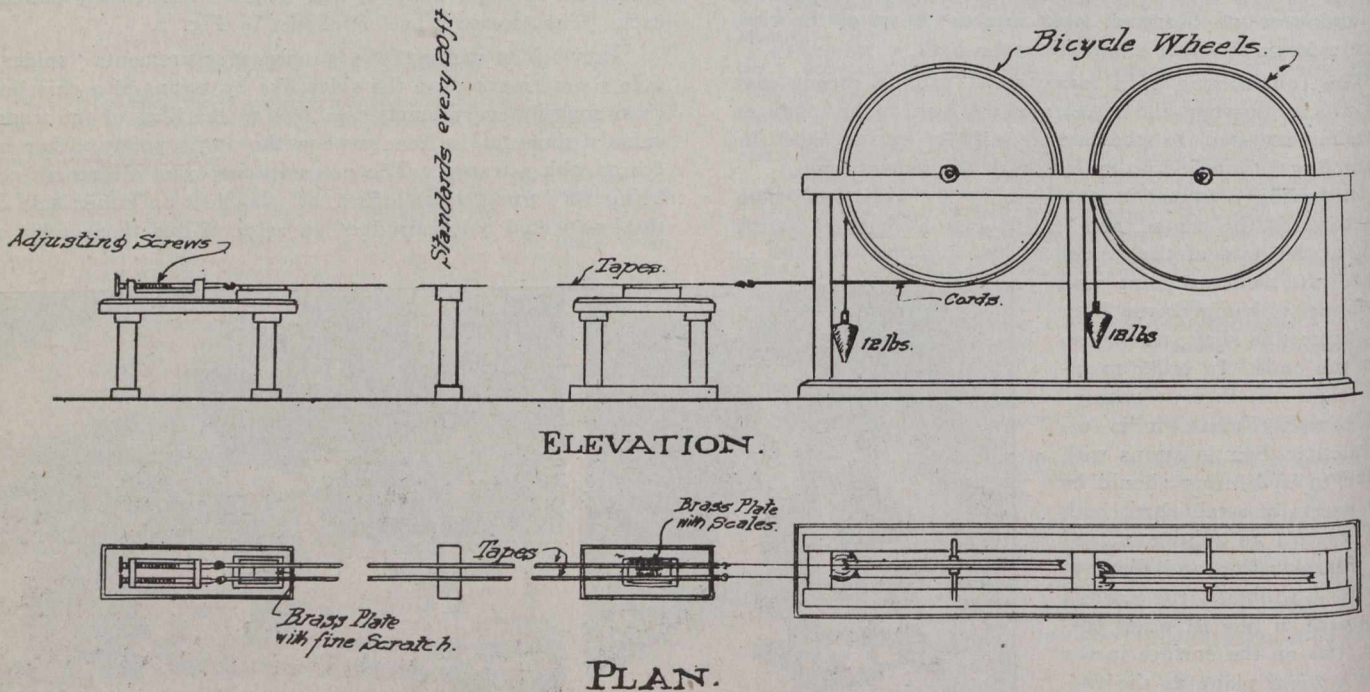


Fig. 3.—Sketch of Tape-Testing Apparatus.

be put at the right height, even on the roughest ground encountered. At the front spider a forestay was set up to hold the front end of the tape. This forestay was simply a fairly heavy cast iron plate with a vertical post, upon which was a sliding clamp to which was attached an adjustable cord for holding the tape. A heavy weight was placed on the back of the plate to resist the pull of the 12-lb. tension weight.

Second.—The rear chainman would call out "Ready for tension" and thereupon the first chainman would attach the front end of the tape to the forestay and the rear chainman applies the tension of the weight by shortening the adjusting cord.

Third.—The rear chainman now stoops down until his eye is on the level and in line with the tops of the two spiders, and lines in the four wooden standards for supporting the tape at twenty feet intervals, so that the hooks are all in the same straight line between the tops of the spiders, and then the tape is hooked up into the hooks. The standards were made of a wooden base with a 1-inch-square vertical post with a sliding block held by a spring, a cord with a hook for holding the tape was hung from the block. A ther-

recorder gets five or six readings which do not vary more than a thousandth or so. While this is being done another man is reading the four thermometers on the standards, the mean reading of which he gives to the recorder. The following is an example of the booking of one set of readings:—

Point.	Readings.	Difference.	Height of spiders.	Temp.
Line 14-15	99.478	99.151	Sp. 4 1.71	
	0.327			
Sp. 4 to 5	99.506	99.150		74.0°
	0.356			
	99.575	99.151		
	0.424			
	99.594	99.151	Sp. 5 1.69	
	0.443			

Fifth.—Having obtained a good series of readings, the recorder calls "unhook," and the tape is unhooked and the whole apparatus is moved forward to the next spider-point, the rear spider being left in its position to retain the measurement in case the one just measured to should be dis-