

SEXTANT FAVE-LEPETIT (*)

RECORDING TYPE 107

The annexed photographs represent Type 107 Favé-Lepetit Sextant, the principal parts of which are the following :M. Partially-silvered mirror; C. Disk governing motion of the mirror; G. Leather strap carrying sextant; R. Cover of recorder-case; R1 Drum carrying roll; R2. Driving drum; V. Squared paraffined paper for recorder; J. Lighting arrangement; A2. Bulb; E2. Rheostat controlling light; E1, E3. Push-buttons for lights; F1. Rubber cushion for superciliary; F2. Adjustable hood; P, Q, R. Gear-casings; S. Sector; 13. Red index; U. Marked push-button; D. "Day" - "Night" lever; A1. Additional part for day sights with artificial horizon; A3. Additional part for night sights with artificial horizon; A4. Device for day and night sights with natural horizon.

The principle of the optics of the Favé Sextant with spherical level is given in *Hydrographic Review*, Volume V, No. 2, Nov., 1928, pp. 165-167.

To use the Favé-Lepetit Sextant type 107 in favourable conditions, it is not sufficient to handle it correctly during the flight; it must also be correctly prepared on land, before the flight, then during the flight, previous to the observations of any celestial body; and again, suitable use must be made of the gross results of the observation.

Both on land and airborne, the sextant must always remain propped in position in its container when not in use. *It is essential that the mirror M should never be even lightly touched* and that the disk C should never be abruptly seized; it is simply necessary to act on the latter tangentially and with one finger only to control the necessary movements of the mirror M. Likewise, when not in use, the apparatus must never lean on a rigid surface whether through the medium of its mirror, of its disk or of the parts bearing those two organisms.

The various forms of use of the apparatus are described below :

1. Operations to carry out, if possible, on the ground :

Supply recorder afresh each time that the unused paraffined paper is almost exhausted. To accomplish this the cover of the recorder case R is opened, the axis of the supporting-drum is withdrawn so that the roll of used-up paper may be removed from the case and replaced by a new one, the paraffined paper is unrolled, squared surface uppermost, it is slipped under the swing, under the rod of the clockwork winder and under the driving drum by turning the last-mentioned slightly so that the clutch catches hold of the perforations in the paper. By setting the clockwork system in motion for a few moments, the correct driving motion of the paper is verified. On stopping the clockwork movement, the driving drum is turned by hand until one of the thick lines of the paper is coincident with the small index mark near the axis of the clockwork winder. The cover of recorder case R is then reclosed.

2. Operations to be compulsorily carried out during the flight :

(a) The sextant is fitted with the additional parts corresponding to the observation to be made :

Additional part A1 when day sights are to be made without having recourse to the natural horizon ;

Additional part A3 and *Bulb A2*, to be set up when night sights without use of the natural horizon are to be operated :

Additional part A4 to be fitted when it is proposed to operate day and night sights using the natural horizon alone as reference ;

Should it be necessary to operate night sights under conditions of every sort, the *lighting accessory J* will be fitted, turning the *rheostat E2* towards the left in its position of maximum lighting.

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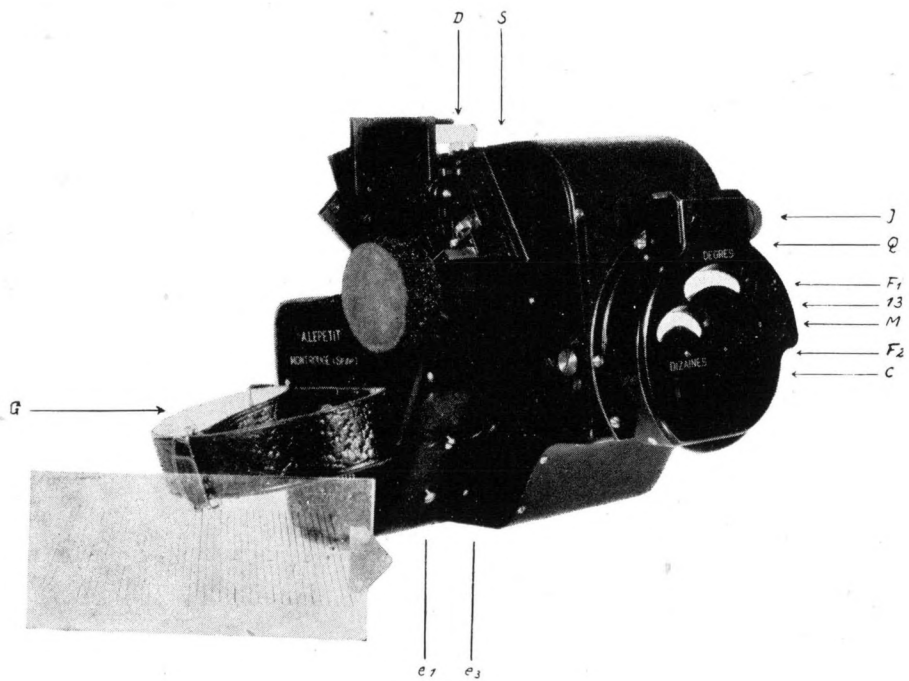


FIG. 1

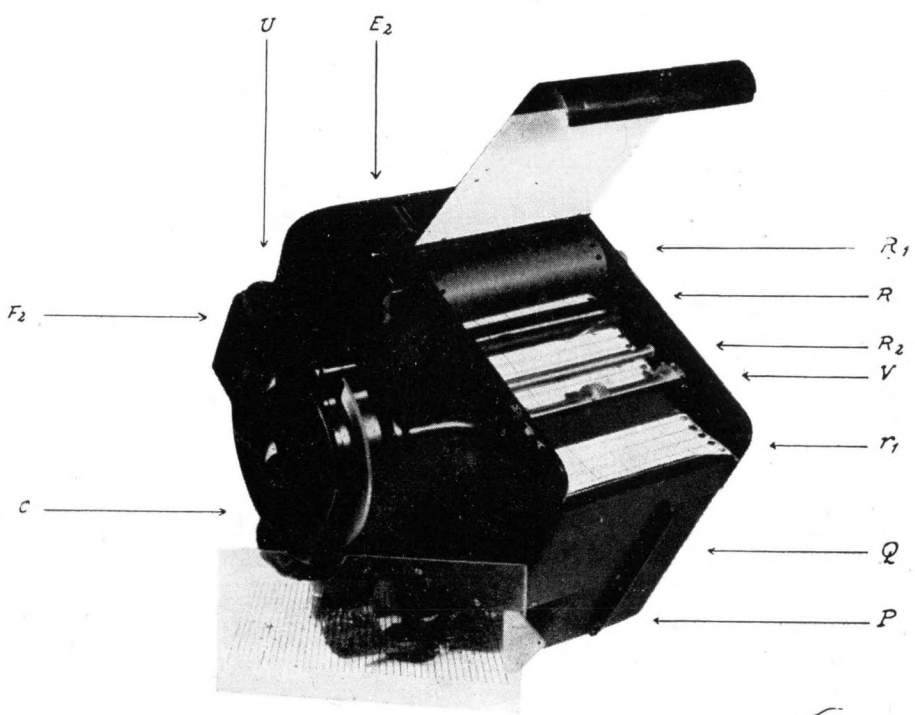


FIG. 2
Favé Lepetit Recording Sextant, type 107.

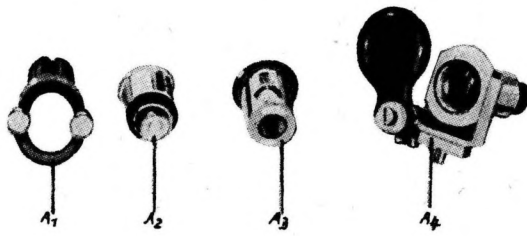


FIG. 3
Additional Parts.

(b) *Preparation of the observation.*—The celestial body to be observed having been selected, and if a choice of altitude is available, a calm and clear flight area will be chosen.

If speed is optional, the flight regime giving the least possible vibration is selected.

If a choice of course is available, that route will be followed which places the celestial body to be observed straight ahead or straight behind.

The pilot is asked to hold to an approximately constant speed and course which are noted on the empty tablet of the sextant along with the approximate azimuth and bearing of the observed star.

With the data thus noted and the latitude by dead-reckoning, two entries are made successively on the two tables forming part of the apparatus: "Ascensional Speed" (in terms of the bearing and of the latitude) and "Correction to Ascensional Speed" (in terms of the bearing and of speed). The numbers shown by each table with the + (plus) sign for increasing altitudes (1st table) and straightahead stars (2nd table) and the sign — (minus) in the opposite case, are noted. The algebraic sum p of the two angles noted is found and entered in large lettering on the tablet.

Example :

True course	150°
Horizontal speed	300 km.
Azimuth angle	120°
whence : Bearing angle	330°
Latitude by dead-reckoning	30°
$p = (+ 11) + (+ 2) = + 13.$	

(c) *To operate a sight.*—A station is made as near as possible to the centre of gravity of the airplane from which the star to be observed may be seen through the transparent partition.

Take hold of the sextant with the left hand passing through the leather strap. Lower hood F2. Wind-up the clockwork movement to its full extent. Wait until the siderometer indicates with exactitude a sidereal angle multiple of 15' (or the chronometer a round number in minutes of time) and at that instant start the clockwork movement with a finger of the right hand. Place the left hand round the case P so as to keep the instrument firmly supported, the thumb free to manoeuvre easily on one or other of the two push-buttons for lighting E1 or E3. Use the right hand for cases Q and R, the inner surface of the thumb touching very lightly the edge of disk C so that it may revolve freely, the index finger being free to act with force on the marker push U. By night, the index finger must also be used to make the rheostat E2 turn easily.

(d) *To take a sight on the artificial or on the natural horizon.*—By turning the disk C, the Sector S is to be placed in the vicinity of altitude zero. Using one finger of the right hand, the lever D is placed on position "Day". Raise the sextant to eye level, the lower edges of case P remaining approximately horizontal. The eye is placed above mirror M (position E1 of the optical sketch) as near as possible to the said mirror, rather opposite the limit of its silvered part. Rest the superciliary on the rubber cushion F1. The other eye need not be closed. Look horizontally onto mirror M.

If the sextant is fitted up for use with the artificial horizon (in this case, by night, do not fail to act on the lefthand lighting push O1), the level appears in the form of a luminous circle, yellowish by day and greenish by night; in the circle appear two vertical black lines cut by a horizontal line; within this circle the bubble appears in the form of a much smaller circle, black round the circumference and clear at the centre. Lead this small circle to the centre of the other, larger circle, overlapping its two vertical lines and its horizontal line, by slightly moving the sextant.

If the sextant is set up for use with the natural horizon, the reversed image of this horizon appears in the silvered part of mirror M. The brown shade of device A4 may be set up if required to distinguish the natural horizon without being dazzled.

(e) *Taking a sight on the celestial body : By day.*—By means of the righthand thumb, disk C driving mirror M is turned anticlockwise until the celestial body appears in the field.

If the artificial horizon is used, care should be taken to maintain the image of the bubble as near as possible to the centre of the image of the level, and : *for the sun,* the observed star is centred on the image of the bubble; *for the moon,* either the highest or lowest edge of the star is made to appear on the horizontal diameter of the bubble image; *for a planet,* the celestial body is made to appear on the horizontal diameter of the bubble image.

If the natural horizon is used, the image of which is reversed while the star appears upright: for the sun and for the moon, one or the other edge of the observed body is made to appear on the horizon image; for a planet, the celestial body is made to appear on the horizon image.

By night.—By means of the righthand thumb, disk C driving mirror M is turned anticlockwise until the observed body appears in the field.

If the artificial horizon is used, particular attention should be given to maintaining the bubble image as near as possible to the centre of the image of the level; with one finger of the right hand, move the lever D from the "Day" to the "Night" position and whenever there thus appears, in place of the bubble image, three small luminous points situated approximately on the level horizontal line, act on the rheostat E2 to give to these luminous points a brilliance comparable to that of the star to be sighted.

Thereafter: for the moon, either the upper or lower edge of the celestial body is made to appear on the line of the three luminous points; for a planet or a star, the observed body should be brought to appear in coincidence with the middle luminous point.

If the natural horizon is used, for the moon or for a planet, operate exactly as for day sights; for a star, operate exactly as for a planet.

(f) To observe a celestial body.—When the observed star is in good sighting position, act on push-button U, thus marking a clearly visible black line on disk C, and a small red line, almost a point, on the paraffined paper.

Repeat the sight on the same star some twenty times in succession for a duration of approximately two to four minutes of time. A marking is made for each sight.

The series of sights terminated, push the righthand lighting button E3 so as to light up Sector S and disk C. Turn disk C with very light touches until a division figured in red coincides exactly with red index τ_3 .

Wait until the siderometer indicates exactly a sidereal angle multiple of 15' (or the chronometer a round figure in minutes of time).

Push three times in close succession, button U.

In this way a triple red line is marked on the paraffined paper at the intersection of two thick black lines.

Altitude H_1 as read on sector S and disk C (red division in coincidence with red index) and sidereal angle S_1 read on the siderometer (or time T_1 read on the chronometer) at the moment of the triple markings are noted on the sextant tablet.

(g) To determine the observed height of the celestial body at any moment.—Open cover of recorder-case R.

Wait until that part of the paper showing the triple markings has been driven into the forward compartment. Stop the clockwork movement and detach the recorder strip by cutting it plumb with partition V by means of the articulated bottom.

This strip shows some twenty single sights (it may happen that the same mark be reproduced twice on the same line of constant sidereal angle since the width of the strip corresponds to a change in altitude of $3^{\circ}45'$ and the marking cylinder rotates one turn for the altitude change of 3°). Flatten the strip. Then join the marks together following the sequence of increasing sidereal angles (or times) by a series of straight lines.

Number the two lines of the graph (line of constant altitude and line of constant sidereal), distinguished by the triple markings, according to the values H_1 and S_1 (or T_1) previously noted. Mark the values, gradually approaching the figures, along the whole strip.

Place onto the strip the grid, accessory of the sextant, so that its line "p" (apparent ascensional speed of the celestial body previously noted) lies on a line of constant sidereal angle.

Move the grid parallelwise to itself until the same number of marks is obtained under the grid as beyond it. Then on the paraffined paper, trace with a stylus a line along the straight edge. This is the average straight line showing change in observed altitude of the star in terms of the sidereal angle (or of time) without taking into account the instrumental correction.

To obtain the observed altitude H_0 of the celestial body corresponding to sidereal angle S (or time T), as shown on the diagram it therefore suffices to subtract, from the quantity corresponding to the intersection of this average straight line with the line of constant

sidereal angle S (or constant time T) which is the measure of the instrumental altitude H_i , the instrumental error e' corresponding to altitude H_o . This error is known with exactitude in quantity and sign if the instrumental errors curve of the sextant is available; otherwise, it is admitted that the instrumental error is equal to that which corresponds to the altitude nearest to H_o for which this error is known.

Note.—If the recording strip has been accidentally mislaid or is unusable, the average observed height corresponding to the mean time of the series of sights may still be obtained, although with much less accuracy, by averaging at sight the altitudes corresponding to the radial lines traced onto disk C by the stylomine for each pressure on push-button U.

