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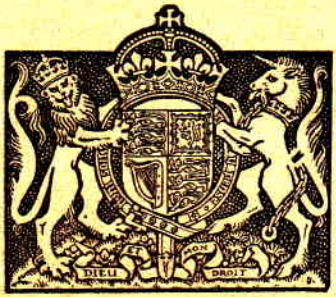

NOTES ON MAP READING

1929

(Reprinted with Amendments (Nos. 1 to 4) 1939)

THE WAR OFFICE

LONDON
HIS MAJESTY'S STATIONERY OFFICE

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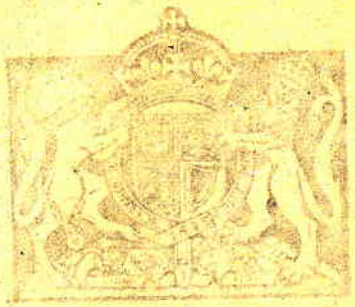

By Command of the Army Council,

H. G. Creedy
2.

THE WAR OFFICE,
30th June, 1939.

INTRODUCTION

This manual is intended for the use of candidates for commissions in the Regular Army and in the Royal Air Force, and also for the instruction of officers and non-commissioned officers. Its object is to provide sufficient instruction in the use of maps to enable the student to visualize, appreciate, and make good use of the tactical features of the ground.

It reproduces Part I of a larger "Manual of Map Reading, Photo Reading and Field Sketching."

These notes will be used in connection with examinations for certificates of education.

CHAPTER XI

ILLUSTRATION OF MILITARY REPORTS

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FINDING THE TRUE NORTH FROM SUN OR STAR

APPENDIX II

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MAP READING

CHAPTER I

INSTRUCTION IN MAP READING

1. *The Object of Map Reading*

The study of map reading must start with a general statement of the object in view: for map reading is not an end in itself.

As it is seldom possible to inspect the ground on which movements will be carried out, or to remember accurately details of such ground once seen, some representation of the area involved must be prepared. This is called a Map.

The object of map-reading is to render possible the clear and accurate visualization of the ground.

2. *The Progressive Steps in Instruction*

To reach that standard the student must be taught to master:—

Chapter II. The names by which the ordinary features of the ground are known, and what meaning to attach to the special expressions and terms used.

,, III. How to measure or estimate distances on the map.

,, IV. By what signs, or symbols, objects are shown on the map.

,, V. How to visualize hill and valley from the contours, and to estimate the intervisibility of points.

,, VI. The difference between true, magnetic, and grid north.

,, VII. The object and use of a map reference.

,, VIII. How to set a map and find position upon it.

,, IX. How to enlarge a map.

,, X. How to use a prismatic compass and protractor.

3. *Maps Generally*

It must be remembered that no map can be perfectly accurate and no map can show more than its scale permits. Even maps of Great Britain, which are as good as possible, are only issued in a revised form every fifteen years, and the

constant alterations and additions in a highly civilized area soon render the best work out of date. The fact that the major portion of the British soldier's instruction will be based on Ordnance Survey maps should not be permitted to lead to an appreciation of Ordnance Survey methods and symbols only.

Constructive common sense and not slavish imitation is the goal to be reached.

Since the "man-in-the-street" is not a qualified map reader, much information is always included in the margin of a map, and the student should be trained to make full use of the data thus supplied and to know where to look for the following information :—

i. What locality it deals with.
ii. Its scale.
iii. Its orientation, and the local magnetic variation (north point).
iv. The conventional signs it employs.
v. The contour system and interval.
vi. The date of issue or revision.
vii. By whom and how it was made.
viii. The system of reference and grid employed.
ix. The names and numbers of adjoining sheets.

Whilst studying each point the student should study how the map itself explains it, and gain the habit of looking at once to the proper place for the information he requires

4. *Map Marginal Lines*

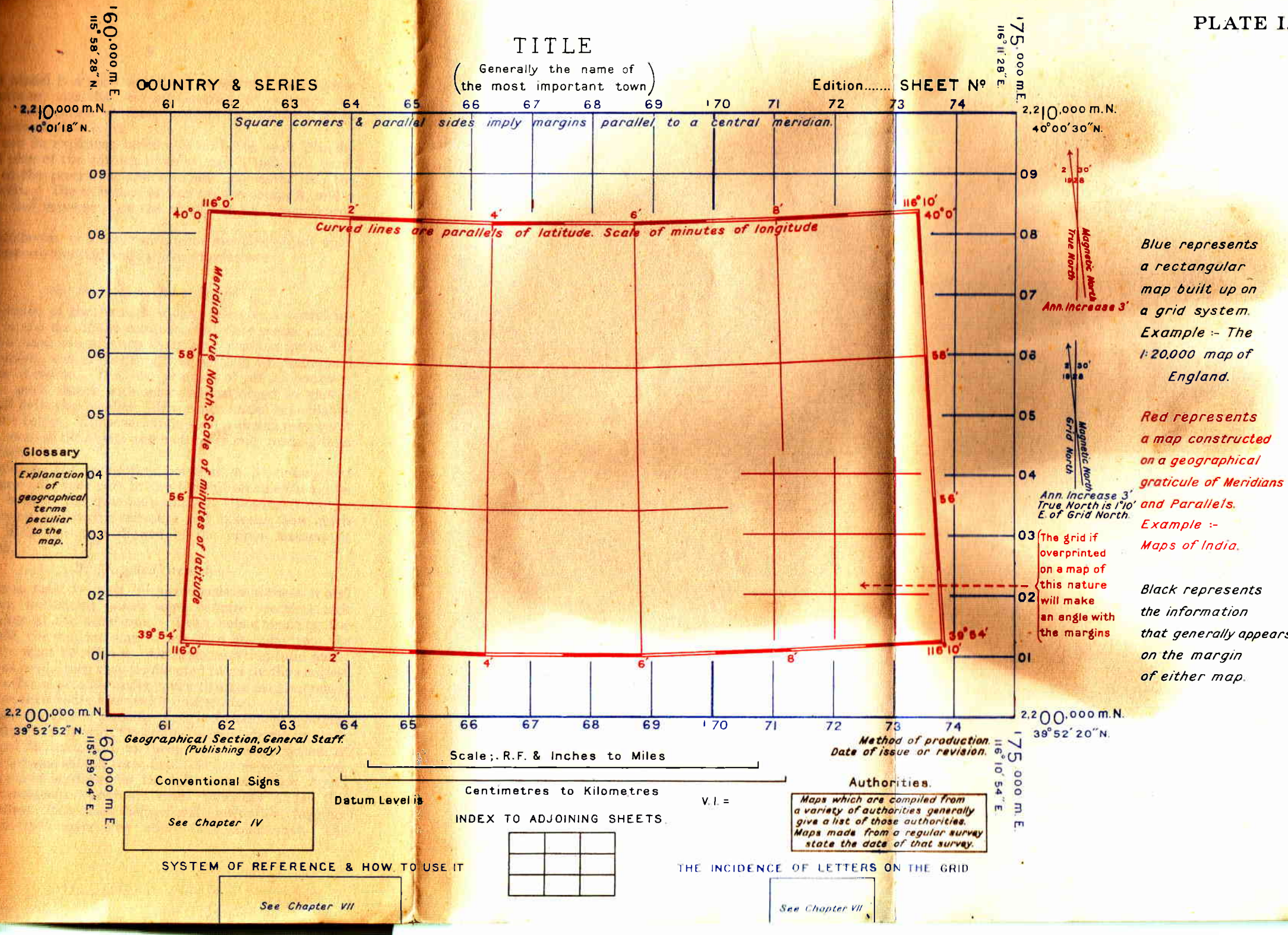
In the course of his service a soldier will deal with all sizes and shapes of map. The only point of consequence in those differences, which do not affect the picture of the ground, is the curved (graticule), as opposed to the rectangular (grid) shape of the bounding lines of some maps. The difference is clearly brought out in Plate I, and should be explained with particular reference to the use of true and grid norths. The practical advantages of a grid for references and for the work of surveying and mapping in the field may here be explained. The maps of Great Britain and of India are the obvious examples to use of rectangular and geographical sheets respectively.

Such possible interesting but unessential points as the position of the origin or the type of projection should form no part of the instruction.

5. *Instruction Indoors*

The practical application of map reading should be emphasized throughout.

PLATE I.



Blue represents a rectangular map built up on a grid system. Example :- The 1:20,000 map of England.

Red represents a map constructed on a geographical graticule of Meridians and Parallels. Example :- Maps of India.

Black represents the information that generally appears on the margin of either map.

A sand model is a most useful aid to learning map names and definitions, and the best introduction to contours and visibility. Instruction in these matters can also be introduced into tactical schemes.

Scales can be explained indoors in no better way than by making a plan of the barrack room at, say, 1 inch to 1 yard. The use of the protractor and compass may enter into the same exercise. The influence of iron on the compass, and a test of its free movement on the pivot, can be demonstrated as a start.

The blackboard, or a table with some movable object upon it, will illustrate the grid and system of reference.

6. *Instruction Out of Doors*

A plan made of the barrack square will give a useful instruction in the use of the compass, and once made, can be "set" and used for practice in finding position (with the compass again), and in checking that position by pacing and scaling the distance. The best practice of all is, however, to make a small sketch with some tactical object in view—say a small defensive locality. If a range finder is available, so much the better. However crude such a sketch may be, it will teach more of the object and method of map reading than many lectures.

To emphasize the connection between map reading and tactics, those who take part in any tactical scheme should be exercised, both at the time and after, in following it on the map, in giving the correct reference and in seeing how much and how little the map showed of the minor features of importance.

7. *Map and Ground*

To learn to read the map, by a comparison between it and the ground, is difficult unless some definite practical task is undertaken at the same time. Thus, before reaching the top of a hill, the student may be asked to describe from the map exactly what he will see. Or again, starting from under some sort of cover, men may be directed to go by the shortest route and as far as possible under cover, to some map reference, and to show their route afterwards on the map.

Where no exercise is possible, and instruction is confined to comparing the map with the ground, a start should be made with tactical features, and, of them, the drainage system of rivers and streams should come first. It is this which shapes the country and accounts for the hill features which should next be considered. Contours come naturally under this latter heading. The trees, hedges and cultivation, together with the natural cover they afford may come next. The

work of man—towns, villages, roads, canals and railways—should come last. The aim of instruction should be to train the mind to form, from a map, a correct mental picture of the country, and to estimate the amount of cover and of tactical difficulty which it is likely to offer. If maps of two different scales are available, a comparison between them, and between each and the country, will explain the amount that a map can show on these different scales. Ultimately it is the standard map, the one inch (abroad the 1/50,000 or 1/100,000), which is the most important. However expedient it may be to start the recruit upon a large scale (say six-inch or three-inch), it must be remembered that the rank and file will see few such maps in war. The large scale will seldom be issued in quantity, except during periods of comparative stability, and the small scale which might be widely used in uncivilized or poorly mapped theatres of war will not be the normal issue for operations or training in a civilized country. It is, however, important to explain how all scales can be read and reference made to them in the light of a common grid.

CHAPTER II

DEFINITIONS

8. *Topographical Forms*

Basin.—(*a*) A small area of level ground surrounded or nearly surrounded by hills, and (*b*) a district drained by a river and its tributaries, *e.g.* the "basin of the Thames."

Col.—A neck or ridge of land connecting two mountains or hills. A col is lower than the mountains or hills it connects, and higher than the surrounding plain or valleys.

Crest.—The general line formed by joining the summits of the main ridge of a chain of mountains.

False crest.—The line along which a lower steep slope changes to an upper gentle slope.

Dune.—A hill or ridge of sand formed by the wind.

Defile.—Any natural or artificial feature which causes a body of troops to contract its normal front during its passage through it, is a defile for that body. A mountain pass is the most common type of natural defile; a bridge, or a raised causeway through a marsh, is an example of an artificial defile.

Estuary.—The tidal mouth of a river.

Escarpment.—An extended line of cliffs or bluffs.

Foreshore.—That portion of the shore between high and low water at maximum spring tides.

Gorge.—A rugged and deep ravine.

Knoll.—A low detached hill.

Main feature.—Those important forms such as ridges, drainage systems, etc., which determine the shape of the country (sometimes called salient features).

Pass.—A road or track over a mountain range.

Plateau.—An elevated plain.

Re-entrant.—A re-entrant occurs where the hillside is curved inwards towards the main feature; it is always found between two salients.

Saddle.—A col.

Salient or Spur.—A projection from the side of a hill or mountain running out of the main feature.

Underfeature.—A minor feature; an offshoot of a main feature.

Undulating ground.—Ground which alternately rises and falls gently.

Watercourse.—The line defining the lowest part of a valley, whether occupied by a stream or not.

Watershed.—A ridge of land separating two drainage basins; the summit of land from which water divides or flows in two directions. A watershed does not necessarily include the highest points of a chain of mountains or range of hills.

This list does not profess to be exhaustive; there are many common words such as hill, mountain, river, slope, island, cliff, ravine, etc., which it is unnecessary to define.

9. *Technical Terms*

Bearing.—True bearing is the angle a line makes with the true north line.

Magnetic bearing is the angle a line makes with the magnetic north line.

Grid bearing is the angle a line makes with the grid north line.

All bearings are measured clockwise.

Contour.—A contour is an imaginary line on the surface of the ground at the same height above mean sea-level throughout its length. Contours may also be defined

as the plans of the lines at which a water surface (of the ocean, for instance) would intersect the surface of the earth were it raised successively by equal amounts.

Contour Interval.—The difference in level between two adjacent contours (generally known as the *Vertical Internal*).

Datum or Datum Level.—The level to which altitudes are referred.

Detail.—All minor natural or artificial features of the ground or on the ground.

Fall of a River.—Its slope, usually measured in inches (or feet) to the mile, thus : 9 inches to the mile.

Fixed Point.—A point is fixed when its position is known and can be plotted on paper in correct relationship to other points.

Form Line.—An approximate contour ; a sketch contour.

Gradient.—A slope expressed by a fraction. Thus 1/30 represents a rise or fall of 1 foot in a distance of 30 feet.

Graticule.—A system of four-sided figures formed by lines which represent portions of meridians and parallels.

Grid.—A system of squares formed by lines which represent progressive distances east and north of a fixed origin.

Grid North.—The lines of a grid point nearly, but not quite, north and south, and nearly, but not quite, east and west. Those which run nearly north and south are Grid North lines.

Hachures.—Vertical hachuring is a conventional method of representing hill features by shading in short disconnected lines drawn directly down the slopes in the direction of the flow of water on the slopes.

Horizontal Equivalent (usually written H.E.).—Is the distance in plan between two adjacent contours.

Latitude.—The latitude of a place is the arc of the meridian from the place to the equator, expressed in degrees at the centre of the earth.

Local Magnetic Attraction.—Is the deviation of the magnetic needle of a compass from its mean position, owing to the presence of masses of magnetic iron ore or of iron in the neighbourhood.

Longitude.—The longitude of a place is the angle at the pole between the meridian of that place and some standard meridian (generally the meridian of Greenwich).

Magnetic Variation.—The angle between the true and the magnetic meridians.

It is called east or west variation according as to whether the magnetic north is east or west of the true north.

Meridian or Meridian-Line.—A true north and south line.

Magnetic Meridian.—A magnetic north and south line.

Orienting or Setting a map, plane-table, photograph, etc., is the process of placing it so that its true north line points to true north.

Plotting.—The process of recording on paper field observations and measurements.

Ray.—A line drawn from the position of the observer, to represent the direction of an object.

Resection.—A method by which the position of the observer is determined by observing the bearings of or drawing lines from at least two previously fixed points.

Section.—The outline of the intersection of the surface of the ground by a vertical plane.

Setting a map.—See Orienting.

True North at a point is the direction of the North Pole from that point.

Vertical Interval (usually written V.I.) is the difference in level between two adjacent contours.

CHAPTER III

SCALES AND UNITS

10. *Definition of Scale*

The word " Scale " means the proportion which the length between any two points on a map (sketch or photograph) bears to the horizontal distance between the same two points on the ground.

Thus if the length between two farmhouses on the map is one inch and the horizontal distance over the ground is two miles, the scale of the map is one inch to two miles.

The word " scale " is also used to denote a line drawn on the map and suitably divided so that measurement of distance can be made, with its assistance, on the map in question.

11. *Methods of Expressing Scale*

1. The scale may be described in two ways—

   i. *In words showing the relation between any unit on the map and any other on the ground.*—As the inch is the unit by which the eye judges small distances, and distances are generally given in miles, English scales are generally made to show a certain number of "inches to the mile" or "miles to an inch." The statement is usually in *miles to one inch* for the one inch and smaller scales: whereas it is usually in *inches to the mile* at scales larger than the one inch. Maps of countries which use the "metre" are, however, generally made to show a certain number of centimetres to a kilometre.

   ii. *By the Representative Fraction* (commonly known as the R.F.), which expresses the same relation in the terms of a fraction with "one" as numerator, the denominator being expressed in the same unit, *e.g.* 1/100. It is obvious that the relation expressed by the fraction remains unaltered whatever the unit employed may be.

The advantage of using the R.F. is that the relation in scale between maps which employ different units can be established at once (see example).

Examples.—The following examples explain the two ways of expressing scales :—

i. Scale 1/63,360 or 1 inch to 1 mile. Here 1 inch on the map represents on the ground 63,360 inches, *i.e.* 1 mile.

ii. Scale 1/100,000, or 1 centimetre to 1 kilometre. Here 1 inch on the map represents on the ground 100,000 inches=1·58 miles; or 1 centimetre on the map represents on the ground 100,000 cms.= 1 kilometre.

2. Supposing that the R.F. alone is given, the number of "miles to the inch" or "inches to the mile" can be found in the following ways :—

i. To find the number of miles on the ground corresponding to 1 inch, on a map for which the R.F. is given, divide the denominator of the R.F. by 63,360.

ii. To find the number of inches on the map corresponding to 1 mile on the ground, divide 63,360 by the denominator of the R.F.

Thus, if the R.F. is 1/80,000, by rule i. the number of miles to the inch is 80,000/63,360=1·26. And by ii. the scale in inches to the mile is 63,360/80,000=0·79.

It is useful to remember that an R.F. of 1/1,000,000 (commonly written 1/M) is equivalent to 15·78 (or approximately 16) miles to an inch. A comparison then tells us at once that 1/250,000 is about 4 miles to 1 inch; 1/2M is about 32 miles to 1 inch; and so on.

12. *Design and Division of Scales*

It is usual on maps and sketches to define the scale in both these ways, and to add at the bottom a printed or drawn scale, divided to show distances in a certain unit.

The unit employed and the R.F. should be stated above the scale. Scales are usually, though not always, made to represent a distance which is a multiple of 10 or 100 units of measure, *e.g.* 100 feet, 50 yards, 80 miles.

A scale should usually be from 4 to 6 inches long, and the first thing to consider is how many tens, hundreds, or thousands of the unit of measure will take up a convenient length on the paper.

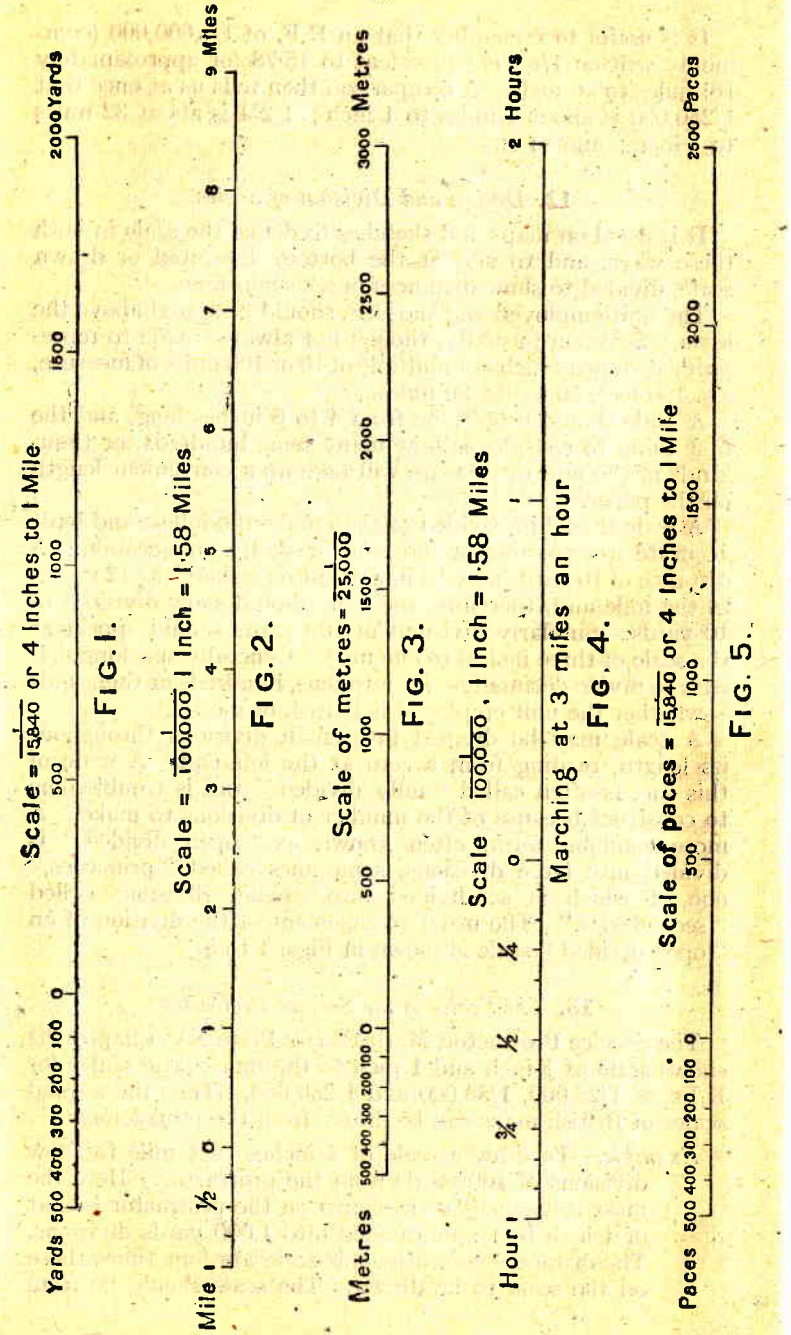
A scale should be divided so as to make the fullest and most accurate use possible of the map or sketch in question. A distance of 10 yards may be important on a sketch at 12 inches to the mile and, therefore, the scale should show divisions of 10 yards. Similarly divisions of 100 yards should appear at the scale of three inches to one mile. Generally speaking it is wise to divide decimally—*i.e.* into tens, hundreds or thousands —whether the unit employed is British or metric.

A scale may be divided into small divisions throughout its length, reading from a zero at the left end. A scale of this sort is often called "fully divided" and is troublesome to construct because of the number of divisions to make. A more common form, often known as "open divided," is divided into large divisions, sometimes called "primaries," one of which is subdivided into smaller divisions called "secondaries." The usual arrangement of the division of an "open divided" scale is shown in Figs. 1 to 5.

13. *The Scales of the Service Protractor*

The Service Protractor, Mark IV (*see* Plate XV, Chapter X) shows scale of ¼ inch and 1 inch to the mile; also scales for R.Fs. of 1/25,000, 1/50,000 and 1/250,000. Thus the normal scales of British maps can be drawn from the protractor.

Example.—To draw a scale of 4 inches to 1 mile to show divisions of 100 yards from the protractor. Here the most convenient scale shown on the protractor is that of 1 inch to 1 mile divided into 1,000 yards divisions. The distances shown on this scale are four times those on the scale to be drawn. The scale should be from



4 inches to 6 inches long. Measuring off this distance it is found that 2,000 yards (8,000 on the 1 inch to 1 mile scale) is the nearest convenient round number. Draw a line equal in length to 8,000 yards on the 1 inch to 1 mile scale; this line represents 2,000 yards on the scale of 4 inches to 1 mile. Divide this line into four equal parts, each representing 500 yards. These are the primary divisions of the scale. Sub-divide the left division into five parts, each representing 100 yards. These are the secondary divisions. The zero of the scale should be placed as shown in Figs. 1 to 5, and the primary and secondary divisions numbered outwards from it.

Primaries should be chosen so as to show miles or kilometres in units, tens or hundreds, or yards, in thousands or five hundreds, according to the unit of measure shown and the size of the scale. Thus a scale of miles or kilometres should show primaries of miles or kilometres; a scale of yards or metres should show primaries of thousands of yards or metres for scales up 1/31,680 in five-hundreds of yards or metres for larger scales. Secondaries should show $\frac{1}{4}$ miles, twentieths of kilometres, or hundreds of yards. Military *sketches* can rarely be of sufficient accuracy to make it necessary to show smaller secondaries; these are, however, shown on the protractor which may be used to measure distances on military *maps*.

14. *Construction of Scales*

The following examples show how a scale may be constructed when no protractor is available:—

1. Example 1.—*To construct a scale of* 4 *inches to* 1 *mile to show divisions of* 100 *yards.*

Here 4 inches represents 1 mile, or 63,360 inches. The R.F. is therefore 4/63,360=1/15,840.

The scale is to be between 4 and 6 inches in length; it will therefore show between 1 and $1\frac{1}{2}$ miles, say between 1,800 and 2,600 yards. Take the greatest round number between these limits, say 2,500 yards.

The length of the scale will then be—

$$\frac{2,500}{15,840}\text{ yards}=\frac{2,500\times 36}{15,840}\text{ inches}=5{\cdot}68\text{ inches.}$$

If it is preferred, the result may be obtained from a sum in proportion, thus—

Yards in a mile.	Yards in the scale.		Inches representing a mile.	Length of scale in ins.
1,760	2,500	=	4	"x"

Therefore x=5·6 inches.

The length of a scale should be calculated to the second decimal of an inch, or the first of a millimetre.

Draw a line 5·68 inches long and divide it into 5 equal parts, each representing 500 yards. Sub-divide the left division into 5 parts, each representing 100 yards, as shown in Fig. 1.

Example 2.—*To construct a scale of* 1/100,000 *to show quarter miles.*

Here 1 mile is represented by 1/100,000 mile=63,360/100,000 inch=0·634 inch. Hence, if the scale is to represent 10 miles in all, its total length will be 6·34 inches.

With the dividers bisect the total length of 6·34 inches, and divide each half into five. The primary on the left will be sub-divided into 4 secondaries, each representing $\frac{1}{4}$ mile. (Fig. 2).

Example 3.—*To construct a scale of* 1/25,000 *to show* 100 *metres.*

On this scale, since 100,000 centimetres=1 kilometre, the length representing a kilometre will be 100,000/25,000=4 cms., that is, about $1\frac{1}{2}$ inches. Consequently 4 kms. can be shown on about 6 inches of scale. In the absence of a scale of centimetres, we may proceed thus—

1 metre=39·370 inches; therefore 4 kms.=157,480 inches, represented by 157,480/25,000=6·30 inches. Divide this length into eight parts, each representing 500 metres. Sub-divide the left primary into five secondaries, each of about $\frac{1}{8}$ inch, representing 100 metres. *See* Fig. 3 and compare it with the scale of metres on the same R.F., on a service protractor.

2. As the value of a scale depends in a great measure upon the accuracy with which it is divided into equal parts, the following method may be adopted :—

To divide the line AB (*Fig.* 6), *into, say,* 9 *equal parts.* From A draw AC of indefinite length, making any convenient

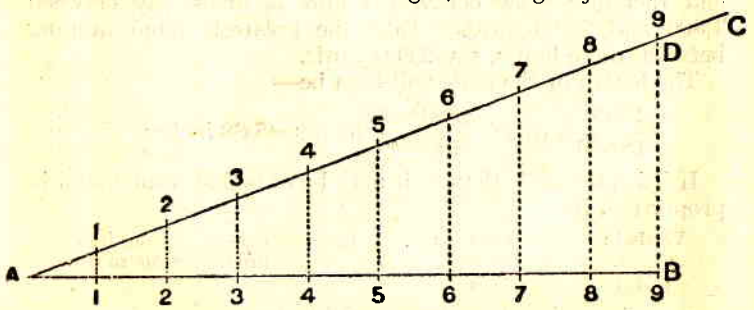


Fig. 6.

angle (say 20° or 30°) with AB. Starting at A, set off along AC nine equal lengths so that the total length divided, AD, is approximately equal to AB. Join DB and then, through each point of division on AC, draw lines parallel to DB and cutting AB, which is then divided into 9 equal parts.

15. *Special Forms of Scales*

1. A map can only have one R.F., but it may have several scales in order to show different units of measure.

Example 1.—In military operations distances are sometimes measured by the time required to traverse them, and in this case the linear scale might be supplemented by a scale of hours and minutes.

To construct a scale of time for a column of troops marching at 3 *miles an hour.*

Suppose the map in use has a scale of 1/100,000, *i.e.* 0·6336 inch to 1 mile or 1 inch to 1·578 miles; 6 inches will then be equivalent to about $9\frac{1}{2}$ miles, or something over 3 hours, which will thus be the range of the scale. Now 3 hours (=9 miles) is 5·70 inches. Lay off this length on the map, or on a small strip of good white cardboard or thick paper, and divide it into 3 parts marked and numbered :—hours, 1, 0, 1, 2. Sub-divide the left division into 12 parts, indicating 5-minute intervals, and the quarter hours as in Fig. 4.

Example 2.—In military sketching it is sometimes convenient to make a scale of paces, since it is only a big man, or one who is consciously pacing long, who can pace a yard. A scale of yards should be given too, and both scales will naturally have the same R.F.

To construct, for sketching, a scale of paces RF $\frac{1}{15,840}$

(Assume that a pace is equal to 30 inches). RF $\frac{1}{15,840}$ is equivalent to 4 inches=1 mile=1,760 yards.

6 inches=$1\frac{1}{2}$ miles=2,640 yards=$\frac{2,640\times36}{30}$ paces

=3,168 paces.

Therefore take 3,000 paces as the length of the scale

x : 3,000 paces : : 6 inches : 3,168 paces.

From which x=5·68″, and the scale will be drawn and figured as shown in Fig. 5.

2. *Diagonal Scale.*—This is a device for dividing a primary division into very small secondaries. If carefully drawn, it is more precise than direct division with the best form of

dividers. Smooth paper and a hard, sharp pencil must be used. The scale is constructed as follows (Fig. 7) :—

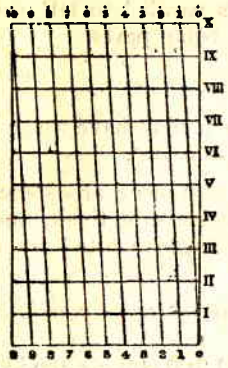


FIG. 7.

Draw 10 equidistant lines, I, II, III . . . parallel to the scale line. In the figure the interval between these lines has been taken at about one-sixth inch, but it may be any convenient distance. It is important that the lines should be exactly equidistant.

Draw a line at each end of the primary (in this case 1 inch division of a scale) perpendicular to these parallel lines. Divide the top and bottom lines (here inches) into the required number (here 10) equal parts and number the points of division (0 to 10) as shown. Join 0 on the bottom line to 1 on the top, 1 on the bottom to 2 on the top ; and so on as shown. Then to measure the distance 0·76 inch, say, run up the diagonal numbered 7 as far as the horizontal line VI. The distance from this crossing to the right-hand perpendicular zero line is 0·76 inch. (See also Plate XV.)

16. *The Choice of Scale*

Maps supplied to the army, in peace or war, vary in scale from a quarter of an inch to the mile, to approximately 2½ inches to the mile. The *standard scale* for training and for operations is one inch to the mile. *Large scale* maps (approximately 2½ inches to the mile) are issued for special types of training and will be issued, when possible, for pre-arranged operations in war. *Small scale* maps, quarter inch to the mile, are issued for specially mobile operations, and for transport and communications.

The scale at which a field sketch is made depends on the object in view, and therefore on the amount of information regarding the features of the country which is required. It is important that the student should realize that the area of paper in a map or sketch varies as the square of the number of inches to the mile (or of centimetres to the kilometre). Thus a portion of ground of a given area will cover *four* times as much paper on a scale of 2 inches to the mile as on a scale of 1 inch to the mile. Beware then of attempting to crowd upon a sketch at a scale of 1 inch to the mile all the detail and information which would appear more correctly at a scale of 2 inches to the mile.

Fig. 8 shows a square mile in its actual dimensions on different scales, and gives a good indication of the most suitable scale to choose for any given purpose.

Road or river reconnaissances and sketches of a defensive

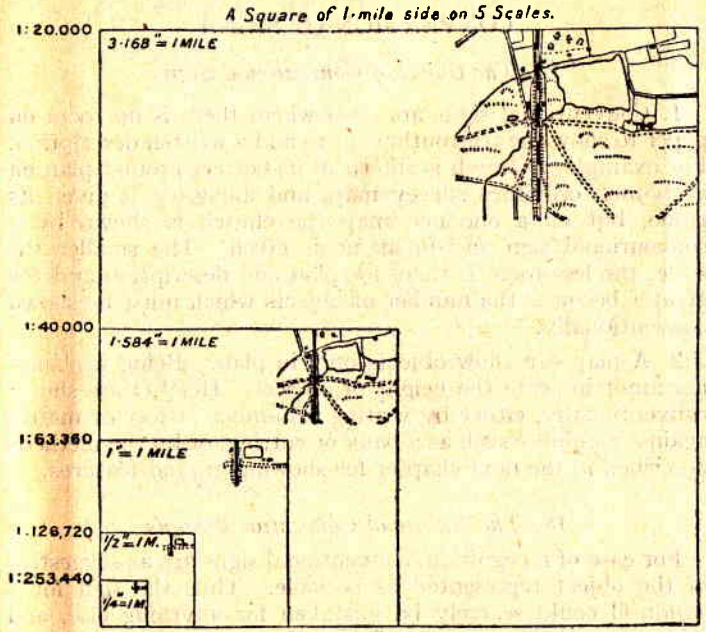


FIG. 8.

or outpost position are usually made on scales ranging from 1 to 4 inches to 1 mile. Sketches which may be required for the defence of a village or town, or for the selection of a camp or billeting area, are generally made on scales ranging from 4 inches to 1 mile and upward.

CHAPTER IV

CONVENTIONAL SIGNS

17. *The Object of Conventional Signs*

1. Conventional signs are used where there is no room on paper to show the true outline, or to add a written description. For example, a church is shown in its correct ground plan on a six-inch ordnance survey map, and alongside is given its name, but on a one-inch map the church is shown by a conventional sign and no name is given. The smaller the scale, the less room is there for plan and description and the greater becomes the number of objects which must be shown conventionally.

2. A map can show objects only in plan. Being itself flat it cannot indicate the height of objects. Heights are shown conventionally, either by writing a number of feet or metres against an object such as a bank or cutting, or by the methods described in the next chapter for showing ground features.

18. *The Nature of Conventional Signs*

For ease of recognition, conventional signs are as suggestive of the object represented as possible. Thus the sign for a windmill could scarcely be mistaken for anything else, and a cross or crescent is included in the respective symbols of churches or mosques. The conventional sign for any object is generally made to approximate to the appearance of that object as viewed from above, with the exception of trees, in which case the side view or elevation is always shown on Ordnance Survey maps. Signs should be as simple as possible to facilitate drawing and printing.

19. *Ordnance Survey Signs and Signs on Royal Air Force Maps*

1. As Ordnance Survey maps will constitute the basis of the training of the young soldier, it is important that the symbols employed on them should be carefully studied. They are shown on Plates II and II*a*, and the more important of these symbols will be found in the bottom left-hand corner of any one-inch sheet.

2. Plate III shows the signs employed for the special use of air pilots. These are of importance to the Royal Air Force only.

ROADS

	Surface over 14' of Metalling	Good & fit for fast traffic	Fit for ordinary traffic	Indifferent or winding road	Bad
Main Routes between Towns / Other Roads					
Roads with less than 14' of Metalling		Main	Other Roads		
Minor Roads					
Bridle & Footpaths					

(Private Roads are uncoloured. Unfenced Roads are shewn by dotted lines.)

Gradients steeper than 1/7

The character of the surface is indicated by colours on the coloured edition.

RAILWAYS

Double Line

Single Line — Principal Station, Bridge over, Tunnel, Viaduct, Station, Cutting, Level Crossing, Embankment, Bridge under

Mineral Lines & Tramways

Electric Railways are shewn as ordinary Railways.

Orchards

Parks & Ornamental Grounds

Toll Bars & Toll Gates — TOLL

Canal & Towing path — (Unfenced) (Fenced) Locks

Aqueduct

Waterpipes or Conduits (underground)

Windpump

Windmill

Church or Chapel with tower

" " " spire

" " " without either

Sites of Antiquities

do Roman Roads

Post, Telegraph, Telephone — T or T

Post Office — P

" " with Telephone — P.T.

Telephone Call Box — T.C.B.

Heights in feet above Mean Sea Level — 145

Contours at 50' intervals — 400, 350

Trigonometrical point

Mile distances — 5

Woods: Deciduous (Unfenced), Coniferous, Mixed

Rough pasture

Marsh

Dangerous Bog

Gravel pit

Quarry or

Boundaries

County

County & Parish

Parish

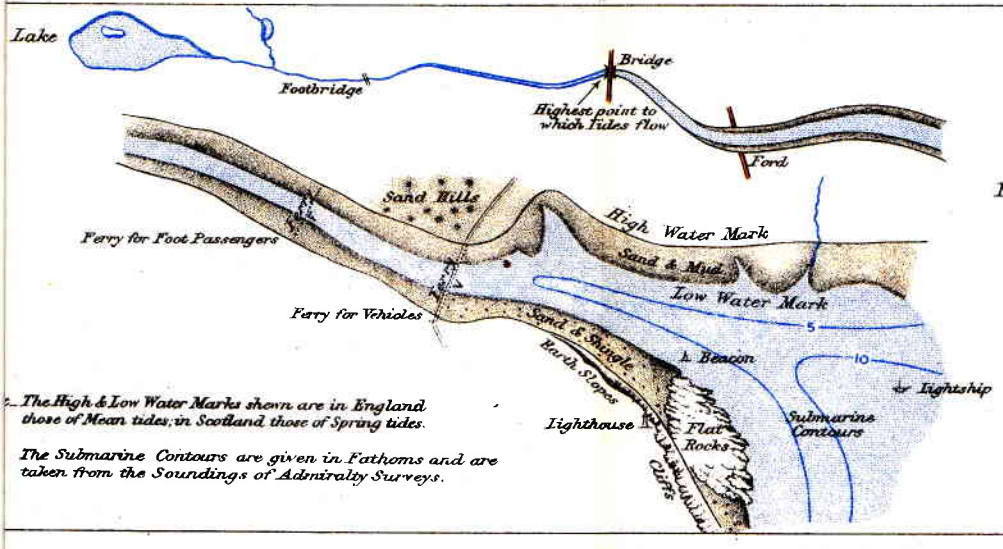
(Scotland)

County (England)

(Parish Boundaries are not shewn in England)

198,000/40. 300 000/41.

CONVENTIONAL SIGNS



Note :— The Mean Magnetic Sheet, for the year given on the margin approximate annual

The High & Low Water Marks shewn are in England those of Mean tides; in Scotland those of Spring tides.

The Submarine Contours are given in Fathoms and are taken from the Soundings of Admiralty Surveys.

CHARACTER OF WRITING

ge District Names	ROCKINGHAM	
ge Towns, Population, over 300,000	LIVERPOOL (England)	GLASGOW (Scotland)
nty Towns d° 100,000 to 300,000	NORWICH (England)	ABERDEEN (Scotland, according to population)
r Towns d° d°	BLACKBURN (England)	DUNDEE (Scotland)
nty Towns d° 30,000 to 100,000	CHESTER (England)	
r Towns d° d°	DARLINGTON (England)	PAISLEY (Scotland)
nty Towns d° 10,000 to 30,000	DURHAM (England)	
r Towns d° d°	MARGATE (England)	AIRDRIE (Scotland)
nty Towns d° under 10,000	DORCHESTER (England)	
r Towns d° d°	LICHFIELD, WEM. (England)	DALKEITH (Scotland)
sh Villages & Villages with inhabitants and over	Bishopstoke	
r Villages	Barton (England)	Barton (Scotland)
nlets & Small Districts	Bickley	
sions, Farms &c.	Burton	
l Parks, Forests & Large Moors &c	RICHMOND PARK (England)	MAR FOREST, Glenmore For. (Minor) (Scotland)

Principal Lakes, Bays & Rivers	Wl
Minor d°	Ma
Large Islands	IS
Secondary d°	HC
Minor d°	Ba
Principal Headlands	St
Secondary d°	He
Minor d°	Col
Important Ranges of Hills	Ml
Minor Hills & Hill Features	Nor (Er
Important Valleys	TA
Minor d°	Pai
Railways (Passenger)	] (Lon
d° (Minerals)	Gor
Railway Stations	DUN
Antiquities	ROM. Wall
Parish	

ORDNANCE SURVEY CONVENTIONAL SIGNS AND WRIT

Roads

Ministry of Transport. Class 1 — A.40

" " " " 2 — B.4082

14 feet of Metalling and over (not classified by Ministry of Transport)

Under 14 feet of Metalling. Tarred

" " " " Untarred

Minor Roads in towns, Drives and Unmetalled Roads

(Unfenced Roads are shown by pecked lines)

Footpaths and Bridle Paths

Gradients of 1 in 5 or steeper

Gradients over 1 in 7 and under 1 in 5

Toll Bars, Toll Gates, Gate — TOLL

Course of Roman Roads

* Principal, 18' of Metalling and over or First Class, fit for fast traffic

* Secondary, 14' of Metalling " " " Second Class, fit for ordinary traffic

* Other Metalled Roads — Good / Indifferent / Bad

* Drives & Unmetalled Roads

Note:- Differences of Road Classification where they occur between the Ordnance Survey and Ministry of Transport are due to the fact that the former is based on examination on the ground, while the latter has more particular regard to the traffic value of the road as a means of through communication.

* Ministry of Transport Road Numbers, Class 1 — A.40

* " " " " " " 2 — B.4082

Note:- On Military Maps made from this Edition only one road colour is used, irrespective of the black symbol, classifying roads as shown thus.

Main Roads

Secondary "

Other "

Other Symbols

Church or Chapel with Tower

" " " Spire

" " " without either

Post Office with Telegraph and Telephone — P

Other Post Offices — P

Telephone Kiosk (G.P.O., A.A., R.A.C.) — T

* Post Office only — P

* Telegraph Office — T

* Telephone (public) — t

* Telephone Call Box (public or private) — t.c.b.

Youth Hostel — Y

Windmill

Windpump

Sites of Antiquities

Trigonometrical Point

Heights in feet above Mean Sea Level — 286

Site of Battle — Hastings (A.D. 1066)

Intersection, Latitude & Longitude at 5' Intervals (not shown where it obliterates important detail)

Wireless Aerial Mast

* Wireless Aerial Mast (over 150 Feet) * (under 150 Feet)

Glasshouses

Boundaries

National

County

County & Parish, County Borough

Parish

Orchards

Parks

Public Parks &c

National Trust Areas — Ranmore Down

Woods

" * Deciduous

" * Coniferous

" * Mixed

Rough Pasture

*

Marsh

Gravel Pit

Quarry or Cliff — or

Ordnance Survey, 1935.

* Note:- On Sheets prepared prior to September 1935, the symbols (marked with an asterisk) are used.

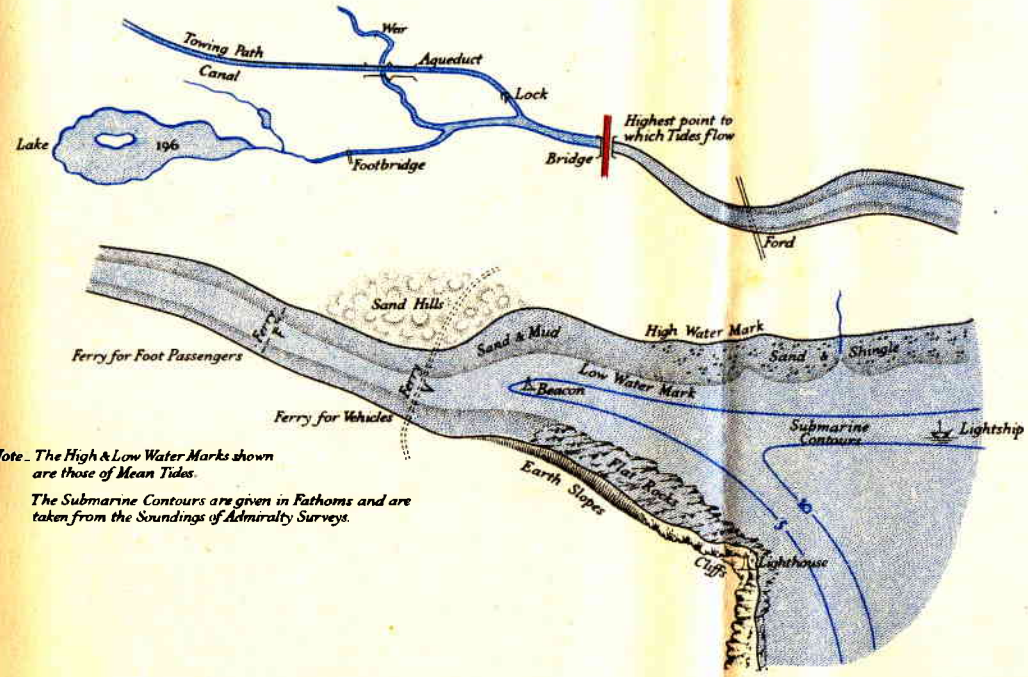
ING for the REVISED ONE-INCH MAP of GREAT BRITAIN *Fifth (and Fifth RELIEF) Editions* PLATE IIA.

...ine, Normal Gauge ★ Double Line
... " " ★ Single Line
... Gauge ★ Mineral Lines
... ★ Narrow Gauge and Tramways
...ailways are shown as ordinary Railways
...y Transmission Lines (with pylons spaced conventionally)
...r (water)

Principal Station, Bridge over, Tunnel, Cutting, Footbridge
Viaduct, Station, Embankment
Station (closed), Level Crossing, Bridge under

Arrow indicates direction of flow

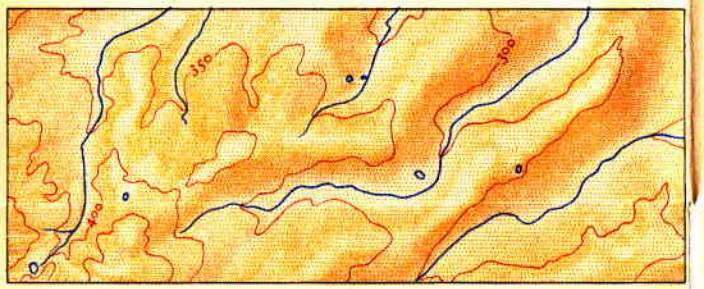
★ Note:- On Sheets prepared prior to 1933 the symbols for Railways (marked with a star) are used.



Note. The High & Low Water Marks shown are those of Mean Tides.

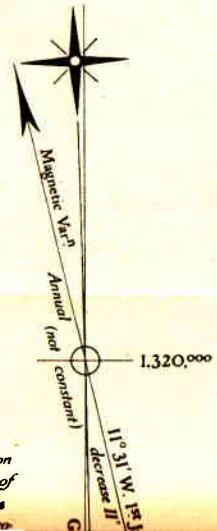
The Submarine Contours are given in Fathoms and are taken from the Soundings of Admiralty Surveys.

CHARACTER OF RELIEF



On Military Maps made from this Edition, Hill Features are shown by Contours only.

Drawn on the Transverse Mercator Projection.
Origin of Projection 49°N, 2°W.



Note:- The Mean Magnetic Variation for each Sheet, for the year of publication is given on the margin together with the appro...

Character of Writing	
Towns, Population over 300,000	LIVERPOOL
" " 100,000 to 300,000	SUNDERLAND
" " 30,000 to 100,000	CHELTENHAM
" " 10,000 to 30,000	DARTFORD
" " under 10,000	LICHFIELD
County Towns, according to population	WINCHESTER
Parish Villages	Hambledon
Parish (where there is no parish village)	ST JOHN THE BAPTIST
Other important Villages	Bracknell
Small Villages	Swanwick
Hamlets	Coleman Green
Mansions	Welbeck Abbey
Farms &c	Newland F^m
Districts in Towns	Clifton
Royal Parks, Forests & Large Moors	RICHMOND PARK
Principal Lakes, Bays & Rivers	WINDERMERE
Minor "	Malham Tarn
Large Islands	ISLE OF WIGHT
Secondary Islands	HOLY ISLAND
Minor "	Cardigan Island
Principal Headlands	START POINT
Secondary "	Heatherwood Point
Minor "	Colbost Point
Important Ranges of Hills	MENDIP HILLS
Minor Hills	Norton Top
Important Valleys	TAFF VALE
Minor "	Painswick Valley
Railways, Normal Gauge	L.M.& S.R.

SPECIAL ROYAL AIR FORCE CONVENTIONAL SIGNS

The Conventional Signs used upon the Quarter Inch R.A.F. Series.

Main Roads between Towns
Other Metalled Roads
Railways — Station
Mineral Lines and Tramways
Race Course — R.C.
Church or Chapel with Tower or Spire
Golf Course
Windmill
Lighthouse — Lightship
Aerodrome
" with Direction Finding W/T Station
Seaplane Station (Dotted over the land)
Landing Ground (permanent)
W/T Station with masts exceeding 250' in Height
Air Navigation Light
Prominent Landmarks or Ground Signs
Prohibited Flying Area
Name of Aerodrome, Landing Ground or Seaplane Station — HENDON
D.F. Station

Administrative Signs on Maps, Sketches or Annotated Photographs.

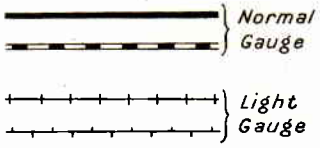
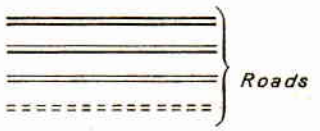
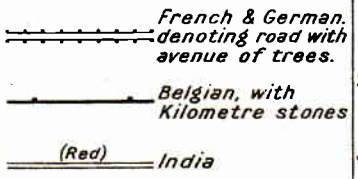
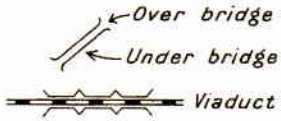
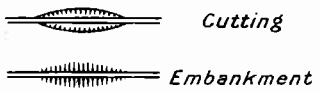
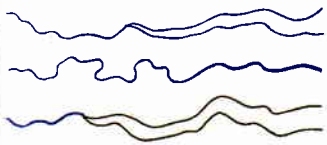
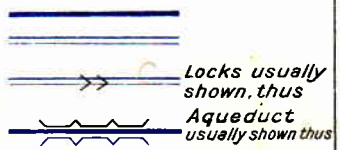
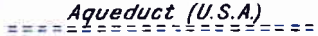
Aerodrome
Temporary Landing Ground

Note :- The internal symbol denotes character and the outline gives the actual shape on the ground. This outline is given only on large scale maps.

Army Co-operation
Bombing day or night } Squadron
Fighter
Aircraft Park
" Depôt
Port Depôt
Wing H.Q.
Group H.Q.
Airship
Balloon

85,000/40.

Ordnance Survey, 1929.

	Usual Types	Variations	Notes
RAILWAYS			1. The number of railway lines is written against the conventional sign. 2. Indian maps have a variety of railway signs which should be studied in the list in the bottom margin of each map.
RAILWAY STATIONS			These symbols may be in red or black according to the colour in which the railway is printed.
ROADS			1. Difference made between classes of roads depend on the country: look at the foot of the map. 2. As a rule road signs express the importance of a road but give no indication as to the surface. 3. On Ordnance Survey maps roads are coloured to show whether surface is good or bad.
BRIDGES		May be in black or red depending on the colour in which the road or railway is printed.	The type of bridge is shown by various symbols varying with each country: see at the foot of map. Some countries write against the bridge IRON; MASONRY; SUSPENSION, etc. to indicate its construction.
CUTTING AND EMBANKMENT		Sometimes in brown U.S.A.	Many maps do not show this feature on small scales.
RIVERS		Non-perennial rivers are sometimes shown by a broken blue line or in black instead of blue. Broken blue lines, however, may often denote that the course of the river is unsurveyed.	These symbols are practically universal. A stream is usually shown as a single line, then as a thick until its breadth reaches a stage where the banks can be shown as separate lines.
CANALS		 Variations showing footpaths or towpaths, differ with countries: see foot of map.	

FERRIES

FORDS

MARSH LAND AND SWAMP

WOODS AND ORCHARDS

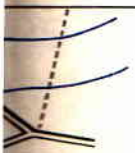
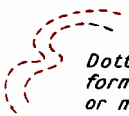
CHURCHES

WINDMILLS AND WELLS

CONTOURS

OR 1418 27,000/11/43,Wa.

PLATE IV

...pes	Variations	Notes
	In England V or F is written along side the Ferry to show whether it carries Wheeled (Vehicular) or only Foot Traffic.	The type of Ferry, whether chain, oar or motor is often shown by the shape of the boat.
	The Japanese carry the road across the river but show no bridge sign.	The road to the river is generally carried across dotted or stops on the bank and the word 'FORD' written.
	The two symbols are sometimes mixed together. On Japanese maps the marsh sign is often partly black & partly blue.	In the case of Mangrove Swamps, Jungle Swamp, etc: the swamp symbol is usually interspersed with a Tree symbol denoting type of swamp.
...chards ...nes & ...pacing ...ads ...f green ...lack or green ...r spacing	Latin-European Countries show trees in plan. Ex: 1:40,000 Belgium.  a. Deciduous  b. Coniferous Coconut Palm Trees Malay Gold Coast	1. Many maps show different types of vegetation by various tree symbols in black or green. 2. All maps differentiate between plantations and woodland by showing the former in a regular pattern, the latter in an irregular pattern.
...er or spire ...her ...additions	France ⊙ ○ Interior dot implies trig. point Eastern Maps Special signs used for temples or pagodas	The idea of all these symbols is to suggest the religion by its correct emblem used as a conventional sign.
...Water Mills ...ps	France	
	1. Contours may be numbered on the face of the map or on the edges. 2. The contours may be in black or red or brown, the latter being the most common. 3. Look at the margins of the maps to see if the V.I. is in feet or metres.	 Dotted lines may represent form lines (approx: contours) or may be inserted between contour spaces at the regular V.I. to show some underfeature of importance which would be missed by the ordinary contours.

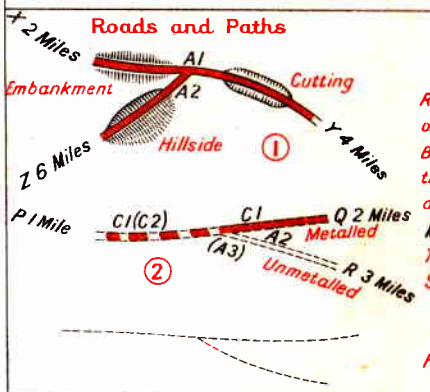
Ordnance Survey, 1928.

CONVENTIONAL SIGNS FOR FIELD SKETCHING

FOR SIGNS OF MILITARY SIGNIFICANCE, eg. TROOPS, OBSTACLES, DEPÔTS, ORGANISATION etc. SEE PLATES III and VI

Lettering to be modelled on that of this plate. In no case is fancy lettering to be used. Words which should appear on the sketch are shewn in black.

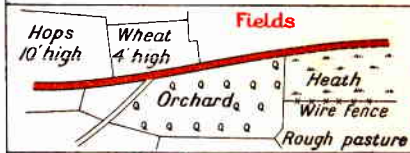
Roads and Paths



Road 1 enclosed by, and 2 without hedge, fence, ditch, or obstacle of any kind.
Brown tint denotes metalled road suitable for traffic at all times. Metalled roads likely to be cut up in bad weather dotted brown. If brown colour is not available, the word **Metalled** or **Unmetalled** should be inserted.
The classification of the road according to Chap. XVIII, Sect. must be added. A1, C3, etc.

Footpath

Fields

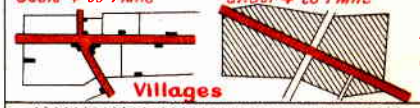


Fields with walls, hedges, fences, ditches or any obstacle. It is unnecessary to state the nature of the cultivation unless such information is required by the object of the sketch.

Woods

if colour available. Nature of wood to be given in writing - "Oak," "Pine," "Mixed" etc. Cover from air observation to be indicated "Dense" or "Open." In case of tank movement, see conventional sign sheet Plate VI for details of diameter and spacing required.

Villages



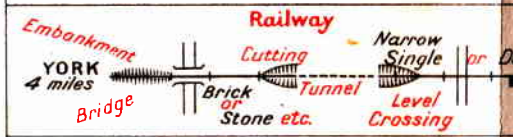
These scales are only suggested. Amount of detail in villages depends on object of sketch and time.

Clearance or Demolitions.

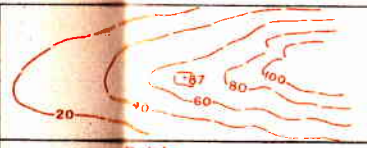
P. Post Office	Church or Chapel with Tower.
T. Telegraph Office	" " " " Spire.
S.P. Sign Post	
o W. Well	Church or Chapel without Tower or Spire.
o S. Spring	Windmill.

Air line or cable Buried — Telephone or Telegraph

Railway

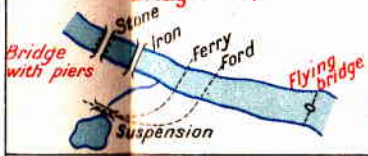


When there is not sufficient time to draw the crossbars, a railway may be shewn by a broad black or red line with the word "Railway" written along it. The guage of the railway must be inserted as "broad, standard, narrow, or tramway."



Form lines and spot heights.

Bridges etc.

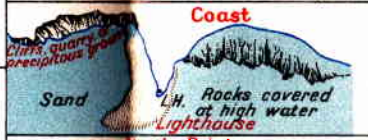


Bridges: State nature: Stone, Iron, Suspension, etc.
Ford or Ferry: State nature of traffic that can use it.

Rivers

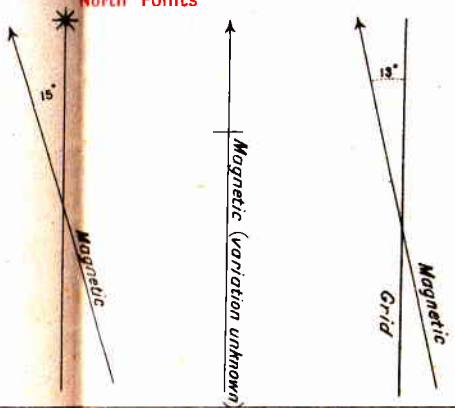
State nature of banks and, if possible, bottom, whether it is dry or flowing and whether subject to floods.
Width of waterway in ft 25 w.
Depth " " " " 3 d.
Height of banks " " -6.

Coast



State nature of foreshore and at what state of the tide it is practicable for landing. Quarries and precipitous ground are shown in the same manner as cliffs.

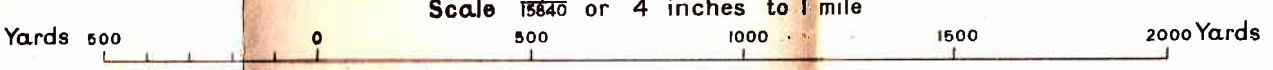
North Points



If magnetic variation is not known shew only magnetic north and state "Variation unknown."

A TYPICAL SCALE FOR A SKETCH

Scale 1/15840 or 4 inches to 1 mile



85,000/40.

MILITARY CONVENTIONAL SIGNS TO BE USED ON MAPS, SKETCHES OR ANNOTATED PHOTOGRAPHS.

(see also Plates III and V)

SUCH ADDITIONAL SIGNS AS OPERATIONS OF A PARTICULAR CHARACTER MAY MAKE NECESSARY WILL BE PUBLISHED IN ORDERS.

Batteries and Gun Emplacements:-

- General — Nature of Arty:-
- When scale allows individual Emplacements, fixed by photograph, are to be shown. — 6"How., 18 Pdr., 12"etc.

Anti-aircraft:-

- A section of guns
- Machine gun
- Searchlight.
- Visual plotting station
- Anti-tank Guns — Artillery — Cavalry or Infantry
- Machine "
- Machine Guns (for use on maps of a scale of 1:25,000 and over)
- Trench Mortars

Dumps:-

- Supply — S
- Petrol — P
- Ammunition — A
- Engineer — E
- Hutments
- Dug-outs
- Searchlight
- Observation Post — O.P.
- Signal Office (Telephone or Telegraph) — T.
- Wireless Telegraph Station — W/T.
- Radio Telephony Station — R/T.
- Beam Station — B
- Direction Finding Station — D/F.
- Visual Signalling Station
- Hospital, Clearing Station or Aid Post

Gas:-

- Gas Projectors — G.
- Gassed Areas (shade YELLOW when possible) — Mustard

Obstacles:-

- Abatis
- Wire Entanglement — on posts / coiled
- Chevaux de Frise

System of Trenches:-

Old or disused trenches are shown dotted.

Tanks:-

- Tank Trap
- Road Block
- Mine
- Mine-field
- Areas strewn with Rocks or Boulders of 18 inches or greater Diameter.

Bridges:-

- Weight capacity of Bridges and Culverts in tons. — 14

Embankments and Cuttings:-

- Height of Embankment in feet — +9
- Depth of Cutting " " — -10

Water:-

- Width of Water-way in feet — 16 w.
- Depth " " " " — 5 d.

Woods:-

- Average diameter of trees in inches — 5 d.
- " spacing " " " feet — 10 s.

TROOPS and HEADQUARTERS:-

Titles will be written alongside the appropriate sign and the authorized abbreviations will be used.
Where necessary (M) will be inserted against mechanized units.

Troops:-

	Cavalry	Artillery	Infantry	Tanks	Armoured Cars	Transport H.T.	Transport M.T.
Individual							
Units:- General		6					
Column of Route							

Headquarters:-

- G.H.Q.
- Army
- Corps
- Div.
- Bde. (Cav. or Inf.)
- Regt., Bn. or Arty. Bde.
- Sqn., Coy. or Bty.
- Tp. or Pl.
- A.A. Div.
- A.A. Group
- A.A. Bde. or Bn.
- A.A. Bty. or Coy.

Thus:-

- 5 Inf. Bde.
- 3 R. Tanks
- B Coy.
- 5 Pl.

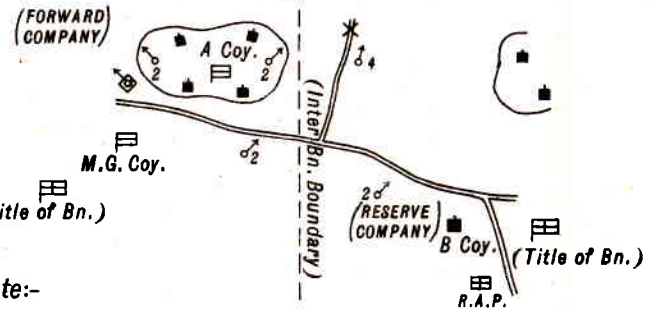
Examples:-

Fd. Bde. R.A. (mechanized) — 17 Fd. Bde. (M)

Unit deployed- one company. — B Coy.

Defended Locality- one platoon. — L.G. 6 Pl. L.G.

Troops in defence:- showing portions of two battalions.



Note:-

These examples show the use of signs and are not to be taken as standard dispositions.

SIGNS WILL BE SHOWN IN RED FOR BRITISH (AND ALLIES) AND IN BLUE FOR ENEMY.

85,000/40.

20. *Other Conventional Mapping Signs*

Later on the soldier will have to use other maps, either at a station abroad or in war. The conventional signs used will not be the same as those of the Ordnance Survey. Differences will be found unimportant, however, if it is remembered that anything new will almost certainly be explained in the left-hand bottom corner. Plate IV is inserted in order to show the signs generally in use for the more important objects on maps other than those of the Ordnance Survey.

21. *Conventional Signs for Sketching*

The signs shown on Plates II, III (partly) and IV are suitable for use on printed maps. In sketching, however, signs must be bolder for convenience in drawing by hand, and others must be added to show the extra information that the larger scale of a sketch generally entails. These signs must also be known, and are given on Plate V.

22. *Conventional Signs for Items of Military Importance*

The maps normally produced in times of peace, and used for training, have no special military information printed on them. In war, however, and occasionally for reports or special exercises in peace, special military information is overprinted on the map. Conventional signs are as necessary for this purpose as for showing ordinary map detail. The proper signs to use are given on Plate VI.

23. *Conventional Signs for Troops and Units*

A sketch made to illustrate a military report must often show the dispositions recommended for attack or defence. The proper signs to use for this purpose are also given on Plate VI.

24. *General on Signs*

All the conventional sign plates which must be studied have been collected and arranged together, because it is sometimes difficult to be sure exactly which category is correct in any particular case. It should be remembered that the only sign list important in early study is Plate II. When the time comes to make the first military sketch Plates V and VI will be wanted. Plate III is required by the Royal Air Force only, and Plate IV will normally be for reference only.

CHAPTER V

RELIEF AND ITS REPRESENTATION

25. *Hill Features and Methods of Representing them*

The chief difficulty felt by most students in map reading is that of understanding the methods used to represent hill features. There are several ways in which hill features and heights may be indicated on a flat surface, viz. :—

i. Contours (including form lines).
ii. Hachures.
iii. Hill Shading.
iv. Layer Tints.
v. Spot Heights.

Methods i and ii are distinct in themselves and are seldom combined on the same map. Method iii is rarely found except in conjunction with either i or ii. Method iv is invariably associated with contours i, and method v is used on practically every map, in connection with one or other method or combination of methods.

26. *Description of Contours*

These are best explained by the following simple practical illustrations :—

All students will be familiar with the ordinary wooden or plaster models sometimes used to represent, in relief, hills and other geographical features. Say we have such a model, the scale of which we know to be 1/12, *i.e.* 1 inch on the model representing 1 foot on the ground. Place the model in an empty tank or bath and pour in water until there is a depth of 1 inch in the bath. The watermark will cut the model all round, 1 inch vertically above its base. Draw this watermark on the model with a pencil. Now add water until there are 2 inches in the bath and draw in the second watermark. Continue to add water by inches in this way, and to draw in the successive watermarks, until the model is completely covered with water.

On removing the model it will be found to be marked with a succession of lines which are vertically 1 inch above the other (Fig. 9). These lines are " Contours."

Now if a drawing of the model is made, as seen from above, *i.e.* a plan of the model on the actual scale, " Contours " at

1 inch vertical distance will appear on it, or in other words a map of the actual ground on a scale of 1/12 with contours at a vertical distance of one foot will have been made. The

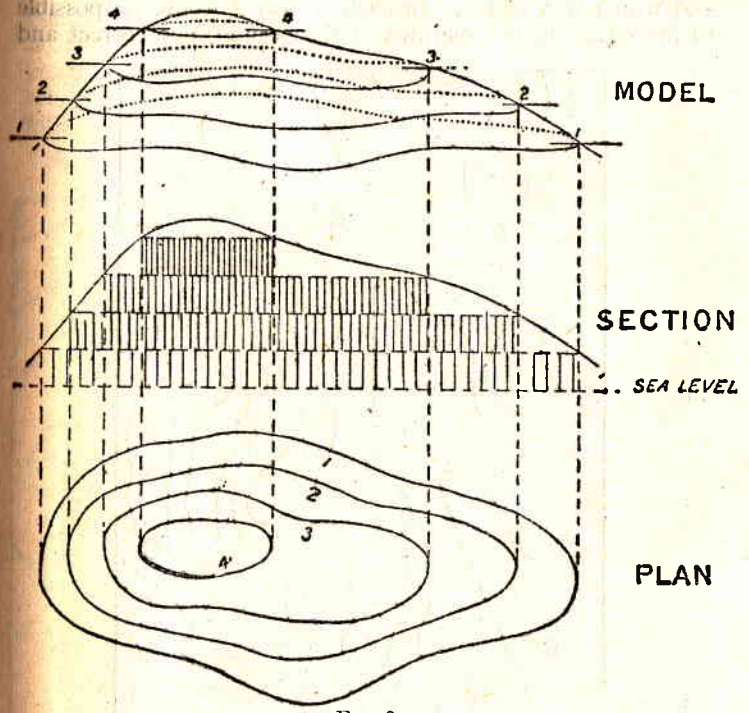


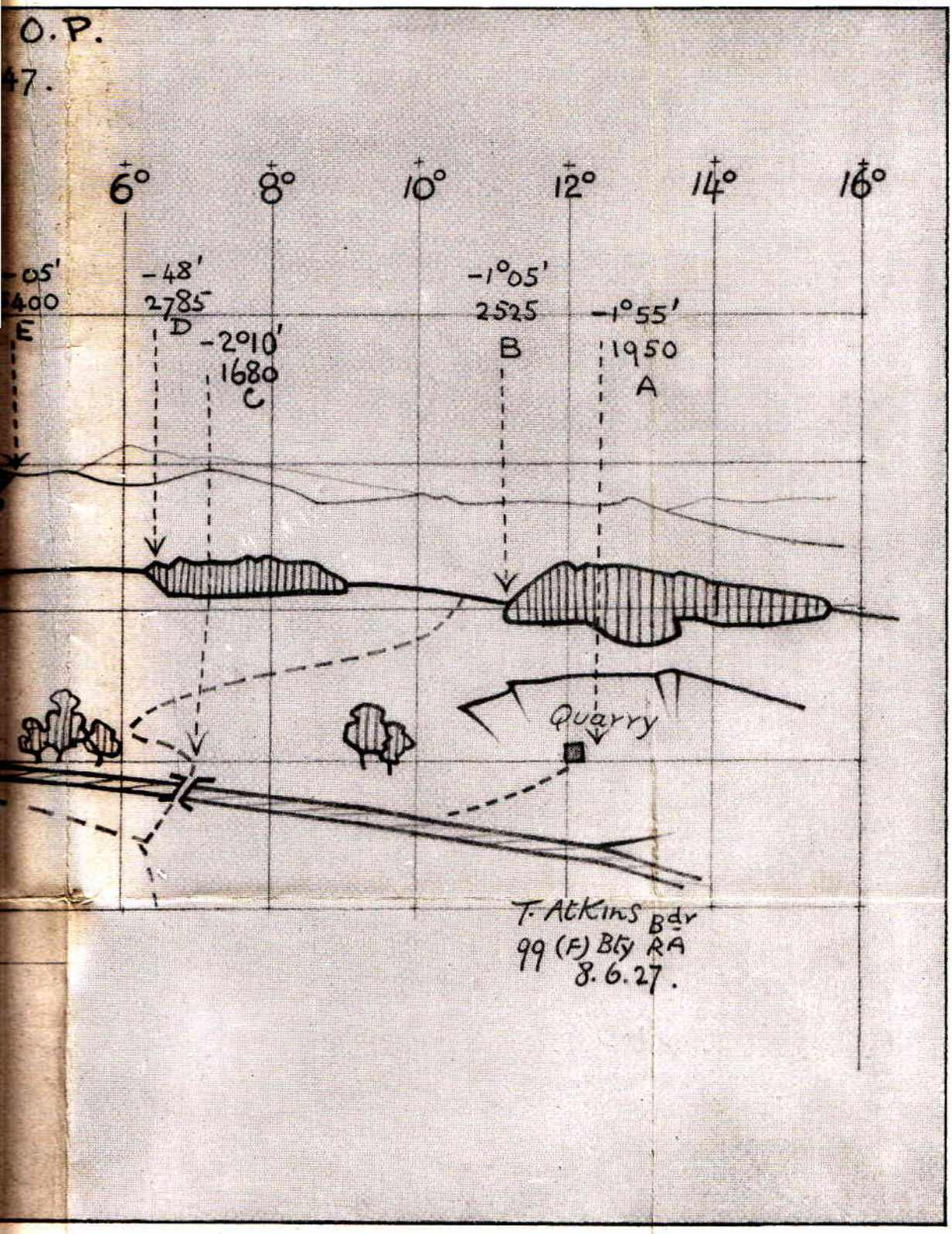
FIG. 9.

Model of Hill with Contours visibly marked, and Plan of same.

vertical distance between the contours is known as the " *Vertical Interval* " (commonly written V.I.). Thus a footnote on a map " Contours at 1 foot V.I." means that any two successive contours are separated by a vertical interval of one foot.

27. *Reading Contours*

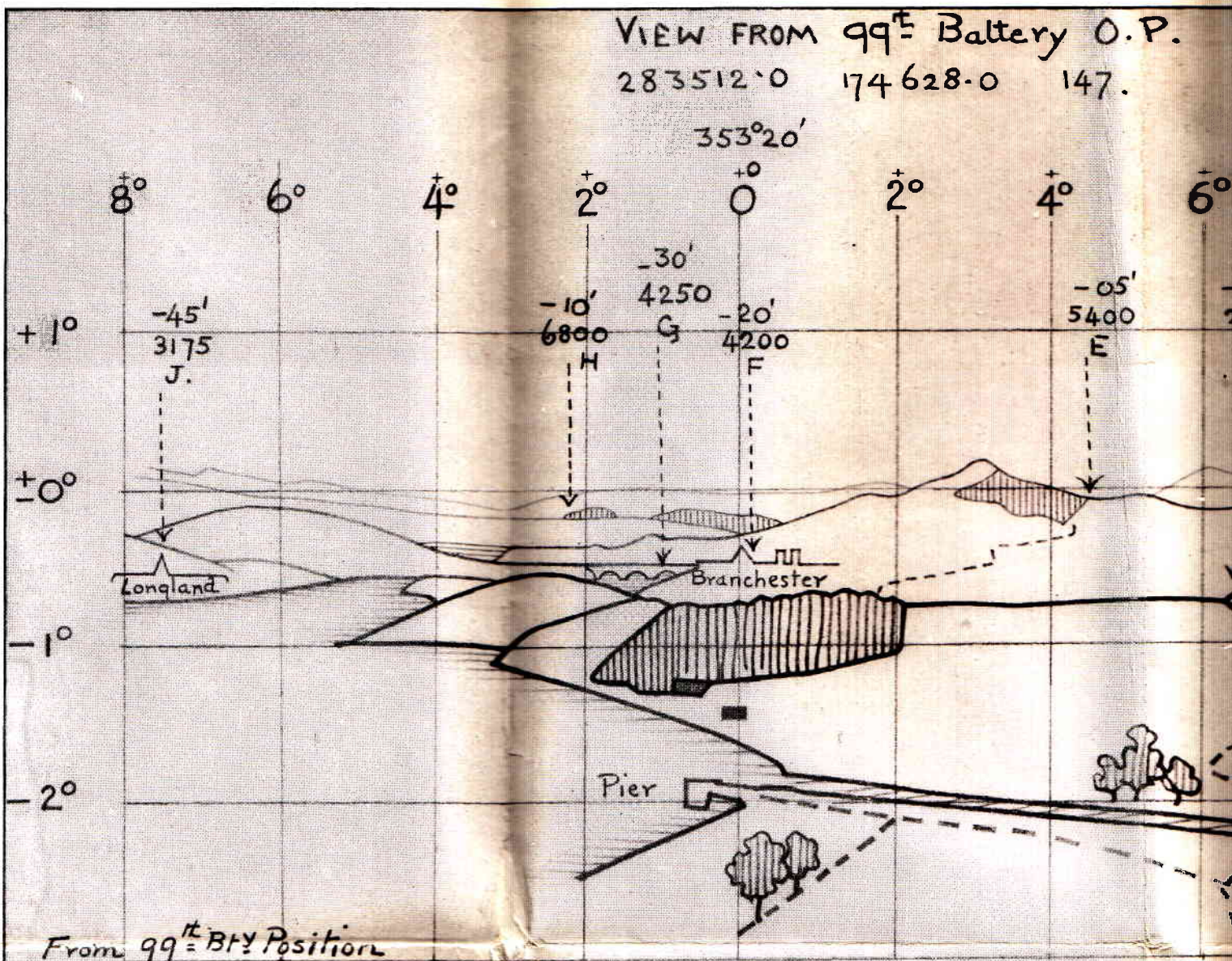
1. The relative position and curvature of contours affords clear evidence of the shape of the ground. The main conclusions which may be drawn from their shape and spacing are here considered. A comparison of the ground with a well-contoured map will suggest others. The student must study this subject with care, as he who cannot understand the evidence of contours will understand neither the map nor the country it represents.



Ordnance Survey, 1929.

VIEW FROM 99ft Battery O.P.

283512·0 174628·0 147.



From 99ft Bty Position

282981·0 173518·5 130

		Line	A of S.	Range	Reliability
A	Quarry House	8° 05' R	−0° 55'	3150	Battery
B	Leyton Wood. L. edge	9° 27' R	−0° 05'	3675	Brigade
C	Morley Bridge	2° 15' R	−1° 10'	3000	Battery
D	Little Leyton Wood. L. edge	4° 49' R	±0° 0'	3825	Brigade
E	Turlip Wood. R. edge	1° 15' R	+0° 45'	6750	Survey Company
F	Branchester Church	0° 0'	+0° 05'	5350	Survey Company
G	Branchester Bridge	0° 48' L	+0° 03'	5350	Battery
H	Little Badley Wood. Ledge	0° 10' L	+0° 40'	8225	Brigade
J	Longland Steeple	6° 45' L	±0° 0'	3150	Survey Coy.

O.R.1428. 300,000/3/41. 31,000/9/43, Gp.

regards width and by figures as regards surface and foundations, viz. :—

" A " roads, those wide enough to take two streams of traffic of the nature denoted by the subsequent figure.

" B " roads, those wide enough to take one stream of traffic of the nature denoted by the figure, but on which individual and occasional vehicles can pass the stream.

" C " roads, those wide enough to take one stream of traffic of the nature denoted by the figure, but on which passing is impossible except on certain definite passing places.

No. 1 category roads capable of taking heavy M.T., viz. 3-ton lorries, heavy guns, etc.

No. 2 category roads capable of taking light M.T. up to 1-ton lorries.

No. 3 category roads capable of taking H.T. only.

No. 4 category roads capable of taking pack transport only, or bridle paths.

The combination of these factors gives the following results :—

		Heavy M.T. 1	Light M.T. 2	H.T. only. 3	Pack Transport. 4
Two streams ..	A	A 1	A 2	A 3	A 4
One stream with occasional passing ..	B	B 1	B 2	B 3	B 4
One stream only ..	C	C 1	C 2	C 3	C 4

Thus, for example, a road sufficiently wide to take one stream of heavy M.T. traffic only will be described as C 1, and this classification will be written on the map or sketch, which illustrates the road report, alongside the road to which it refers.

2. In addition, when the surface of a road deteriorates in the wet season, its classification at that period will be shown in brackets. For example, an unmetalled road in a semi-tropical country, capable of taking two streams of light M.T. in the dry season, and only H.T. in the wet season, will be shown on the sketch as A 2 (A 3).

3. It is also of value to write after the classification, the type of metalling employed, viz. : granite, laterite, etc., thus giving an indication as to the wearing qualities of the road under continuous traffic.

4. The reporter should use his common sense and put in illustrative form all the information possible, in order to save time for the officer who has to make use of the report.

APPENDICES

APPENDIX I

FINDING TRUE NORTH FROM SUN OR STAR

1. *True North by Compass.*—True north is readily obtained from magnetic north if the variation of the compass is known. The compass, magnetic variation and the finding of true north in this way have already been explained in Chapter VI.

2. *True North by Watch and Sun.*—Lay the watch flat with the hour hand pointing to the sun. In the northern hemisphere the direction of true south is then midway between the hour hand and XII. In the southern hemisphere point XII to the sun ; then true north lies midway between XII and the hour hand.

Thus, in northern hemisphere, time 15.00 hrs. With watch set as described above, south lies in the direction midway between the figures 1 and 2 and north in the opposite direction.

This method is very rough. It is of no use in the tropics. The farther away from the equator the more accurate it becomes. Replacing the watch by a 24-hour dial drawn on the sketch does not make for much greater accuracy in the absence of a special device. If summer time is in force correct the watch before taking the observation.

3. *True North by the Sun.*—The method described below is one of " Equal Altitudes." Drop some sealing wax on a penny and press down thereon the flat end of a pencil, taking care that the latter is truly upright and central on the face of the coin. Place the " style " so formed on a table in the open, to which a square of white paper is pinned. Run a pencil point round the coin and find its centre O (Fig. 58). At about 10.00 note that the shadow of the pencil's point is at A. Mark A and join it to O and with OA as radius draw the circle C around O. Note that as the sun moves the shadow at the same time traces an arc (dotted, Fig. 58).

At about 13.45 examine the shadow again ; note that it is again approaching the circle. At about 14.00 the apex of the shadow again crosses the circle ; mark the point of crossing, B. Then ON, which bisects the angle AOB, is the direction of true north in the northern hemisphere, or true south in the southern hemisphere.

The reader can improve at will on this crude arrangement, and can experiment on the ground with the shadow of the corner of a roof suitably situated or with a pointed stake set at a slight angle in the ground. The centre of the circle C in these cases is vertically beneath the edge of the roof or the point of the stake ; in the latter case it may be obtained by aid of a weighted string or plumb-bob.

If the observer's position be not too near the poles, the apparatus be suitable and care be taken with the working, it

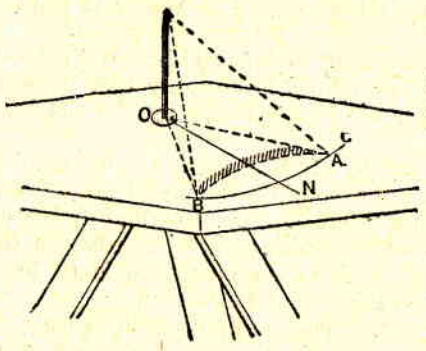


FIG. 58.

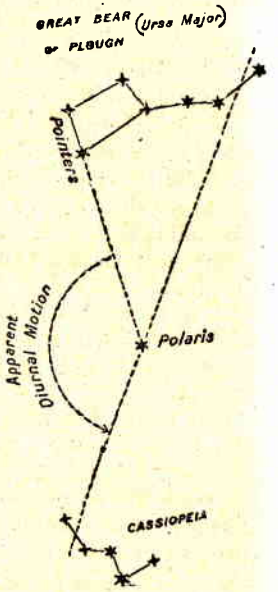


FIG. 59.

is possible to obtain true north with considerable accuracy by this method.

4. *True North by the Stars.*

1. Northern Hemisphere—The Pole Star (Polaris).—Everyone should be familiar with the Pole Star. It is the bright star indicated by the two "Pointers" of the Great Bear or Plough, Fig. 59.

Polaris gives an approximate line to true north. In latitudes less than 60° it is never more than 2½° in bearing from the Pole. All stars revolve round the Pole and twice in the 24 hours Polaris is in the meridian, *i.e.* truly north. Midway between the times when it crosses the meridian, Polaris is approximately at its extreme distance, *i.e.* 2° about lat. 45°, east or west of true north.

There are two easy ways of knowing when Polaris is in the meridian : the first, by means of stars in the constellation of the Great Bear ; the second by stars in Cassiopeia, which is a conspicuous group, shaped like the letter W (Fig. 59) on the opposite side of the Pole Star from the Great Bear.

The Pole Star is exactly north when the point halfway between the two end stars of the tail of the Great Bear is vertically above or below it ; and the same is true for the point halfway between the two stars which form the first stroke in the W of Cassiopeia. Note this line of points, as pecked in Fig. 59, passing through Polaris.

As the height of the Pole, in other words the latitude, increases, Polaris becomes of increasingly less value as a means of finding true north.

2. Southern Hemisphere—The Southern Cross.—The Southern Cross may be used as follows : Consider the Cross as a kite ; prolong the greater axis 4½ times in the direction of the tail, and the point reached will be approximately the South Pole. If a piece of paper be marked off along its edge by 12 dividing lines, spaced equally, and be held so that the first and third scale lines coincide with the head and tail stars respectively, the intersection of the 12th line with the edge of the paper will give, approximately, the southern Pole.

The southern Pole is more difficult to fix than the northern, as there is no bright star near it.

3. Southern Cross and Hydrus.—Continue the line above described for another two lengths of the greater axis of the Cross, *i.e.* to the 16th line of the scale ; we thus reach a star named β Hydri, which of the bright stars is the nearest to the South Pole.

When a Crucis, in the tail of the kite, and β Hydri are in the same vertical, they are nearly in the meridian and thus mark true south.

APPENDIX II

NIGHT MARCHING

1. *General.*—Night marching even under the best conditions demands long practice and care on the part of the guide. Unless the guide has a knowledge of elementary astronomy and tables to give him the correct bearing of the stars, the direction of a night march in a country unknown and unmapped or featureless must be maintained by compass, luminous for dark nights.

2. *Marching on a Compass Bearing.*—The guide must know

the bearing on which he wishes to march. He then observes some object which has the required bearing and marches towards it.

In the Service Prismatic Compass the magnetic north is marked by a broad luminous arrow-head. The glass cover is turned until the setting-vane on its rim, corresponding to the luminous direction mark on its glass, points to the required magnetic bearing as shown on the external ring; the cover is then clamped at this bearing. The box is now held so that the direction mark is superimposed on the arrow-head, in which position the line of the luminous patches in the lid, fully extended, indicates the line of advance.

In the liquid type of compass the bearing may be read directly at night with the same exactitude as by day; but in night marching some of this accuracy is unavoidably lost and marching on the pointers is in general sufficient.

As a rule, the darker the night the greater the assistance afforded by the luminous paint. During a moonlight night a luminous compass may be of no greater value than an ordinary compass with a clearly marked north-point.

3. *Prolonging the Compass Indication.*—It is often difficult to identify an object ahead on the correct bearing. A stick painted white or with white paper pasted on it, or best of all, one prepared with luminous paint, may then be useful. The operator, standing perfectly steady, should wait until his compass has come to rest, and then hold the stick, at an angle of 45° to 60° with the horizontal plane, in the direction indicated by the line between the luminous patches in the compass-lid.

With the stick thus held it is easy, except on very dark nights, to pick up some object on which to march: the advance is continued until the guide considers it desirable to halt and allow the compass to settle so as to observe the direction of advance afresh.

The object may be terrestrial or it may be a star. If it is terrestrial the march can be continued until the object is reached, when a new point must be chosen. If the object is a star, it must be remembered that the bearing of a star, except one close to the Pole like Polaris, is constantly changing. An advance can be continued on a star for 10, 15 or 20 minutes according to its position in the heavens.

4. *Celestial Objects.*—The most convenient stars to select for marching on are those which happen at the time to have an altitude of from 15° to 30°; stars below 15° may become lost in haze, whilst for those above 30° the head has to be inconveniently raised. Speaking broadly, a star at these altitudes will rarely move more than 5° in azimuth (*i.e.* to a flank) in 20 minutes. Hence, if at the end of every 15 to 20

minutes the observer halts and takes a fresh bearing, he can count on keeping direction correctly.

Although it is of assistance to an observer to know the stars, it is not necessary that he should study them. Anyone can, with care, march on a compass bearing with the stars as points to direct him, although he may be totally ignorant of the names of the stars or even of the constellations. The great point is to be sure that the compass bearing is correctly taken and prolonged, and that the star selected is adhered to until a change is required.

In civilized and well-mapped countries the use of stars for keeping direction is not likely to be necessary. In uncivilized country on the other hand, the method may be of great value. Any officer to whom such a task would be likely to fall would be wise to acquire an elementary knowledge of astronomy.

5. *Marching by Compass when no Objects are Visible.*—It may happen that, owing to clouds or fog, no terrestrial objects on which to march between halts are visible; then the only safe way is for an assistant to stand behind the observer and work as follows: The guide with the compass and luminous stick, as soon as the compass becomes steady, gives the word "steady." The assistant, carefully noting the alignment of the luminous stick, then advances in what he judges to be the right direction, until the guide halts him before he is lost to sight, by giving a low whistle.

The guide, having thus halted his assistant, notes by means of the compass whether the latter is standing on the true line of advance or to the right or left of it. He then moves up and, placing himself on what he judges to be the correct alignment, sends forward his assistant again.

The rate of advance obviously depends on the distances covered between halts; after the first few advances the assistant will have ascertained the number of paces he can safely take without being lost to sight, and on reaching that distance he will halt without waiting for the whistle. This is important, since the whistling might attract attention when close to the objective.

Slabs of cardboard or wood prepared with luminous paint, are of great assistance in this tedious process of sending on an assistant; a slab 12 inches square can be seen at from 30 to 200 yards distance, according to the condition of the atmosphere and the paint, and by this means the rate of advance can be greatly accelerated.

Besides the guide and his assistant, a third person should be employed to keep a careful record of the distances traversed.

It may be useful to remember that a constant error of 5° in bearing causes a deviation from the course of 150 yards per mile of march.

APPENDIX III

SPELLING OF PLACE NAMES

1. *Spelling.*—There is no geographical subject which has given rise to more discussion and to greater differences of opinion than that of the spelling of names, and it is desirable that officers should have some acquaintance with the principles involved. It is a matter which affects not only maps, but also official reports and handbooks.

When a country uses the Roman characters there is no difficulty. Clearly the name must be spelt as in the country of origin unless there is an anglicized form in common use, *e.g.* Florence for Firenze, when the form adopted would be a matter for consideration in each case. The question of transliteration does not arise.

2. *Transliteration.*—When, however, a language does not use the Roman character, the names must be transliterated for English use. Such languages are Russian and Bulgarian which use the Cyrillic character, Arabic and Persian which use the Arabic character, Hebrew, Greek, Chinese, and many other Eastern languages. In Russian, Arabic, Hebrew and Greek it is possible to prepare tables showing how each letter should be transliterated so that an Englishman should pronounce the word in its new form as nearly as possible as it is pronounced in the country of origin.

Whatever system of transliteration is used it is evident that only a small measure of success can be obtained. The letters do not, as a rule, correspond exactly with the English letters; and even if they did, the fact that there may be several different ways of pronouncing the same letter would make a perfect representation of the sound impossible. It is easy to see that the transliteration, letter by letter, of the English words *through*, *though*, and *tough*, would give a foreigner no guide to the pronunciation of more than one of them.

3. *Principles of Transliteration.*—For better or worse, however, names have to be transliterated, and rules for doing so have to be devised. These fall into two parts :—

i. The sounds to be attributed to each letter of the English alphabet must be laid down and adhered to for the transliteration of all languages.

ii. A table has to be drawn up for each language which it is desired to transliterate, showing what letters of the English alphabet, employed as in i, are to be used for each letter of the foreign alphabet in question.

For i, a new set of rules has recently been drawn up by the Permanent Committee on Geographical Names at the Royal Geographical Society on which the War Office and several other Government departments are represented. It is printed below. It differs but little from the Knox rules which have been followed for many years by the Geographical Section of the General Staff, which themselves were almost identical with the old rules of the Royal Geographical Society, based on the Washington system of the Admiralty. These rules aim at rendering sounds *approximately* only, without having recourse to the elaborate symbols, used by phoneticians, and unsuitable for maps.

4. *R.G.S. II System*, 1924

Rules for the Spelling of Geographical Names for British Official Use

1. The spelling of every place-name in an independent country or self-governing dominion using the Latin alphabet* shall be that adopted by the country or dominion, except in the case in which certain important localities have also, in addition to the official name, another customary name, notably different, in which case the name customary in British use (*i.e.* "conventional") may be adopted (*e.g.* Geneva, Warsaw, etc., for Geneve, Warszawa, etc.).

2. In colonial possessions the spelling of such place-names as belong to languages coming under Rule I will be spelt in accordance with that rule.

3. The accents and diacritical marks in official use by the above countries will be retained. Wherever it appears desirable, the pronunciation will be shown by giving the name as translated on the system below.

4. All other place-names throughout the world will (with the exception of "conventional" names and some others) be spelt in general accordance with the following system.

The broad features of this system are :—

i. That vowels are pronounced as in Italian and consonants as in English;

ii. That every letter is pronounced, and no redundant letters are used.

The system aims at giving a close approximation to the *local* pronunciation; but it is recognized that in some languages, notably Russian, Greek and Arabic, the necessity for letter-for-letter transliteration often renders this impossible.

* Including "Latin" alphabets containing extra or modified letters, such as Czech, Crotian, Polish, Roumanian, etc. The pronunciation of these letters is given in the "Alphabets of Foreign Languages," etc., mentioned below.

Table of Spelling and Pronunciation, R.G.S. II—*contd.*

u	Long as in *rule*, or as *oo* in boot; short as in *pull*	Zūlū; Rŭanda.*
ū	Represents the French *u*, as in *tu* (Fr.)..	Üskūb.
v, w, x	As in English.	
y†	Always a consonant, as in *yard*; it should not be used as a terminal vowel, *e* or *i* being substituted; *e.g.* not Kwaly or Wady, but ..	Kikuyu, Maya. Kwale, Wadi.
z	As in English *gaze*, not as in *azure*.	
zh	As the *s* in *treasure*, the *z* in *azure*, or the French *j* in *je*; but for the sound in Russian, Bulgarian, and Chinese use *j* (*vide* note above under *j*)	Zhob, Azhdaha.
	Notes.	
	The doubling of a vowel or a consonant is only necessary when there is a distinct repetition of the single sound, and should otherwise be avoided	Nuulua, Moorea, Jidda, Muhammad.
	Accents should not generally be employed; but in order to indicate or emphasize the stress, an acute accent may be used	Saráwak, Qántara, Tong-atábu, Parana.
	A long or short mark over a vowel (*e.g.* ā, ŏ) should only be used (and that sparingly) when without it there would be danger of mispronunciation	Kūt, Hashīn, Angŏra
	Hyphens will not be used except to indicate pronunciation and with the Persian izafat	Mus-hil, Pusht-i-Kuh.

* The long and short symbols given here are merely for explanation, not for use.

† Pronounced differently in Greek: *see* "Alphabets of Foreign Languages transcribed into English according to the R.G.S. II System" (published by the Royal Geographical Society).

Inverted Comma and Apostrophe.—The inverted comma ' is employed only to represent the Arabic ' *ain* ع, and the Hebrew ' *ayin* ע. The apostrophe ' in foreign words indicates a liquid sound (see below).

Liquid Sounds.—The occasional "liquid" or "palatalized" sound of *d, l, n, r, t*, etc. (as in *d'you, lure, new, clarion, tune*, etc.) is as a rule sufficiently represented by a following *y*; where, however, owing to a following consonant, or to the letter in question coming at the end of a word, the *y* is inapplicable, the liquid sound will be represented by an apostrophe, thus: *d', l', n', r', t'*, etc.

The "Neutral Vowel."—The "indeterminate" or "neutral" vowel sound (*er*), *i.e.*, the sound of *a* in *marine*, *e* in *often*, *i* in *stir*, *io* in *nation*, *o* in *connect*, *ou* in *curious*, *u* in *difficult*, etc., *e* in French *je*, or the often unwritten vowel (ع *Fat-ha*), in Arabic, etc., is represented as a rule by *a*: as in Basra, Hawiya; but sometimes by *e*, when the sound approximates more to *e* than to *a*: as Meshed, El Gezira.

(In any guide to pronunciation issued by the Permanent Committee on Geographical Names, the "neutral vowel" is represented generally by the italic *e*: occasionally also by italic *a* or *u*.)

This sound must not be confused with *e-mute*, where the *e* is not sounded at all: as in Abbeville.

Nasal Vowels.—In illustrating the pronunciation of French, Portuguese, Polish, etc., nasal vowels, the nasalization will be represented by italic *n*: as Czestochowa, pr. Chănstokhóva.

5. *Special Rules for Certain Languages.*—It is hoped that in future the system given above will be universal. Even if space permitted it would not be necessary to print here the transliteration tables for each language. The R.G.S. has published a book of "Alphabets of Foreign Languages transcribed into English according to R.G.S. II System," but it is too much to hope that they will be universally adopted. The surveys of India and Egypt have their own systems for transliterating, and any change of system would involve many alterations in existing maps.

Although the use of these rules and tables involves a transliteration letter by letter which is designed to give the best approximation possible to the pronunciation, an expert in both languages will constantly be aware that the transliterated form does not represent the sound, and may feel tempted to improve on it; but usually the results must be accepted.

6. *Unwritten Languages.*—The pronunciation table printed above is equally essential for arriving at a suitable form of spelling names in unwritten languages, such as those in tropical Africa or the Pacific. Here sound is the only guide, and the object aimed at is to represent the name so that it will be pronounced correctly by an Englishman. Even so, certain spellings which contradict the R.G.S. II System have become conventional, as the use of *th* to render the sound of *dh* in Fijian. It is evident that no system of transliteration will enable a name to be correctly pronounced by people of different nationalities.

7. *Chinese and Japanese.*

1. It is very desirable that officers to whose lot it falls to ascertain by word of mouth and to record names should follow the rules here given. Certain languages require special treatment. For instance, Chinese and Japanese are written languages but have no alphabet. It is therefore necessary either to treat them as unwritten languages and be guided by sound only, or to prepare elaborate tables giving the Roman lettering to be used for each syllable or symbol. This was done for Chinese by Sir T. Wade, and his system has been that most generally used ever since. The Directorate General of Posts publishes a list of Post Offices in China, with its own system of spelling which is not always consistent.

The Permanent Committee on Geographical Names proposes to follow the Post Office List for Chinese (but not for Turki, Mongol, etc.) names, as far as it goes, and to adapt the spelling of other Chinese names to the Postal system, such as it is.

2. A similar system has been prepared for Japanese by Mr. Hepburn; but the Japanese publish official maps giving the names in Roman lettering, and these would presumably be accepted. The Land Survey Department has, however, recently introduced a new system of spelling which differs considerably from the well-established system used by the Imperial Geological Survey. Greek also has to be specially treated, for the Greek alphabet is so familiar that it is usually more useful to be able to recognize the original letters than to put the name into a strange form even if that form gives the correct pronunciation. Thus the letter ϕ is always transliterated by *ph* and not by *f*.

8. *Double Transliteration.*—Many other difficulties arise. For instance, a name of Russian origin may appear on a map transliterated into German. To get it in its correct form by our rules it would be necessary to put it back into Russian and then transliterate it afresh as *Fr.* Tchernigov, *Ger.* Tschernigow, *Eng.* Chernigov. Native names in Africa and elsewhere are transliterated by other Powers according to their own rules and pronunciation, and a fresh transliteration is required for an English map. Examples are :—

Fr. Ouadi, Djebel ; *Eng.* Wadi, Jebel ; *Ger.* Kilimandscharo, Ssonjo ; *Eng.* Kilimanjaro, Sonyo ; *Port.* Inhambane, Cuango ; *Eng.* Nyambane, Kwago.

APPENDIX IV

TABLES.

I. R.F. and Equivalent British and Metric Scales.
II. British and Metrical Units of Length.
III. Metric Square Measures.
IV. Russian Metric and British Units of Length.

TABLE I.—R.F. AND EQUIVALENT BRITISH AND METRIC SCALES

R.F. 1 to	Miles to 1 inch.	Inches to 1 mile.	Kms. to 1 cm.	Cms. to 1 km.	R.F. 1 to	Miles to 1 inch.	Inches to 1 mile.	Kms. to 1 cm.	Cms. to 1 km.
5 M.	78·91	·0127	50	·02	63,360	1	1	·6336	1·578
4 M.	63·13	·0158	40	·025	62,500	·9864	1·014	·625	1·6
3 M.	47·35	·0211	30	·0333	50,000	·7891	1·267	·5	2
2 M.	31·57	·0317	20	·05	42,240	·6667	1·5	·4224	2·367
1½ M.	23·67	·0422	15	·0667	40,000	·6313	1·584	·4	2·5
1 M.	15·78	·0634	10	·1	31,680	·5	2	·3168	3·157
750,000	11·84	·0845	7·5	·1333	30,000	·4735	2·112	·3	3·333
633,600	10	·1	6·336	·1578	25,344	·4	2·5	·2534	3·946
500,000	7·891	·1267	5	·2	25,000	·3946	2·534	·25	4
400,000	6·313	·1584	4	·25	21,120	·3333	3	·2112	4·735
316,800	5	·2	3·168	·3157	20,000	·3157	3·168	·2	5
300,000	4·735	·2112	3	·3333	15,840	·25	4	·1584	6·313
253,440	4	·25	2·534	·3946	15,000	·2367	4·224	·15	6·667
250,000	3·946	·2534	2·5	·4	12,672	·2	5	·1267	7·891
200,000	3·157	·3168	2	·5	10,560	·1667	6	·1056	9·470
190,080	3	·3333	1·901	·5261	10,000	·1578	6·336	·1	10
150,000	2·367	·4224	1·5	·6667	5,280	·0833	12	·0528	18·94
126,720	2	·5	1·267	·7891	5,000	·0789	12·67	·05	20
125,000	1·973	·5069	1·25	·8	2,500	·0395	25·34	·025	40
100,000	1·578	·6336	1	1	1,760	·0273	36	·0176	56·82
80,000	1·263	·792	·8	1·25	1,000	·0158	63·36	·01	109
75,000	1·184	·8447	·75	1·333	500	·0079	126·72	·005	200

Table II.—British and Metrical Units of Length

Geographical Mile.	Statute Mile.	Kilometre.	Furlongs.	Chains.	Fathoms.	Metres.	Yards.	Feet.	Links.	Inches.	Centimetres.
1	1·1529	1·8554	9·223	92·23	1,014·5	1,855·4	2,029·1	6,087·2	9,223	73,046	185,537
	1	1·6093	8	80	880	1,609·3	1,760	5,280	8,000	63,360	160,934
		1	4·97	49·71	546·8	1,000	1,093·6	3,280·8	4,971	39,370	100,000
			1	10	110	201·2	220	660	1,000	7,920	20,117
				1	11	20·12	22	66	100	792	2,012
					1	1·829	2	6	$9\frac{1}{11}$	72	183
						1	1·0936	3·281	4·971	39·37	100
							1	3	$4\frac{6}{11}$	36	91·44
								1	1·515	12	30·48
									1	7·92	20·12
											2·54

1 Sea or Nautical Mile.

Latitude.	Statute Miles.	Cables.	Metres.	Feet.
0°	1·1451	10	1,842·86	6,046·13
30°	1·1480	10	1,847·53	6,061·45
60°	1·1538	10	1,856·93	6,092·30
90°	1·1568	10	1,861·66	6,107·82
*M	1·1509	10	1,852·24	6,076·91

* M is the mean value of a Sea or Nautical Mile. The lengths of this mile as given here are not precisely the same as those adopted by the Admiralty, but the differences are negligible for map purposes.

Conversion Tables

Table III.—Metric Square Measures

	Square yards.	Acres.
1 Centaire (1 square metre)	1·196	—
1 Are (100 square metres)	119·599	0·02471
1 Hectare (10,000 square metres) ..	11,959·923	2·471058

Table IV.—Russian Metric and British Units of Length

	Statute Mile.	Verst.	Kilometre.	Sajenyam.	Metres.	Yards.	Feet (Futam).	Inches. (Dyuimam).	Centimetres.
Statute Mile.	1	1·5086	1·6093	754·29	1,609·3	1,760	5,280	63,360	160,934
Verst.	1	1	1·0668	500	1,066·80	1,166·67	3,500	42,000	106,680
Kilometre.			1	468·7	1,000	1,093·6	3,280·8	39,370	100,000
Sajenyam.				1	2·1336	2·333	7	84	213·36

Other Russian Measures

1 Marine Sajen	.. ..	= 1 fathom
1 Arshin	.. ..	= 28 inches
1 Stopa	.. ..	= 14 inches
1 Vershok	.. ..	= $1\frac{3}{4}$ inches
1 Paletz	.. ..	= $\frac{1}{2}$ inch

The Russian foot and inch are the exact equivalents of the British units.