EXTRACTS OF BOOKS

CORRECTION OF THE EFFECT OF THE MAGNETIC FIELD ON THE RATES OF WATCHES.

Note by Mr. PAUL DITISHEIM, *presented to the Paris Académie des Sciences.*
(Reports of Proceedings of the Académie des Sciences - N° 19 - 5th November, 1928 - Page 808).

The introduction of elinvar for compensating watches for all temperatures should bring about much progress with regard to preserving their rates from the effects of permanent magnetism.

Mr. DITISHEIM invented a new compensator-attachment for balance wheels fitted with elinvar spiral springs. The comparative test of several groups of watches was carried out according to the rules for competitions for Naval non-magnetic watches, using an artificial magnetic field 50 times more powerful than the magnetic field of the Earth.

The results of the experiments show that watches in ordinary casings, unprotected magnetically and without the special attachment, had a daily rate which reached 2 h. 50 m. in the artificial field, while the same watches, fitted with balance-wheels with special attachment, have a daily rate of 4 minutes only.

When the same movements are enclosed in the special anti-magnetic casing, the daily rates are reduced to somewhere in the neighbourhood of a second instead of the rates previously observed in the field of the Earth.

A STUDY OF THE VARIATION OF MEAN SEA LEVEL FROM A LEVEL SURFACE

by

HENRY G. AVERS.

(Extract from *Geodetic Operations in the United States. January 1. 1924 to December 31, 1926,* by WILLIAM BOWIE. *Special Publication N° 134 of the United States Coast and Geodetic Survey. United States Government Printing Office, Washington,* 1927).

In each of the four general adjustments of the first-order level net of the United States, it was assumed that the plane of mean sea level on the open coasts of the Atlantic Ocean, the Gulf of Mexico, and the Pacific Ocean is at the same elevation. Although evidence is increasing to show that the assumption may not be exactly true, it is believed that, under the circumstances, it was probably the best that could be made where the practical side of levelling is necessarily of great importance in the assignment of elevations to the bench marks.

When the tidal stations on the Atlantic Coast at Fort Hamilton, N. Y., and Portland, Me., were connected by a line of first-order levelling, the results showed that the plane of mean sea level at Portland was 169.4 millimetres higher than the plane of mean sea level at Fort Hamilton. Similarly, on the Pacific Coast, the levelling showed the plane of mean sea level at Vancouver, Canada, to be 102.8 millimetres higher than the same plane at Seattle, Wash.

These differences are about three times as large as those which could be attributed to the systematic or accidental errors in the levelling, and a study has been made to determine if, in general, there is a slope in the mean sea-level surface.

For the purpose of this study, a special adjustment of the first-order level net has been made.

In the adjustment, the entire net was allowed to swing free on one mean sea-level connection, that at Galveston, Tex.

The resulting values seem to indicate that along the coast of the Gulf of Mexico there is a general slope downward in the mean sea-level surface from west to east, and that along the Atlantic and Pacific Coasts there is a general slope upward from south to north.

The levelling thus indicates that mean sea level on the Pacific Coast is higher than at approximately the same latitude on the Atlantic coast. This result agrees in sign with that shown by the levelling across the Isthmus of Panama, where it was found that mean sea level on the Pacific coast is 0.583 foot (0.179 metre) higher than on the Atlantic Coast.

The levelling is of such accuracy that on an average a correction of only about 0.15 $^{m}/_{m}$ per k/m is necessary to close the circuits formed by the more modern lines. It is believed, therefore, that the differences in level found by the adjustment are real differences and that they are not due to any peculiarities in the levelling.

This adjustement was made solely for the purpose of study and the results will not be used in assigning elevations to the bench marks.

The entire question of the variation of the mean sea-level surface from an equipotential surface is of much interest to geodesists, geophysicists, and oceanographers and it is hoped that other countries will make a similar study of the mean sea-level determinations along their coasts.

THE EFFECT OF VIBRATIONS ON THE RATES OF CHRONOMETERS.

Note by Mr. G. P. ARCAY, *presented to the Paris Académie des Sciences.*

(Report of Proceedings of the Académie des Sciences N° 24 - 10th December 1928 - Page 1125).

After the most careful regulation, pocket chronometers commence to lose when carried.

This losing is due entirely to slight vibrations to which the watch is subjected and has been found to exist when transporting chronometers either on board ship, on a railway train or in a motor vehicle.

Mr. G. P. ARCAY made some systematic experiments, the chronometer being placed in a wooden transport box fixed vertically or horizontally to a thin deal board 60 $^{c}/_{m}$ long. One of the ends of this board was fixed and the other, at each revolution of a shaft capable of 100 400 and 1400 revolutions per minute, was raised by a cam thus moving the watch through 2 $^{m}/_{m}$. The principal results of these experiments are given below :

(1) Vibrations affect the rate and the quicker the greater the effect.

(2) The effect of vibration is more marked when the chronometer is horizontal.

(3) Within the limits of the cadences employed, the result is always a retardation.

(4) The chronometers permanently retain a losing rate.

(5) As the chronometers lose, so the amplitude of oscillation of the balance wheel gets less.

It appears, therefore, that the retardation is caused by friction between the balance wheel pivots and the jewelled bearings, which friction is the greater when the bearings and the pivots have not been well polished. The vibration test is thus proved to be a criterion of quality and might well be added to those already proposed for the chronometer competitions.

CONCERNING A SIMPLE METHOD FOR THE EXTRACTION OF FRESH WATER FROM SEA WATER, FROM SALT OR POLLUTED WATERS, FROM ALL AQUEOUS SUBSTANCES AND EVEN FROM THE ATMOSPHERE, BY MEANS OF HEAT FROM THE SUN'S RAYS.

by

DR. JULES RICHARD, DIRECTOR OF THE OCEANOGRAPHIC MUSEUM OF MONACO.

(*See* Bulletin de l'Institut Océanographique N° 535, of 5th April, 1929).

8vo — 27 pages — 7 illustrations.

The question of the extraction of fresh water from sea water is one of the greatest interest; in innumerable cases it would be of advantage to use the heat of the sun's rays for the extraction of fresh water by distillation.

If an ordinary closed gardener's frame, in the bottom of which has been placed a flat vessel containing a shallow depth of water, is exposed to the sun, this water, heated in a closed recipient and vaporised in the hot air of the frame, appears in condensed form on the lower surface of the glass.

The interior surface of the sloping glasses becomes covered with drops of water arising from the condensation upon contact with the glass. These drops intermingle and their weight causes them to slide to the lower edge of the glass, then fall to earth. Let us suppose that these drops are collected in a gutter placed along the lower edge of the glass and fitted with a tube for the flow of the distilled water; then this water would be collected in a recipient. Such is the principle, extremely simple, of a very practical system of distillation.

From 1 to 2 quarts of distilled water per day per square metre of glass exposed to the full rays of the sun, are easily obtained.

It is astonishing that such a simple method, and one suitable for use in a thousand different ways, should be unknown and neglected.

DETERMINATION OF THE INTERNATIONAL DATUM FOR HEIGHTS, TAKING INTO ACCOUNT THE LAW OF VARIATION OF THE ANNUAL MEAN SEA LEVEL.

Memorandum by Mr. E. PRÉVOT, *presented to the Paris Académie des Sciences.* (Report of Proceedings N° 23 of the 3rd June, 1929).

Ever since 1894 the International Geodetic Association has been considering the choice of an international datum for heights. In 1889, Mr. Ch. LALLEMAND pointed out that the most practical solution of the problem consisted in connecting the *normal datum* for heights in each country, with the mean level of a neighbouring sea (*See* Ch. LALLEMAND, Report presented in the name of the Committee of the International Datum for Heights — Report of Proceedings of the International Geodetic Association, Geneva, 1893, p. 124. Publisher: G. REIMER, Berlin 1894). Now, from the above-mentioned note it follows that in the course of time the mean level undergoes slow oscillations, in the neighbourhood of a decimetre (4 inches). The unicity of datums for heights will therefore be very badly established if, as is generally the case, the tidal observations from which they are obtained are not simultaneous and cover an insufficient period. The equation by which Mr. E. PRÉVOT expressed the long-period variation of the annual mean sea level will henceforth enable *an International Datum for Heights*, valid for all the continents, to be ascertained with greater accuracy.

Let the term *mean normal level* designate, at any point, that which would correspond to a very long period of observations, for example of 93 years, which is the period of the slowest of all known marine waves. If, in every country, there were an automatic tide-gauge station, called "Standard Station", where observations had been taken over a sufficiently long period to enable the numerical coefficients of the equation for the annual mean level to be obtained, it would be easy to deduce from them the value of the mean normal level at that place.

The normal mean levels thus calculated for various countries would appertain to one and the same surface level, the Geoid, which would thus be fixed experimentally and which it would be suitable, therefore, to take as the *International Datum for Heights.*

At most of the stations actually provided with self-recording tide gauges or mean-level recorders, however, the period of observations will be insufficient for a long time yet for such direct calculation. Nevertheless, in those places where there is even now a standard station, a result very near to the normal mean level may be obtained in view of the two following remarks:

1. The numerical coefficients of the equation for the annual mean level are applicable over an area, though no doubt limited, which is probably very great.

2. If the long-period variations of the level, as observed at several stations in the same region, be compared, a certain similarity is observed, which proves that they are due to hte same general causes. Then, if for two stations A and B of an assumedly stable coast, the values of the mean levels resulting from simultaneous observations covering a relatively short

period of from 5 to 10 years for example, be calculated, the discrepancy between these two heights might be considered, with a certain degree of accuracy, as a constant which is valid for any other period (this discrepancy represents the algebraic sum of the levelling error between A and B and of the possible permanent anomalies of the mean level at these two stations).

This being so, let M be the normal mean level calculated for a local standard station and μ be the normal mean level required for another station in the same area where only temporary tidal observations have been taken ; let M_n and μ_n be the mean levels obtained from simultaneous observations, during n years, made at the standard and at the temporary station respectively.

According to remark N° 2 above, the discrepancy $\mu_n - M_n$ is a constant ; the relation

$$\mu = M + \mu_n - M_n$$

therefore, will give a very close value of the normal mean level at the temporary station.

If this latter station has to be made use of to determine the normal datum for levelling a country, it will be sufficient to make the datum coincide with the normal mean level μ thus calculated, and thus, *ipso facto*, ensure its identity with the international datum for heights.

With the object of lessening the result of levelling errors in any given country, the value of the normal mean level could be determined as just described, at several temporary stations, situated on the coast of the country, or on neighbouring coasts, and then the normal datum for heights of that country would be made to coincide with the mean of the values obtained, calculated after having eliminated those stations subject to local anomalies. (*See in* "*Geodetic Bulletin*" of 1928, pp. 96 and 97, the rule proposed by Mr. E. PRÉVOT for making the necessary discrimination).

UTILIZATION OF PHOTOGRAPHS FROM AIRCRAFT BY THE HYDROGRAPHIC EXPEDITION TO INDO-CHINA.

During the Hydrographic expedition carried out in Indo-China in the second half of 1925, two hydroplanes were used for taking photographs in the Fai-tsi-long archipelago.

In his report the Officer in charge of the expedition expressed himself as follows on the subject of the use of these photographs :—

"Towards the end of October it was found possible to make use of a first series of photographs and to take in hand the topography which had been put aside until then. These photographs were useful also for preparing for sounding in those regions which are crowded with small islands.

"More than four stations were always on each photograph. Experience has shown that each islet, however small, requires to have one or two stations fixed by sextant ; the steepness of the cliffs is, in fact, the cause of a good deal of distortion, the coastline being often concealed by the shadow of the cliff tops, and finally, difficulties in fixing the position of the plane render a relatively large number of the stations useless, so that there cannot be too many of them.

"We experienced some difficulty with the restitution of the region to the N. E. of the Brandon Mountains. Graphic construction had to be abandoned and the restitution could not be done until after the calculation of a certain number of points on each photograph.

"The "camera lucida" was used whenever the tilt of the photograph did not admit of its direct use after reduction to the scale of $\frac{1}{10{,}000}$.

"As photography could only give approximate positions for the summits of islets, the position and height of these were determined from theodolite stations". (*See* "*Annales Hydrographiques*", 3rd series — Volume 1927-1928 — *Service Hydrographique* — Paris, 1928).

MAPPING UNITED STATES AIRWAYS

(Extract from *The Military Engineer* - November-December, 1928. p. 476)

A very interesting article on the cartography of United States' Airways appeared in *The Military Engineer* for November-December, 1928. Below are given a few extracts from this article which point out certain conventions suitable to air-navigation charts and from which stands out clearly the co-operation necessary between the different State Departments for the production of these charts. The problem which this subject offered for consideration, and which has been solved by the United States, interests other countries also and may be of interest to those Hydrographic Offices among whose duties falls the preparation of coastal charts for air navigation.

"Most pilots prefer what are called "strip maps", which are narrow and need to be folded in only one direction. The size used is 11 inches wide, covering 80 miles on the scale of 1 : 500,000. Lengths vary from 24 inches to 48 inches, representing approximately 200 to 400 miles. These maps should be very clear and not burdened with too many details.

"On airway maps produced by the United States Coast and Geodetic Survey, the symbols for larger towns are coloured yellow and their names are printed in capital letters for emphasis. This system has recently been adopted by the Board od Surveys and Maps of the Federal Government. The locations of the villages are shown by circles, uncoloured, with the names in smaller type.

"On airway maps, the elevations in general are indicated by different colour tints, called gradients, following the same general scheme as that used on the "world-map" now being constructed by international agreement on a scale of 1 : 1,000,000, the difference being that the airway maps use a lesser number of tints. Seven different gradients are used, as contrasted with twelve on the world map. Another difference is in the use of the foot as the unit of altitude on the airway maps, while the metre is the unit of altitude on the world map. Both maps use green tints for lower altitudes and brown for higher elevations; the deepest tint of green is used for the lowest altitude, or from sea level to 1,000 feet on the airway maps. The highest altitudes are indicated by the deepest tint of brown, or from 9,000 to the maximum elevation that has been included within the limits of the map.

"In addition to the colour tints with limits of 0, 1,000, 2,000, 3,000, 5,000, 7,000, 9,000 and the maximum, there are shown on the airway maps contour lines at intervals of 500 feet marked by figures showing their elevations above sea level. Many town elevations are shown by figures near the names of the towns. Elevations are shown for prominent peaks and occasionally, where contours and tints are insufficient, hachures are employed to emphasise conspicuous peaks. The tint is omitted from the principal highways, leaving the white between the black parallel lines, in order that they may appear more conspicuous.

"Recently, the Aerial Navigation Committee of the Board of Surveys and Maps recommended some changes in the symbols used on airway maps. These were adopted by the Board at its October meeting. The most interesting of these new symbols are those for airports. Formerly, these were made by the use of two or three intersecting lines within a circle, the intersection marking the exact location of the airport on the map. The new symbols retain the circle but eliminate the lines, except the symbol for marked auxiliary field which is made by two intersecting red lines.

"The change in the airport symbols was made primarily to allow stars to be placed in the centre of these symbols, representing airports whose positions are marked for night flying by revolving or flashing beacons. These symbols with centres left blank have the advantage of allowing stars to be placed in the centre as soon as the fields are marked by lighted beacons, without the necessity of removing any lines to make places for them. This leaves the space outside the symbols for other marks, such as the *LF* for lighting facilities just adopted, to tell the aviator that the field is equipped with flood lights, border lights, or with other aids needed for night landing and taking-off.

"Another change in symbols was that made for lighter-than-air facilities formerly approved by the Board. The original symbol suggested the hangar, but the new symbol suggests the mooring mast which is always present at any place equipped for the accommodation of dirigi-

bles, whereas the hangar may not be constructed. The symbol is designed to be attached to the airport symbol whenever the field includes facilities necessary for handling lighter-than-air-craft.

"The recent developments in radio stations, radio compass-stations, and directive radio beacons threaten to complicate the map if it is attempted to show all the activities in the line on the map. The dot-and-circle marks the location of a radio station, beside which are given the letters descriptive of the type of radio station, and in parenthesis are enclosed the call letters. In places, it will be practically impossible to group all the various letters and symbols around an airport symbol, and the Department of Commerce Bulletins will need to be consulted for this information. In connection with the work of the Aerial Navigation Maps Committee and the Technical Standards Committee of the Board ,of Surveys and Maps, in the revision of symbols for airway maps, there was excellent co-operation between the representatives of the different departments.

"In addition to the maps of the United States Geological Survey, some of the many maps which have helped in the compilation of the airway maps are those of the Bureau of Public Roads, the Forest Service and the Bureau of Chemistry and Soils of the Department of Agriculture, of the General Land Office, of the Interior Department, of the Post Office Department and of the State highway and railway commissions, and the blue-prints of the various power and light companies. When a route reaches the coast, the charts of the United States Coast and Geodetic Survey and those of the Hydrographic Office are used. The air navigation maps of the Air Corps of the Army, and the air maps of the Navy Department were used where the Department of Commerce airways join the routes already mapped by those bureaus. The maps of private organisations have been helpful as references".

The United States Air Routes established and the projected plan of maps are shown in an index map which accompanies the article quoted. The existing federal air maps are on sale at a nominal price by the Aeronautics Branch of the Department of Commerce, Nineteenth Street and Pennsylvania Avenue, N. W., Washington, D. C. Airway bulletins containing descriptions and sketches of the airports are also issued by the same office.

SCHEME FOR THE ORGANIZATION OF A METEOROLOGICAL SERVICE FOR THE ATLANTIC

Under this heading, a very interesting article by Sub-Lieutenant HUBER appeared in the "*Revue Maritime*" for the month of October, 1928 (Société d'Editions Géographiques, Maritimes et Coloniales, 184, Boulevard St-Germain, Paris, VI^{e}).

The Author pointed out that a Meteorological station at sea such as exists on board the *Jacques-Cartier* or the *Ville d'Ys* cruising in the North Atlantic, could easily take in meteorological reports transmitted by the Eiffel Tower and Arlington stations, the observations from Greenland and from transatlantic shipping, and, by means of all these elements and of her own observations, easily construct a meteorological chart extending over the whole zone comprising the North Atlantic and Europe.

But, in order that a chart of this kind should be really complete for all the Oceanic zone and that no large gaps should appear in it, it would be necessary that the sea meteorological stations should be sufficiently numerous and conveniently placed so as to be able to pick up local reports from the whole Ocean.

With this object in view, the author suggests dividing the North Atlantic into about ten meteorological zones, each one controlled by one station which, for economical reasons and because of greater stability in transmitting, should be on land.

Each station would make local summaries from the observations of shipping in its own zone, forward them to a central office which, after receiving the meteorological signals from all the zones, would broadcast the general situation, say twice a day. The stations, informed of the general situation, supplemented in their own zones by possible complementary observations, and taking into account local particularities, would work out a forecast which they themselves would circulate.

Thus, working to an established time table, a local forecast could be circulated for each zone twice a day.

For deciding on the stations and determining the zones, the author suggests the following distribution, which would not necessitate, for the local service stations, a range greater than 1,000 sea miles.

Newfoundland Zone (St-Pierre).
Bermuda Zone (Bermuda).
Lesser Antilles Zone (Fort de France).
French Guiana Zone (Cayenne).
Cape St. Roque Zone (Natal).
Cape Verde Zone (St. Vincent).
Canary Is. Zone (Santa Cruz).
Portuguese Zone (Lisbon).
French Zone (Brest).
British Zone (Valentia).
Greenland Zone (Cape Farewell).
Azores Zone (Ponta Delgada or Horta).

For the zone bordering the coast of the United States of America and for the Haïti Zone, the observations of vessels are already collected by the Weather Bureau stations.

The author particularly emphasizes the importance of stations for the Newfoundland and Azores Zones.

All maritime countries are interested in the constitution of a complete Meteorological Service for the Atlantic and in the creation of a regular broadcasting service, which would also permit the best aerial routes to be selected at all seasons.

International agreement would be necessary to settle the various questions which arise on this subject and the plan proposed by M. HUBER provides an interesting basis for its study.