The inside of the cover is grooved with deep threads to give additional friction to the rubber seal. This container will accommodate all types of magnetic as well as Rochelle salt units. A tire valve is provided for the purpose of introducing air pressure to equalize the water pressure outside the container. This is necessary because of the light construction of the container.

— C —

Open and closed views of a small container being used in connection with sono-radio buoys are shown. Its dimensions are as follows:

Diameter	1-7/8'
Length	3-1/2'
Thickness of cylinder	1/8"
Thickness of cap and end	1/4"

This container accommodates only the small telephone sound powered units and the small crystal vibration pickups. It has been made up in steel, bakelite and aluminum, and bored out of solid rod rather than made from tubing. This makes a much stronger construction. The aluminum containers have been submerged to 150 fathoms without collapsing, while the steel ones are practically unbreakable. The latter have been subjected to 6,600 pounds per square inch external pressure without failure.

Attention is particularly directed to the improved type of seal cap used on the containers in A and C. It will be noted that the cap is provided with a flange which prevents the seal from being forced inward by water pressure. This type of cap permits the use of soft gum rubber for a seal. This improvement is of most value for hydrophone installation in deep water.

The average sensitivity of the small hydrophones is greater than the large ones, B, except at the diaphragm resonance frequency which is above the bomb frequency range and is of little value. The compactness of the former is such that it permits a simplified installation for sono-radio buoy work and allows a wide depth range.

Commander O.W. Swainson, former Commanding Officer of the Ship *Pioneer,* has suggested that "B" could be much easier handled and secured for operation if it had a handle or lug attached to the side or cylindrical part. Many different hydrophones were built on the *Pioneer,* under his command, one type being built of boiler plate, 1/4 inch thick, and about 2 feet in diameter, the cylinder being 8 or 10 inches long. The same type of speaker unit was used and the sensitivity seemed about the same as the Vincent type. I believe careful comparative measurements might show a greater sensitivity for the larger area of diaphragm.

The Dorsey and Davis types of magnetophones were developed on East Coast vessels and continue in use on this and the Gulf Coasts. Those of the Vincent type are preferred on the West Coast. When the latter types have been used on the East Coast the feeling seems to be that bomb signal has been unduly prolonged. One disadvantage is that if roughly handled, while the unit is in place, the unit may be broken loose while the East Coast type has no such disadvantage.

Taken altogether, all of these magnetophones have given excellent results and will continue to do so and operators on each coast will probably use the type with which they believe they can get the best results.

THE BASTIEN POSITION CALCULATOR

(*Reproduced from the « Revue Scientifique » N° 11, November* 1939)
(Translated from the French)

The Bastien Position Calculator, of which the most recent and perfected design has been constructed by the firm of H. Morin in Paris, is essentially an apparatus designed to solve without calculation the spherical triangle in the cases usually encountered in navigation.

All classical systems of spherical coordinates define the position of a point by the angles which its radius makes with two well defined diametral planes. If several systems have one of their diametral planes in common, one can pass from one to the other by a simple rotation in this plane about the centre of the sphere.

The Bastien position calculator is, in principle, a representation of the sphere on this common plane, such that :

1.— The angles of rotation about the centre of the sphere, in the plane of representation must be rigorously maintained in their true magnitude.

2.— The angles of definition of the points on the sphere are represented to a scale varying as little as possible over the entire extent of the sphere.

That is, the plane representation of the sphere shall possess the same fundamental properties as the sphere for all changes of the coordinates of the type mentioned above.

In order to realize these conditions on the plane representation, M. Bastien has chosen a law of representation in polar coordinates about the centre of the sphere O : the two points C and C' of the sphere, of which the orthogonal projection is O, are presented by this point O ; all the points of the great circle of the plane of representation become identical with their representations ; all the points of each great circle passing through C and C' are represented by the points of the radius of the representation, which is the orthogonal projection of this great circle. Finally, the linear distance to the centre O from the representation m of each point M of one of these great circles, is related to the shortest distance on the sphere of M to C or C', by a law of proportionality established with a view towards best realizing condition 2 above.

In order to define a star on the celestial sphere (or what comes to the same thing its projection on the terrestrial sphere) we utilize in the current manner the two following systems of coordinates :

a) Equator-meridian of a known locality, which gives the coordinates :

Declination D, on the one hand — local hour angle AHg or the local angle at the Pole Pg, depending upon the method of measurement, on the other hand.

b) Geocentric horizon-meridian of a known locality which gives the coordinates :

True altitude Hv, on the one hand — the bearing Y, or the angle at the zenith Z, depending upon method of measurement, on the other hand.

These two systems of coordinates, both having as axial plane, the plane of the meridian of a known locality, fall into the preceding category when one chooses for both the same position of origin. The angle of rotation necessary to bring the plane of the equator to the plane of the geocentric horizon is the complement of the latitude, L, of the position (co-latitude).

The Bastien Position Calculator thus provides a possibility of passing from a knowledge of the declination, the local angle at the pole and the latitude, to a determination of the true altitude and the angle of the star at the zenith (azimuth). It will suffice, in accordance with the principle of the device itself, to mark by means of a fixed bearing on the movable representation of the plane, the position of the coordinates D and Pg, then to turn this representation about its centre to the angle L, to read off the new coordinates which then appear under the fixed reference point ; these are the values sought, Hv and Z.

The problem, which is in effect the resolution of the spherical triangle, called in navigation the « triangle of position », and which, when two sides and the included angle are known, is the problem of the determination of the elements of a line of equal altitude relative to an auxiliary point, is the fundamental operation of the Marcq St Hilaire method. It is just with this idea of obtaining the greatest possible simplification in the solution of the problem, under conditions encountered by aircraft in aerial navigation, that the most recent design of the Bastien Position Calculator has been worked out.

It comprises : (see figure)

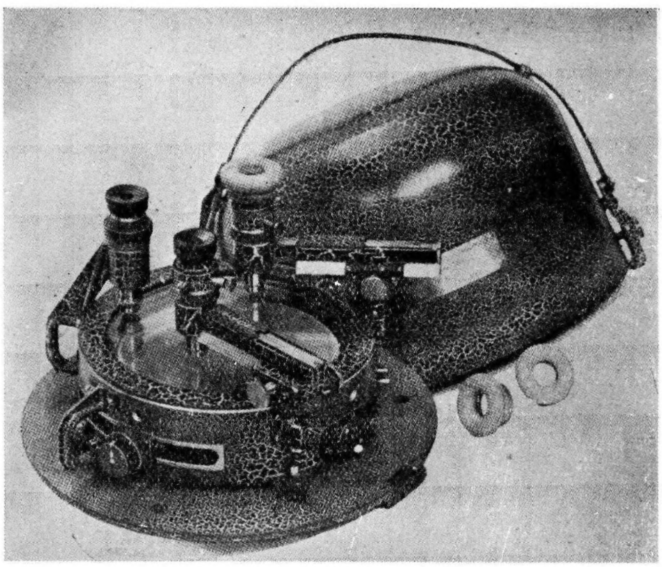
A) A graduated plate ;

B) A frame in which the plate can revolve ;

C) Magnifying eye-pieces to aid in reading the plate graduations ;

D) Auxiliary devices to facilitate the reading ;

E) A case for protecting the whole device ;



The Bastien Position Calculator.
Le Calculateur de Point Bastien

A) The graduated plate is of transparent glass ; on this is engraved, with the greatest possible accuracy, the diagram representing the two families of curves of the coordinates of the sphere of the fixed system. Each curve in one of these families represents the locus of points having a certain constant coordinate in the chosen system, for example a constant declination in the system based on the equator ; each curve in the other family represents the locus of points having the coordinate constant in the same system, for instance, a constant angle at the pole. The curves are drawn at intervals of every 15', which allows a point to be determined on the diagram to within 3' and even to 1' if the operator is exprerienced. The curves are numbered and differenciated, one family from the other, by the relative location of the numerals and by their character. The external circumference of the plane representation is itself graduated in angles at the centre or in latitudes.

B) The graduated plate is centered as accurately as possible in the mounting ; which is in turn centered in a frame with respect to which it can turn. A regulating knob is provided for rapid turning of the device, the fine adjustement and the locking in any desired position.

The shock absorbers are for the purpose of eliminating any rough jars to the instrument in an airplane or any disturbing vibration.

C) The frame carries the reading microscopes with a magnification of 40, which permit the desired graduations of the plate to be read.

One of the microscopes occupies a fixed position above the external circumference of the plate ; it serves for the reading of the latitude, L. corresponding to a given position on the diagram.

Two other microscopes, either of which may be employed, as desired, for the purpose of fixing the reference point above the plate, are movable at the end of arms fitted with screws for rapid movement, for fine adjustment and locking. These arms serve to find the point of reference.

The three magnifying eye-pieces are fitted with cross-hairs to increase the accuracy in fixing the point of reference.

D) Two accessories serve to permit a search of the plate with ease, rapidity and accuracy ; on the one hand, three lamps located in the frame, below the plate, give a mild and even light regularly diffused over the entire plate ; on the other hand, the finely graduated plate is covered by another plate on which the family of curves are drawn at much greater intervals, visible to the naked eye, which serve to delimit in any given case the region to be searched with the movable microscope ; this rough plate also serves to protect the finely graduated fixed plate.

E) The cover in the form of a hemispherical cupola is removable and is provided with a strap. It has a radius of about 18 cm. and serves to protect the apparatus when it is not in use.

The weight of the Bastien Position Calculator is about 5 kg. (11.0 lbs) without the cover and 6.5 kgs (14.2 lbs) with cover.

The practical calculation of the position with the Bastien Position Calculator does not vary in any respect from the theoretical determination of Hv and Z, starting with the factors D, Pg and L. One begins by setting the graduation 90 of the external circumference beneath the fixed sight ; one then marks the point on the plate of Pg and D by means of one of the movable sights ; then the plate is turned until the value of L appears beneath the cross wires of the fixed sight ; then one reads off Hv and Z in the movable sight.

Of course, as we have stated already, the Bastien Position Calculator is capable of solving practically, and without calculation, all the other problems of spherical trigonometry which are based on the coordinates of the classical type. In particular, we note that it serves for the practical determination, as rapidly as the determination of the position line, of the distance between two points along the orthodromic and the angle at the origin of this orthodromic, or the determination of a line of « radio bearing ».

The brief summary of the principle of the instrument and the above example show the great value of the device for aerial navigation over great distances. In a great number of cases, and in particular when using the current astronomical methods of navigation, it does away with all difficult calculation and makes it possible for all the personnel engaged in aviation to take part in the navigation without going through the discouraging preliminary study required for the uninitiated in navigation.

SETTING OUT DEEP SEA TIDE GAUGES

by

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(Translated from the German.)

(Extract from: "Bericht über die zweite Teilfahrt der Deutschen Nordatlantischen Expedition des Forschungs- und Vermessungsschiffes "Meteor", Januar bis July 1938".)

During the second part of the 2nd Partial Cruise of the German North Atlantic Expedition, deep sea tide gauges were set out, pursuant to a series of experimental tests lasting several years. Thus, for the first time, it was possible to set out these devices in a depth of 300 metres in the high seas. This was on the southern Echo Bank:

Lat. 25° 23' N. and Long. 19° 26.4' W, from 19th to 22nd May 1938 (312 m.)

A second tide gauge station was made off the Cape Verde Islands. Here, there is a depth of about 100 metres and two deep sea tide gauges were used for purposes of comparison and in order to check the accuracy of the devices.

a) 15° 40.05' N. 23° 16.2' W. from 25th to 28th May 1938 (depth 94 m.)
b) 15° 39.45' N., 23° 15.95' W., from 25th to 28th May 1938 (depth 95 m.)

In the past, observations on the height of water have generally been connected directly to the coast, since the usual tide poles and recording gauges could be installed nowhere else. For tidal investigations, however, the necessity for observations in the open sea has always existed, in order that the phenomenon might be comprehended, not only linearly but over a surface area, and for the purpose of testing the present theories from all aspects and improving them through the supplementary data thus obtained. Since in the open sea, the variations in the height of water cannot be directly determined by means of the usual tide poles, resort was had to indirect methods by setting out the so-called "deep sea tide gauges," which record photographically the changes in the pressure of water and thus permit the calculation of the heights of water. (For this it is necessary to know the function giving the density of the column of water and its hourly variations).

....

The first tests were conducted in the shallow and then the deeper water of the North Sea, and finally in the Norwegian Fjords, which were chosen particularly on account of their expanse of deep and quiet water. It is evident that the use of heavy and at the same time ultra-sensitive recording devices would meet with difficulties in a rough sea.

At first the pressure measuring element employed was the Bourdon tube. The technical difficulty here was that the tubes, which must necessarily be exposed to the total pressure of water from the surface to the bottom, required