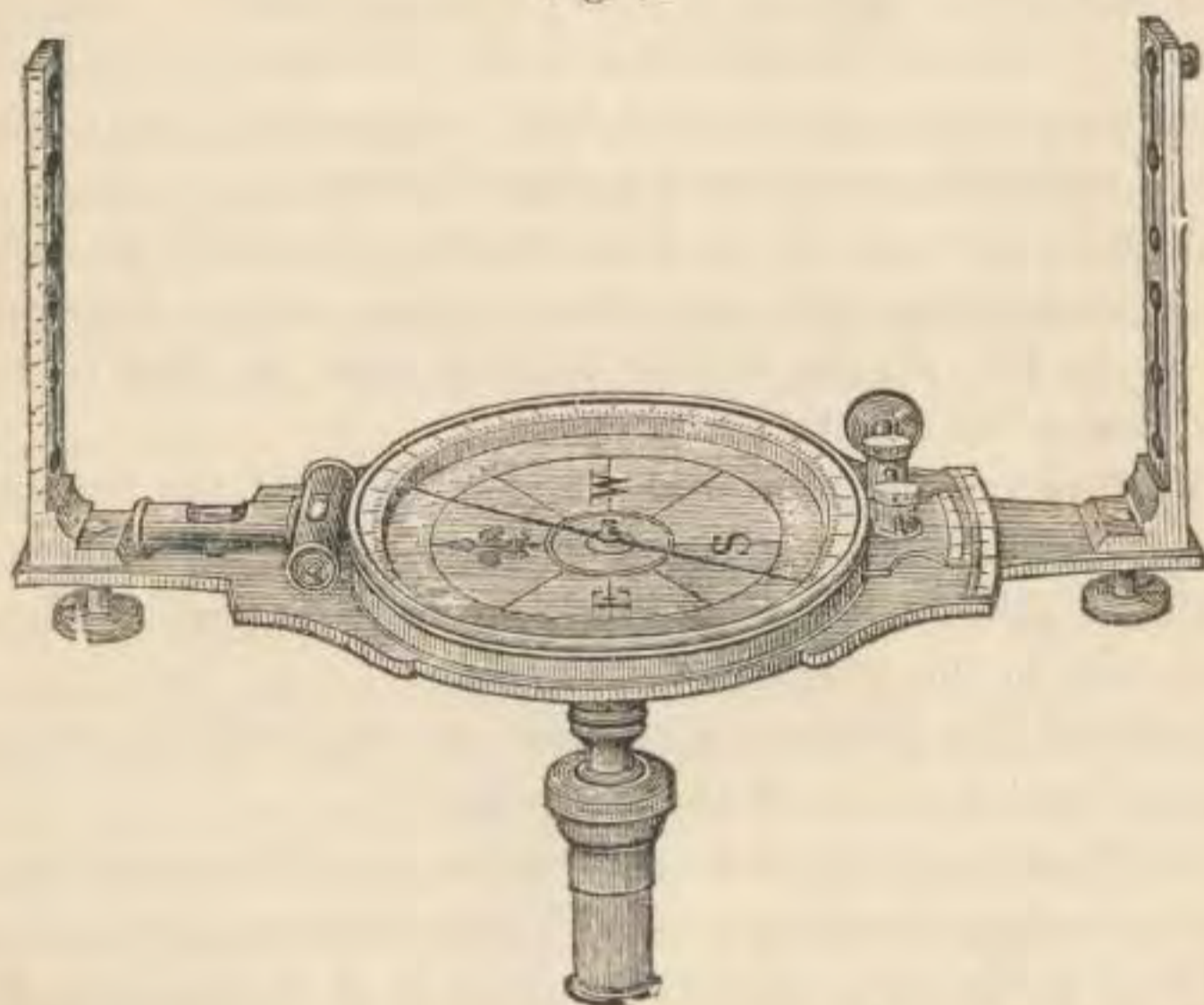


Surveying Instruments.

THE VERNIER COMPASS.

Fig. 2.



The vernier compass, represented in Fig. 2, differs from the instrument just described, in having its compass circle, with a vernier attached, moveable about a common centre by turning the "tangent screw," seen at the south end of the plate.

Sometimes a rack and pinion movement is substituted for the tangent screw, and is desirable where frequent changes of the vernier are required. It makes no difference in the price of the compass.

The superiority of the vernier over the plain compass con-

sists in its adaptation to the retracing the lines of an old survey, and to the surveys of the U. S. public lands, where the lines are based on a true meridian.

Variation of the Needle.

It is well known that the magnetic needle, in almost all parts of the United States, points more or less to the east or west of a true meridian, or north and south line.

This deviation, which is called the VARIATION OR DECLINATION of the needle, is not constant, but increases or decreases to a very sensible amount in a series of years.

Thus at Troy, N. Y., a line bearing in 1830, N. 31° E., would now, 1862, with the same needle, have a bearing of about N. 32° E., the needle having thus in that interval travelled a full degree to the west.

For this reason, therefore, in running over the lines of a farm from field notes of some years standing, the surveyor would be obliged to make an allowance, both perplexing and uncertain, in the bearing of every line.

To avoid this difficulty the *vernier* was devised, the arrangement of which we shall now describe.

THE VERNIER is divided on its edge to thirty equal parts, and figured in two series on each side of the centre line.

In the same plane with the vernier is an arc or limb, fixed to the main plate of the compass, and graduated to half degrees.

The surfaces of both vernier and limb are silvered.

On the vernier are thirty equal divisions, which exactly correspond in length with thirty-one of the half degrees of the limb.

Each division of the vernier is, therefore, one-thirtieth or, in other words, one minute longer than a single division of the limb.

TO READ THE VERNIER.—In “reading” the vernier, if it is

moved to the right, count the minutes from its zero point to the left, and vice versa. Proceed thus until a division on the vernier is found exactly in line with another on the limb, and the lower row of figures on the vernier will give the number of minutes passed over. When the vernier is moved more than fifteen minutes to either side the number of the additional minutes up to thirty or one-half degree of the limb is given by the upper row of figures on the opposite side of the vernier.

To read beyond thirty, add the minutes given by the vernier to that number, and the sum will be the correct reading.

In all cases when the zero point of the vernier passes a whole degree of the limb, this must be added to the minutes, in order to define the distance over which the vernier has been moved.

TO TURN OFF THE VARIATION.—It will now be seen that the surveyor having the vernier compass, can by moving the vernier to either side, and with it of course the compass circle attached, set the compass to any variation.

He therefore places his instrument on some well defined line of the old survey, and turns the tangent screw until the needle of his compass indicates the same bearing as that given in the old field notes of the original survey.

Then screwing up the clamping nut underneath the vernier, he can run all the other lines from the old field notes without further alteration.

The reading of the vernier on the limb in such a case would give the change of variation at the two different periods.

The variation of the needle at any place being known, a true meridian, or north and south line, may be run by moving the vernier to either side, as the variation is east or west, until the arc passed over on the limb is equal to the angle of variation; and then turning the compass until the needle is made to cut the zeros on the divided circle, when the line of

the sights would give the direction of the true meridian of the place.

Such a change in the position of the vernier is necessary in surveying the U. S. public lands, which are always run from the true meridian.

“THE LINE OF NO VARIATION, as it is called, or that upon which the needle will indicate a true north and south direction, is situated in the United States, nearly in an imaginary line drawn from the middle of lake Erie to Cape Hatteras, on the coast of North Carolina.

A compass needle, therefore, placed east of this line would have a variation to the west, and when placed west of the line, the variation would be to the east, and in both cases the variation would increase as the needle was carried farther from the line of no variation.

Thus in Minnesota the variation is from 15° to 16° to the east, while in Maine it is from 17° to 18° to the west.

At Troy, in the present year, 1862, the variation is about 8° to the west, and is increasing in the same direction from two to three minutes annually.

TO READ TO MINUTES.—A less important use of the vernier is to give a reading of the needle to single minutes, which is obtained as follows:

First be sure, as in all observations, that the zero of the vernier exactly corresponds with that of the limb; then noting the number of whole degrees given by the needle, move back the compass circle with the tangent screw until the nearest whole degree mark is made to coincide with the point of the needle, read the vernier as before described, and this reading added to the whole degrees will give the bearing to minutes.

To use the Vernier Compass.

Proceed in the same manner as directed in regard to the Plain Compass, when making new surveys, always taking

care that the vernier is set at zero and securely clamped by screwing up the nut beneath the plate.

In surveying old farms, allowance and correction must be made for the variation, as just described.

Sizes of the Vernier Compass.

We make but one size of this instrument, having a six-inch needle and a main plate fifteen and a half inches long.

Weight of the Vernier Compass.

The average weight of this instrument, with the jacob staff mountings, is about $9\frac{1}{2}$ pounds.

THE ADJUSTMENTS of the Vernier Compass are mainly those of the instrument first described, and need not here be repeated.