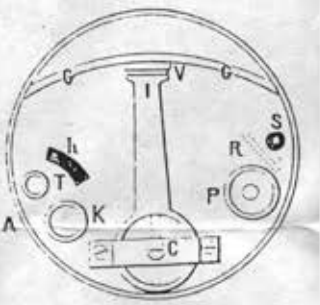
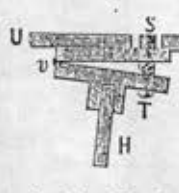
Trautwine, Civil Engineer's Pocket Book - 1909

# THE BOX OR POCKET SEXTANT.

THE portability of the pocket sextant, and the fact that it reads to single minutes, render it at times very useful to the engineer. By it, angles can be measured while in a boat, or on horseback; and in many situations which preclude the use of a transit. It is useful for obtaining latitudes, by aid of an artificial horizon. When closed, it resembles a cylindrical brass box, about 3 inches in diameter, and 1¾ inches deep. This box is in two parts; by unscrewing which, then inverting one part, and then screwing them together again, the lower part becomes a handle for holding the instrument. Looking down upon its top when thus arranged, we see, as in this figure, a movable arm I C, called the **index**, which turns on a center at C, and carries the vernier V at its other end. G G is the graduated arc or **limb.** It actually subtends about 73°, but is divided into about 146°. Its zero is at one end. Its graduations are not shown in the Fig.



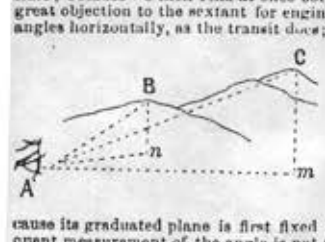

Attached to the index is a small movable lens, (not shown in the figure,) likewise revolving around C, for reading the fine divisions of the limb. When measuring an angle, the index is moved by turning the milled-head P of a pinion, which works in a rack placed within the box. The eye is applied to a circular hole at the side of the box, near A. A small telescope, about 3 inches long, accompanies the instrument; but may generally be dispensed with. When so, the eye-hole at A should be partially closed by a slide which has a very small eye-hole in it; and which is moved by the pin *h*, moving in the curved slot. Another slide, at the side of the box, carries a dark glass for covering the eye-hole when observing the sun. When the telescope is used, it is fastened on by the milled-head screw T. The top part shown in our figure, can be separated from the cylindrical part, by removing 3 or 4 small screws around its edge; and the interior can then be examined, and cleaned if necessary. Like nautical, and other sextants, this one has two principal glasses, both of them mirrors. One, the **index-glass,** is attached to the underside of the index, at C; its upper edge being indicated by the two dotted lines. The other, the **horizon-glass,** (because, when measuring the vert angles of celestial bodies, it is directed toward the horizon,) is also within the box; the position of its upper edge being shown by the dotted lines at R. The horizon-glass is silvered only half-way down; so that one of the observed objects may be seen directly through its lower half, while the image of the other object is seen in the upper half, reflected from the index-glass. That the instrument may be in adjustment, ready for use, these two glasses must be at right angles to the plane of the instrument; that is, to the under side of the top of the box, to which they are attached; and must also be parallel to each other, when the zeros of the vernier and of the limb coincide. The index-glass is already permanently fixed by the maker, and requires no other adjustment. But the horizon-glass has two adjustments, which are made by a key like that of a watch, and having a milled-head K. It is screwed into the top of the box, so as to be always at hand for use. When needed, it is unscrewed. This key fits upon two small square-heads, (like that for winding a watch;) one of which is shown at S; while the other is near it, but on the side of the box. These squares are the heads of two small screws. If the horizon glass H should, as in this sketch, (where it is shown endwise,) not be at right angles to the top U U of the box, it is brought right by turning the square-head S of the screw S T; and if, after being so far rectified, it still is not parallel to the index-glass when the zeros coincide, it is moved a little backward or forward by the square head at the side.




**To adjust a box sextant,** bring the two zeros to coincide precisely; then look through the eye-hole, and the lower or unsilvered part of the horizon-glass, at some distant object. If the instrument is in adjustment, the object thus seen directly, will coincide precisely with its reflected image, seen at the same time, at the same spot. But if it is not in adjustment, the two will appear separated either hor or vert, or both, thus, * *; in which case apply the key K to the square-head S; and by turning it slightly in whichever direction may be necessary, *still looking at the object and its image*, bring the two into a hor position, or on a level with each other, thus, * *. Then apply the key to the square-head in the side of the box; and by turning it slightly, bring the two to coincide perfectly. The instrument is then adjusted.

In some instruments, the hor glass has a *hinge* at *v*, to allow it play while being adjusted by the single screw S T; but others dispense with this hinge, and use *two* screws like S on top of the box, in addition to the one in the side.

If a sextant is used for measuring vert angles by means of an **artificial horizon,** the actual altitude will be but one-half of that read off on the limb; because we then read at once both the actual and the reflected angle. The great objection to the sextant for engineering purposes, is that it does not measure angles horizontally, as the transit does; unless when the observer, and the two objects happen to be in the same hor plane. Thus an observer with a sextant at A, if measuring the angle subtended by the mountain-peaks B and C, must hold the graduated plane of the sextant in the plane of A B C; and must actually measure the angle B A C; whereas what he wants is the hor angle *n A m*. This is greater than B A C, because the dists A *n* and A *m* are shorter than A B and A C. The transit gives the hor angle *n A m*, because its graduated plane is first fixed hor by the levelling-screws; and the subsequent measurement of the angle is not affected by his directing merely the line of sight upward, to any extent, in order to fix it upon B and C. For more on this subject; and for a method of partially obviating this objection to the sextant, see the note to Example 2, Case 4, of "Trigonometry."




**The nautical sextant,** used on ships, is constructed on the same principle as the box sextant; and its adjustments are very similar. In it, also, the index-glass is permanently fixed by the maker; and the horizon-glass has the two adjustments of the box sextant. It also has its dark glasses for looking at the sun; and a small sight-hole, to be used when the telescope is dispensed with.