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METEOROLOGICAL OFFICE

THE
FISHERY BAROGRAPH

A note on the use of the barograph in
anticipating gales
and
Instructions for the care and maintenance of
barographs lent to fishing
communities.

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OFFICE

FISHERY BAROGRAPH

It reads on the face of the barograph the
atmospheric pressure
and the temperature of the air
in the room in which it is used.
The barograph is a combination
of a barometer and a thermometer.

It is a very useful instrument for
the study of the weather.

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the study of the weather.

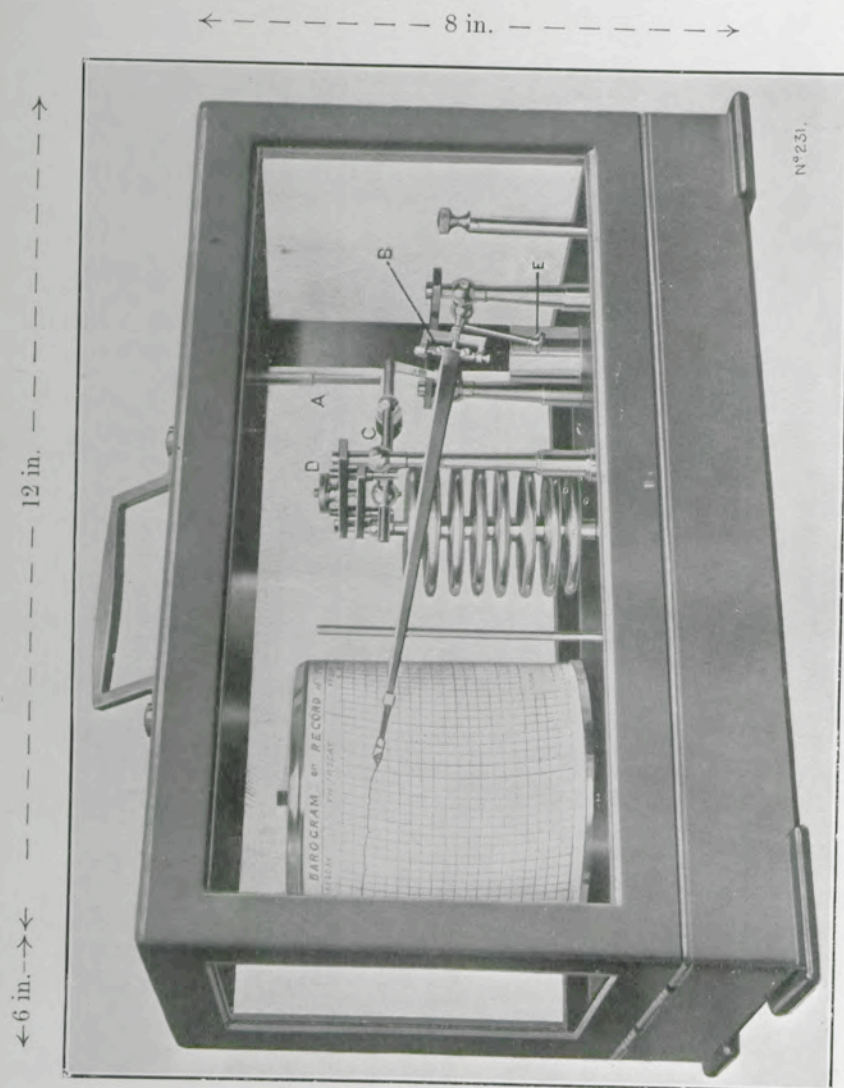


Fig. 1.

THE FISHERY BAROGRAPH

A NOTE ON THE USE OF THE BAROGRAPH IN
ANTICIPATING GALES
AND
INSTRUCTIONS FOR THE CARE AND MAINTENANCE OF
BAROGRAPHS LENT TO FISHING COMMUNITIES

I.—USE OF THE BAROGRAPH

1. Advantages of a barograph over a barometer.—The barograph or recording barometer, like the mercury barometers supplied in the last century, is specially useful for anticipating gales or high winds. But the barograph has a great advantage over the barometer because it shows not only what the barometer is reading at the time of observation, but also clearly and unmistakably what the barometer has been doing in the last few hours. The reason why this is specially important is because most gales which come on suddenly come when the barometer is falling rapidly or rising rapidly. Gales do also come when the barometer is not changing very much, but in gales of this type the force of the wind usually increases gradually so that the wind itself acts as a warning.

2. Use of local knowledge.—The barograph should always be used in conjunction with the observer's own knowledge of local conditions and especially in conjunction with his observations of the state of the sky and any changes in the direction of the wind or in the direction of motion of the lower clouds. Observations of the direction of the lower clouds are specially important at places where the wind is so much affected by neighbouring hills or mountains that it gives no indication of the wind on the open sea.

3. Gales of cyclonic type.—The most common type of gale in this country is associated with a cyclonic "depression" or "disturbance." The onset of the gale is heralded by a fall of the barometer and by a backing of the wind. Both the barometer and the wind are usually affected an appreciable time before the actual gale begins, but this time varies; it may be as short as two or three hours, more often it will be ten or twelve hours, while on some occasions the wind will back and the barometer begin to fall and no gale will come. If this occurs it is usually because the centre of the disturbance has passed north or east and remained at a considerable distance from the place concerned.

The rate at which the barometer falls depends to some extent upon the locality. An extremely rapid fall would be one in which the curve fell from one thick horizontal line (see Fig. 2, p. 7) to the next thick horizontal line in three hours. Such extremely rapid falls do occur occasionally in the extreme north

and north-west of the country, but even there they do not occur many times in the course of a year. In the east and south such falls are very infrequent. A fall at half the rate, that is, from one thick horizontal line to the next in six hours is a rapid fall and would usually be accompanied by high winds or gales in the open sea. In a stormy winter month falls at this rate may occur between five and ten times in the course of a month; on the other hand, a whole winter month may pass without any fall at this rate.

A rapid rise or fall does not always bring a gale: in fact a gale will probably not occur more than once out of every three occasions of rapid rise or fall. It is however not safe to conclude, because a gale has not come with a rapidly falling barometer, that it will not come at all. Some of the worst gales come after the pen has ceased falling or even when it has started rising.

Another point worth remembering is that gales with a rapidly rising barometer are generally more squally than gales with a falling barometer.

4. Usefulness of observation of "veil" cloud.—In addition to the backing of the wind and the falling of the barometer another important sign is the clouding over of the sky by a whitish veil of high cloud. If this whitish veil, at first thin, increases in thickness at the same time as the barometer falls and the wind increases, it is almost certain to bring bad weather even although the wind may not actually reach gale force. If, however, the barometer is high and steady, the threatening sky is not as a rule followed by bad weather.

5. Length of warning.—Broadly speaking the barograph will not give a *long* warning of approaching gales; it should be looked at immediately before the period during which the unexpected development of a gale would be dangerous.

Barographs are issued to places all over the British Isles: in some respects the warning of the barograph record is independent of the district: but there are also some general features of difference.

6. Peculiarities of different regions.—In the southern districts of England (and in the Irish Sea) easterly gales often come without much fall of the barometer: thus if the wind is moderate from an easterly direction a small fall of the barometer should be looked upon with suspicion: this is more particularly the case in the late winter and early spring months.

In north-east Scotland and Orkney and Shetland the same is true of southerly or south-easterly gales.

7. Direction of gales.—As regards the direction from which a gale will come the barograph gives only a rough general indication: viz., southerly gales are most likely with a falling barometer and north-westerly or northerly gales with a rising barometer. Valuable guidance in regard to the probable direction of gales and the changes to be anticipated is afforded by observation of the

general type of weather. If for example the wind has been on the whole from some westerly point with alternations of good and bad weather and signs of an approaching gale are observed with a falling barometer, it is extremely probable that the gale will be from S. or SW. at first and that it will change to W. or NW. and that the worst squalls will occur about the time of change of direction.

8. Meaning of steady curve.—In addition to its usefulness in giving warning of approaching bad weather the barograph is also a useful guide in telling whether or not a quiet interval is likely to be brief or prolonged, when the instrument is set to record approximately sea-level pressure. If the level of the curve on the chart is high (above 1020 mb. say), and is keeping more or less flat, then if the weather is quiet it is likely to continue quiet for a period of 24 hours or more. Strong winds may occur with a high level of the curve, but they practically never set in suddenly and are the result of a gradual increase which acts to some extent as its own warning.

The barograph is usually fairly steady in fair weather but fluctuates in unsettled stormy weather. Thus a rapid rise is usually soon followed by a fall. If however the rise (whether rapid or slow) is sufficiently prolonged for the barometer to attain a comparatively high level, an improvement in the general conditions may be looked for.

9. Use in conjunction with "wireless" forecasts.—The barograph can profitably be used in conjunction with the forecasts broadcast by wireless telephony by the B.B.C. General forecasts are issued three times daily; at 10.30 a.m. from Droitwich (5XX) and twice each evening (once on Sunday). Detailed shipping forecasts for twelve hours are broadcast from Droitwich (5XX) at 10.30 a.m. and normally about 9.30 p.m.; on Sundays at 10.30 a.m. and 11 p.m. All gale warnings are included in the shipping forecasts, and are also issued when necessary at fixed hours in the afternoon and evening.*

The "general inferences" accompanying the forecasts indicate the places where the barometer is relatively low (these are usually called either depressions or troughs and are generally bad-weather systems), and where it is relatively high (anticyclones or wedges, quiet-weather systems).

These systems usually move at varying speeds over the sea or earth's surface, and they produce corresponding changes in the barograph record. For example if an anticyclone over London is replaced by a depression two or three days later the barograph record will show that this change was accompanied by a fall in the barometer. The predicted movements of these systems are described in the broadcast messages, so that an observer provided

* The times of issue of gale warnings usually are:—from 5XX, 10.30 a.m. and about 9.30 p.m.; from all stations of the B.B.C., after the time signals at 1 p.m., 4.45 p.m. and 6 p.m. On Sundays from 5XX, 10.30 a.m. and 8.50 p.m.; from all stations after the time signals at 12.30 p.m. and 4.30 p.m.

with a barograph can usually verify for himself whether the movement foretold is being maintained or not. Sometimes the actual movements of the system are different from those predicted. The observer who has had experience in using his barograph in conjunction with broadcast forecasts may be able to detect such cases some six to twelve hours after the issue of a forecast and thus modify the forecast for himself.

II.—CARE OF THE BAROGRAPH.

10. Construction of the instrument.—As its name signifies, this instrument gives a continuous record of atmospheric pressure. In principle it consists of seven or eight aneroid boxes so connected that their motion corresponding to changes of pressure is communicated by a system of levers to a pen which makes a trace on a chart fixed to a rotating drum. The system of levers and the pen arm serve to magnify the motion of the boxes, so that an inch measured vertically on the chart corresponds to a change of pressure of one inch of mercury. The drum is rotated by clockwork.

The atmospheric pressure is measured vertically on the chart while time is measured horizontally. The pressure scale runs from 950 to 1050 millibars. The height of each small division (from one dotted horizontal line to the next full horizontal line) represents 5 millibars of pressure. In the middle of the chart is printed a small subsidiary scale showing the equivalent values of the pressure in inches of mercury. Each division measured horizontally represents an interval of two hours, the corresponding time being indicated at the top of each alternate vertical division. Both sides of the paper should be used.

11. Adjustment of the instrument.—Two different devices for setting the position of the pen on the chart are adopted by different makers. The standard method, shown in the illustration, is to adjust the height of the fulcrum of the principal lever *C* by means of the milled-head screw *D* on the central bridge. In other instruments the adjustment is made by raising or lowering the point in the base plate to which the lowest of the set of aneroid boxes is fixed. This adjustment is made either by a milled-head screw on the base plate between the aneroid boxes and the clock drum or by a screw or square head underneath the instrument.

Instruments sent out from the Meteorological Office are adjusted to indicate the pressure at sea level when put in position at the selected site. Upon receipt of the first complete week's record, it is sometimes found that the pen needs raising or lowering to make the registration correct. In such a case instructions will be issued by the Meteorological Office indicating by exactly how much the pen is to be shifted.

[If the instrument were moved subsequently to a site at a different level, re-adjustment would be necessary.]

12. Exposure.—The instrument should *always* be protected from shaking, from sudden changes of temperature, and from dust and dirt. If kept in an institute available to the fishing community, it should be placed on a very firm shelf some distance

away from a fireplace or other source of heating and not too near a window. If, on the other hand, it is necessary to keep it in a glass enclosed shelter or office window in a public place, it must be shielded from direct sunshine. Should there be any vibration, due to passing traffic, an excellent cushion may be formed with two pieces of rubber tubing on which the four corners of the instrument rest.

13. Friction.—(a) *Clock and lever bearings.*—Friction between working parts of the instrument must be avoided, but where the instrument is kept as free from dust and dirt as possible, it should work well for several years before needing cleaning and oiling of the lever bearings and the clock. With this instrument one may expect that when the clock fails it is time for the overhaul of the whole.

(b) *Pen friction.*—The most serious friction generally occurs between the pen and the paper on which it writes. The pressure of the pen on the paper should be as small as possible. The gate suspension of the pen arm, seen at *B* in the illustration, enables the observer to adjust this pressure to a nicety. Just as a garden gate can be made to close itself gently by tilting the post to which it is hinged just out of the vertical, so the pen can be made to rest very lightly against the chart by tilting the gate *B* very slightly towards the clock. Necessity for this adjustment is often indicated by sudden jumps in the trace when the barometer is rising or falling, and by the failure of the pen to return to its original position after making a "time-mark." The gate should first be loosened by unscrewing slightly the milled head *E*.* It should then be slightly tilted towards the clock drum until the

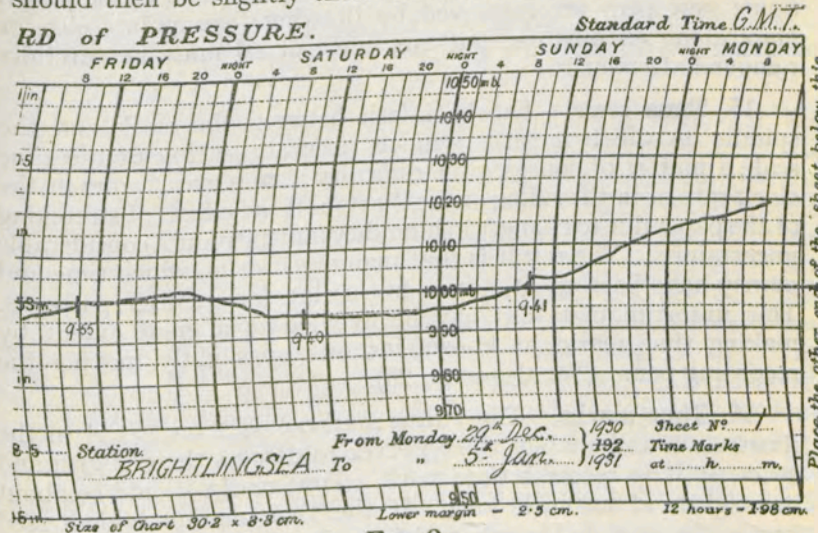


FIG. 2.

pen just falls against the chart. The head *E* should then be carefully tightened again, taking care not to alter the inclination of the gate whilst so doing.

* In some barographs the milled head *E* is omitted. In these instruments the gate fitting can be rotated slightly on its fixing screw.

14. Inking and cleaning of pen.—The pen should be inked by means of the special dipper provided, which is to be seen standing in its case at the extreme right of the illustration. Sufficient ink to reach the level of the three sides of the pen is plenty. Special care must be taken not to let the ink come in contact with the metal style which carries the pen, as this will corrode the style and cause the pen to stick firmly so that it cannot be removed for cleaning. The ink may also cause the style to become brittle and break, when a new one would be required. On no account should a style which has had the tip broken off be used as the length of the pen arm is of vital importance to the scale value of the instrument both as regards range and time. Should the style be accidentally inked, it should be immediately washed, dried and wiped with an oily rag.

When the pen becomes clogged it may sometimes be freed by means of a pointed match; a pin or knife should on no account be used. In persistent cases the pen should be carefully removed from its style or arm, and washed in water or methylated spirit. The pen should be replaced so that it occupies its former position exactly; care should be taken in handling the style as it is easily bent, and a bent style means spoilt records.

A thin clear trace should be aimed at, for if the trace be thick and blurred, many of the smaller variations, such as those shown on the barogram reproduced in Fig. 2, become obliterated and often these variations are the most important of all.

The point of the pen should not scratch or stick to the paper. Some new pens are improved by drawing their points *once* or *twice* along an oilstone, but any trace of oil must be carefully removed afterwards.

15. Time scale.—The back-lash between the clock and the spindle on which it turns, renders accurate setting of the time scale a matter of considerable difficulty; moreover, errors in the clock rate or in the ruling of the charts and the effects of stretching of the paper due to changes in humidity may introduce considerable uncertainty. The result is that many records on which time and money have been spent, are all but useless for scientific purposes. This unfortunate result may be avoided to a great extent by making time marks at known instants by slightly moving the recording pen. (See also para. 20).

16. Time marks.—The "time marker" is shown at *A* in the illustration and enables the observer to depress the pen arm and so cause it to record a time mark. Time marks should be about one-eighth of an inch long. If the time marker is depressed *gently* the pen will mark satisfactorily and the length of the time mark can be kept within the desired limit.

When time marks are to be made they should be made punctually to the minute at a fixed hour daily. Any deviations from this time should be noted to the nearest minute and entered on the records alongside the appropriate time marks as shown in

Fig. 2 before they are filed. If it is inconvenient to make time marks at the same hour each day, other times may be selected but particular care must be taken to note those times carefully in a note-book and *enter them on the records before they are filed.*

[The clock or watch from which the time is taken for the time marks must be compared regularly with a wireless time signal or a post-office time signal to correct any errors in its rate.]

17. Adjustment of the clock.—The clock rate can be adjusted to agree very closely with the time scale of the charts by means of the clock regulator. On removing the lid of the clock, the regulator is disclosed to view either directly or in some cases by moving to one side a small slide.

18. Dating of the charts.—The date, (day, time, month and YEAR) of commencement and end of the record as well as the name of the place, should be entered on each chart either before it is fixed on the instrument or immediately after it is taken off. The chart must be changed each Monday morning. It is strongly recommended that the pen be set to show G.M.T. correctly throughout the year; that is to say, during the period of "British summer time" the time shown by the pen should be an hour behind the clock. The standard of time must, in any case, be shown clearly on each chart by writing in the letters G.M.T. (Greenwich mean time) or B.S.T. (British summer time) in the space provided in the top right-hand corner of the chart. The place at which the record is taken should be entered on the chart. If a record is missed in consequence of an accident (pen not marking, etc.), the fact should be noted on the chart, which should be filed with the successful records and *not* be destroyed or used again.

19. Fixing the charts on the drum.—Before removing the drum from its spindle, the pen should be pulled away from the chart by means of the pen-lifter which can be operated from the outside of the case of the instrument. The chart is placed round the clock drum where it is held in position by a clamp. Care must be taken that the horizontal lines printed on the chart are parallel to the flange at the base of the drum and that the chart fits closely to the drum. As a general rule it is sufficient to see that the lower edge of the chart touches the flange at all points of its length. If the charts are not accurately cut, however, allowance should be made for the fact by eye. This may be done by seeing that the central horizontal lines are continuous where the two ends of the chart overlap and that the bottom edge of the chart touches the flange at one point at least. The clock should then be wound and replaced on its spindle, taking care that the cog wheels on the clock and the spindle engage properly without impact, which might cause damage.

20. Setting the pen.—When starting the record note the correct time to the nearest minute and set the clock drum so that the pen marks the correct time on the chart. The effect of back-lash

is reduced to a minimum if the drum be turned on its spindle so as to bring the pen *back* to the required time from a point in advance of its proper setting. For example, if the chart is changed at 8 a.m. the pen should first be set to 12 noon and the drum then slowly turned backwards until the pen just reaches 8 a.m. While doing this the pen should be held off the paper, otherwise the first few hours of the record may be spoiled.

21. The completed records.*—The custodian is not required to forward all these to the Meteorological Office or the local Fishery Officer but he must furnish the latter with a specimen week's record, complete with daily time marks, whenever one is required for the purpose of checking the adjustment of the instrument; the completed records not required by the Meteorological Office must be retained for reference until they are 12 months old, after which they may be destroyed if the custodian so desires.

Note.—Annual supplies of charts will be sent automatically for use with instruments supplied by the Meteorological Office. The local Fishery Officer should be notified immediately when a new supply of ink or a new pen is required or when any defects in the instrument develop in order that arrangements may be made for the necessary repairs. Correspondence and inquiries regarding the instrument should normally be addressed to the local Fishery Officer.

* This paragraph refers only to cases where the Meteorological Office has supplied a fishery barograph to a fishing community.