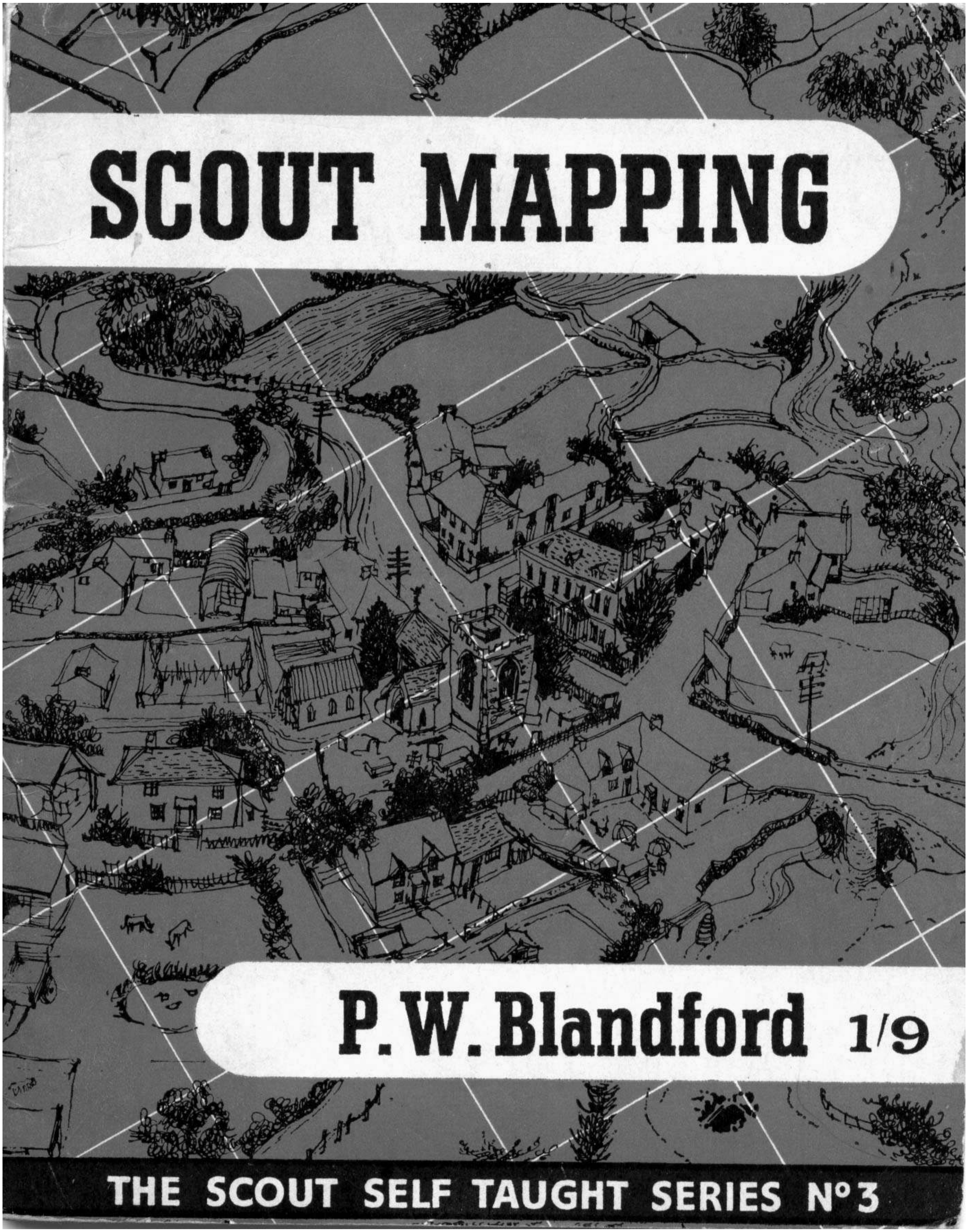
SCOUT MAPPING



P. W. Blandford 1/9

THE SCOUT SELF TAUGHT SERIES No 3

First Edition - . . .1956

Second Edition - .1960

Revised - 1963

Revised to comply with the Association’s ‘Policy, Organisation and Roles 1959” (with amendments to 1st April, 1962)

BROWN, SON & FERGUSON, LTD., GLASGOW, S1

Original Printed and Made in Great Britain

Editor's Notes:

The reader is reminded that these texts have been written a long time ago. Consequently, they may use some terms or express sentiments which were current at the time, regardless of what we may think of them at the beginning of the 21st century. For reasons of historical accuracy they have been preserved in their original form.

If you find them offensive, we ask you to please delete this file from your system.

This book was written in England and thus contains English spelling and English terms.

AUTHOR’S NOTE

In this little book, which was first published as a series in *The Scout*, I have set down notes on all the aspects of mapping which a Scout should know to get the most out of the subject, and all the basic information he needs to pass the mapping tests necessary to qualify as Second or First Class or to pass the mapping part of several proficiency badges.

Mapping is a practical subject and a book can only take you so far. You can only learn mapping thoroughly and get the most interest and fun out of it by getting out with map and compass, and using them on every possible occasion. In Britain we are very fortunate in having the Ordnance Survey series of maps, which are the envy of most other countries, and contain an enormous amount of accurate information, if we learn how to use it. A one-inch O.S. map is cheap. With this and a simple compass you can tackle almost everything described in this book. Other apparatus can be home-made. Advanced equipment, which you may progress to one day, may be very attractive, but its main advantage is in its greater precision. The method of use is the same, and practice with simple equipment will show you the way.

P.W. BLANDFORD.

Publication approved by the Boy Scouts Association

SCOUT MAPPING

by

P. W. BLANDFORD

Assistant County Commissioner Sea Scouts, Warwickshire
Leader — National Scout Canoe Cruises

Author of *Rope Splicing, Netmaking, Scouting on the Water, Canoeing* etc.

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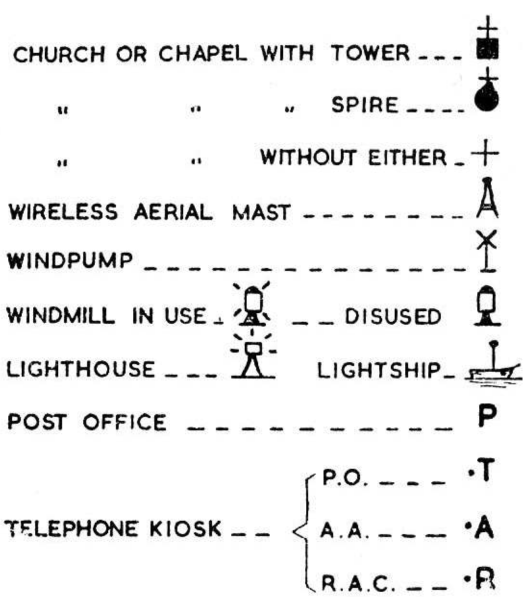
SCOUT MAPPING

Maps—what they are

Are you keen on mapping? Most chaps are. It is a fascinating subject and you cannot get far with Scout activities without finding the need of a map, either a sketch you make yourself or one prepared by the expert. To be a good all-round Scout you must include amongst all your other skills the ability to get the most out of a compass and map. Where would the backwoodsman be without his ability to find his way over unknown country? Even more so, pity the airman or seaman attempting to navigate without knowing how to use his map or chart.

Because of the importance of mapping to a Scout there are tests in Second Class and First Class badges, and in many of the proficiency badges. If you want to know more about mapping and pass any or all of these tests, I will try to pilot you all the way.

Of course, a map is a diagram of some part of the earth's surface drawn to a smaller size than the original. Usually, if it is a sea area we call it a chart. The map is something like the picture you would get when you looked down from a very high aeroplane—in fact aerial photographs have been used in place of maps or as aids in making new maps. Early maps were covered in little pictures—sometimes put in to represent genuine features, and quite often just to add a pretty touch to an area about which the mapmaker was clueless. Nowadays, little signs and symbols are used to represent features, and these are known as "conventional signs." Colour is also used to give a clearer picture, making a map much more interesting and easy to follow.



In Britain we are lucky in having the excellent series of Ordnance Survey maps, covering the country with accurate maps available in a variety of scales. The name comes from the fact that in 1791 the Ordnance Survey was formed to make a map of the country to a scale of one inch to one mile for defence purposes. Other scales followed and, of course, the maps have become far more used for civil purposes, but the name remains.

You may wonder what is the difference between a map and a plan. Plans are to a much larger scale than maps. A plan shows everything to scale, including the outlines of buildings and widths of roads. As the scale becomes smaller some of the items would be represented by such tiny marks that they would be impossible to identify. For instance the outline of a church could be shown correct to scale if a large scale was chosen, but as the drawing became smaller a change would have to be made from the actual shape to a conventional sign. This is noticeable in the widths of roads on a scale of 25 in. to one mile it is possible to show the actual widths of roads, but even coming down to 6 in. to one mile the width has to be exaggerated in places to get in all the detail. On a smaller scale there can be no attempt to draw the width to scale and roads are represented by parallel lines. The difference between an Ordnance Survey plan and a map can be recognised in the representation of the actual road width in a plan and the use of out-of-scale markings on a map.

Of the many O.S. maps there are five you should know about. There is a general one at 10 miles to one inch, which covers the whole country with two sheets, and is the one to use for long-distance routes. Next comes the quarter-inch map which covers a useful area on each sheet and is the best map for motorists. The one-inch map is the one most used by Scouts, and is the one you should get to know first. The 2½-inch map (i.e. 2½ in. represents one mile) is very good for walking as it shows the countryside in great detail. There is a six-inch map which is very useful for local details. One showing the area around your hut or the country for a wide game can be very useful.

Ordnance Survey maps can be ordered through any bookseller and there are agents with stocks in most towns. Besides the actual maps there are several books explaining them, and charts about them, which make good decorations in the Troop room. There is a book called *A Description of Ordnance Survey Small Scale Maps*, which includes the one-inch, that ought to be in all Troop libraries. (New edition 1956).

If you want to be technical there is plenty to interest you, and if you only want to learn how to use your map there are plenty of coloured pictures and parts of maps. Get your Skipper to write to the Ordnance Survey Office, Chessington, Surrey, for details of their publications.

Map and compass.

A map is not completely useful unless you have a compass. You can use a map without a compass, but the two together make for accuracy and are a lot more fun in any case, so in part of the tests for your Second Class badge you read, “Know the 16 points of the compass and how to set a map.”

Although the 16 points are still used, for more accurate work compasses marked in degrees are also popular. Many compasses have both markings. North is 0 and the degrees are marked all round and numbered Eastward about, so that E is 90°, S is 180° and W is 270°. In a small compass, every degree cannot be marked so check what each space on your compass represents.

Almost any compass can be used to set a map, although you cannot work as precisely with a little compass on the side of a whistle as you can with a prismatic one. However, for hiking and cycling about this country a very fine degree of accuracy is not so essential as it might be for a man planning a six-day crossing of a desert. With roads and all the civilised features which we cannot get away from, a general direction is as much use as one which is spot on, in most instances.

The compass needle does not point to the true North Pole. Instead it is attracted by an area to the North of Canada. The exact point does not stay put, so that the needle does not always point exactly the same way. Fortunately, the movement is not much, and for ordinary purposes in Britain the difference is not enough to matter, as it amounts to about ½ degree in four years. However, you cannot ignore “variation” completely if you are to set a map properly by compass. Variation is the amount the compass needle points away from true North. In Britain you can assume that it is about 10 degrees West—at least for the time you are in the Troop.

Ordnance Survey maps are made with their vertical edges running North and South, so you can assume that, when the map is properly set, a line continued up one edge would eventually reach the North Pole. At the. bottom, in the margin, is a note of the amount of variation and a diagram showing its direction.

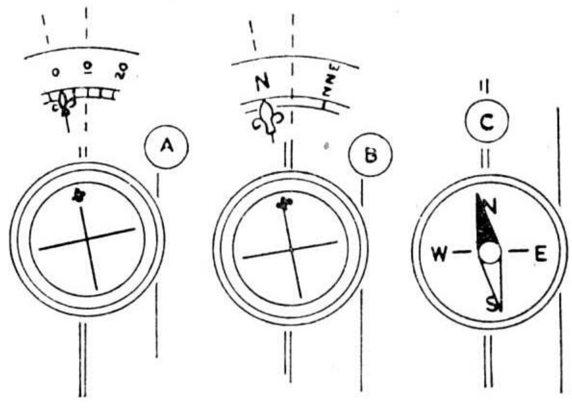
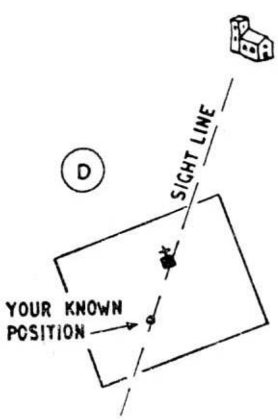


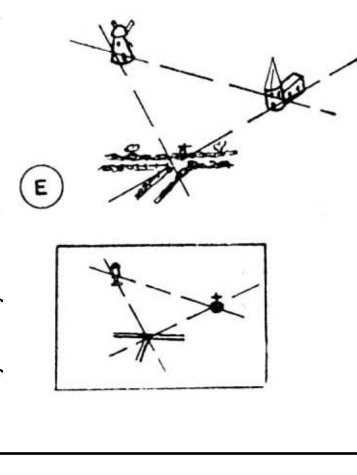
Fig. 2A. Fig. 2B. Fig. 2C.

With the map on a flat surface, put your compass over one border line. If you have a compass with a floating card — one with the bearings on a disc which turns with the needle — let the needle settle, then turn the map until the needle points 10 degrees West (Fig. 2A). If there are no degree markings, let the border line follow through about half-way between N. and N.N.E. and S. and S.S.W. (Fig. 2B). If your compass card is fixed to the bottom of the case, put it over the border line, with N. and S. on the line, then when the needle settles, turn the map to bring the needle 10 degrees or half a point West of N. (Fig. 2C). When you have your map arranged so that its sides run N. and S. it is "set" and directions on the map are the same as those on the ground.

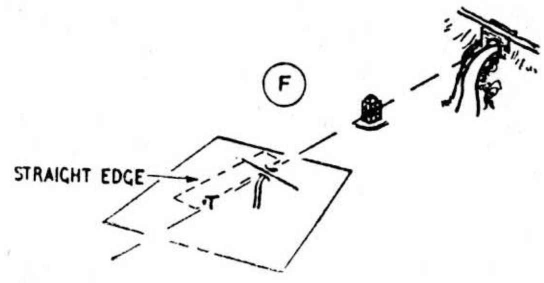


If you can see several landmarks which you can identify on the map, you can set it without using a compass. If you can only see one landmark and you know where you are on the ground and on the map, you can set the map. Several landmarks help to check each other, or you can use an odd landmark to check your setting by the compass.

Suppose you are on a hill top, which is marked on the map, but you are uncertain of your directions and have no compass. Looking around you spot a church with a tower about two miles away. On your one-inch O.S. map you look around, about two inches from the hill, and find the church with tower symbol. If you turn your map around so that you can sight the actual tower through the church and hill on the map, the map will he set (Fig. 3D).



If you are not certain of your exact position and have no compass to set the map, look around for objects which you can identify on the map. Turning the map to the same general direction as the objects appear to be will give sufficient accuracy for most purposes (Fig. 3E). If two of the objects are in line with you, or almost so, the map can be set by sighting them. Use a straight-edge of some sort—a piece of paper will do. Move the map around so that when the straight edge is laid along the two objects on the map you can sight them on the ground (Fig. 3F). If they are not actually in line with you estimate the amount of variation to set the map. Be careful to have the objects in the same order on the map as they are on the ground, otherwise the map will be set backwards. This is called a reciprocal bearing, which sounds very clever, but means that if you work on it you will finish up by "going coming back."



Ordnance Survey Maps.

Before we get any further with mapping test work we should get a clear picture of what the one-inch Ordnance Survey map has to offer, because this is the map most used in Scout activities. There is a considerable amount of information packed into a map which is not all immediately obvious.

The work of the Ordnance Survey never stops. Maps are constantly being revised, and in the bottom margin of the map you will find details of the revisions which are included in your particular map. However, a point will be reached where a map will not stand any more revision and a new edition has to be produced. That has happened with the one-inch O.S. maps. The complete set of maps, known as the "New Popular (Sixth) Edition" for England and Wales, and the "Popular Edition" for Scotland, have been replaced by completely new maps called the "Seventh Series." There are 190 sheets covering England, Wales and Scotland.

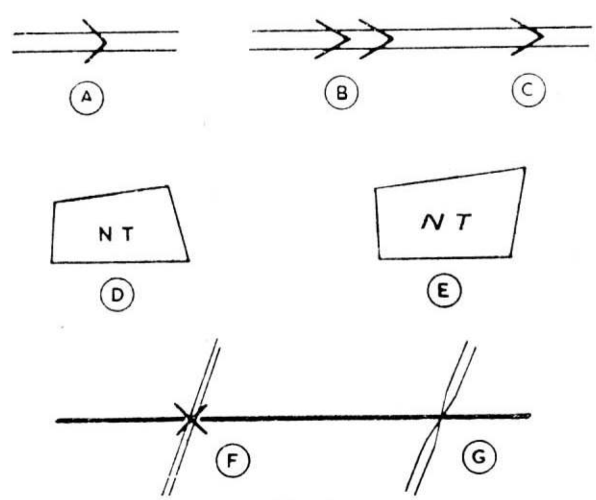


Fig. 4.

There are several differences in the "Seventh Series" maps, in addition to those due to bringing the map up to date. Grades of roads are in three colours, instead of two; main roads are drawn narrower; tree symbols and grid lines are grey instead of black; and the whole effect is one of spaciousness, making the map easier to read. Old hands who are used to the earlier maps should spend some time comparing the conventional signs given in the bottom margin, preferably with a map of each edition beside you.

Much useful information is included without making the map complicated. Where gradients steeper than 1 in 7 were the only ones indicated (Fig. 4A), there are now two symbols; one showing 1 in 5 or steeper (Fig. 4B), and one showing those between 1 in 5 and 1 in 7 (Fig. 4C). Where National Trust areas were green with the letters "N,T.," they are now enclosed with a red line, and if the letters arc upright you know that the place is always open (Fig. 4D), but if they are sloping it is only open at certain times (Fig. 4E). The letter V was used to indicate a youth hostel. Now it is more exactly located by a red triangle. Where a level crossing used to be marked by a red cross (Fig. 4F), it is now shown by the road narrowing to nothing at the railway line (Fig. 4G).

A one-inch O.S. sheet covers about 28 miles N. and S., and 25 miles E. and W. Each map bought folded is in a cover which has an index to the sheets for the whole country on the back. If you want a map to go on the wall of the Troop room you can buy one on paper, unfolded, for 3s. 6d. Folded, in a stiff card cover, it costs 5s. 6d. Some maps are available mounted on cloth. If you are planning to go to an area for a holiday, and will only use the map for a short time, then a paper map will do; but for your home area the extra cost of a mounted map is worth while.

If you want a map to draw on, there is an outline edition at 3s. This is uncoloured and gives you scope for working up the features of a wide game. You can write or paint in new places and set the stage for a game, knowing that the genuine features are correctly placed.

On the one-inch O.S. maps there are contour lines, which we will deal with later, but there are no colours indicating the various levels. Consequently it is not always easy to picture the ups and downs of the country as shown on the map. For popular holiday areas there are one-inch Tourist maps, and these differ from the ordinary one-inch maps in being "layered"—with layers of colour representing various heights. For a mountainous area like the Lake District this is a big help in visualising the country. However, the tourist maps are not revised as often as the standard sheets and if you want the result of the latest survey you need one of the latter maps.

There are a large number of old wartime maps about. They are covered by purple lines and markings as well as all the usual things. These maps can be quite useful to the troop, but remember their age and ignore the network of purple lines.

Post-war one-inch O.S. maps are covered with a network of parallel lines in black or grey. These are not lines of latitude and longitude, as you might imagine. Latitude and longitude are indicated on the extreme outside border, and the lines with numbers around the inner border represent the national grid. The squares are numbered northward and eastward from a point off the S.W. tip of Cornwall. Every place can be given a number, called its "grid reference," from which you can locate it on a map. There is an explanation of the system on every map. With the actual map to work on you find the system is quite simple to understand. Get used to giving the grid reference for a camp site or meeting place on a hike.

Compass directions.

As a part of the First Class mapping tests you have to be able to point out a compass direction during the day, or the night, without the use of a compass. Some people have a better sense of direction than others—I remember spending hours exploring a mine, crawling and walking through various workings, then when we came to the surface again one member of the party thought for a few minutes and said, “When we were at a certain point, we were over there.” He was right, but the rest of us had no idea of the underground directions. Even if your sense of direction is not very good, there are many things that will serve as a guide to directions.

Get to know the general direction of several things in your locality. How does the main road lie? Which direction does your H.Q. face? What is the bearing between a couple of church spires, or other prominent objects? If you can settle on a few key directions, such as these, you can compare other bearings with them if you are working in the same area.

There are several things which will serve as a clue to compass directions. The majority of churches are built with the altar at the east end (Fig. 5A), so that the congregation sit facing E. This is not an absolutely rigid rule, but it is more often right than wrong. The

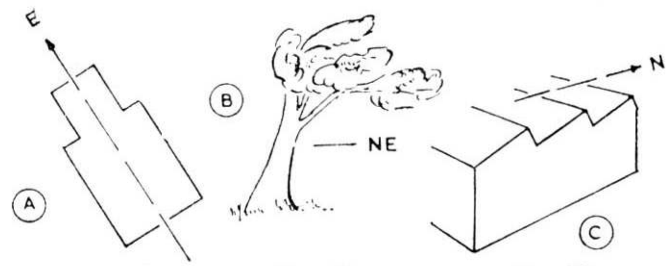


Fig. 5A. Fig. 5B. Fig. 5C.

strongest and the most frequent winds in Britain come from the S.W. Consequently trees and bushes in exposed places are likely to lean and have their branches bent away from the prevailing wind (Fig. 5B). Factories and similar large buildings sometimes have the roof supported in a series of ridges by north-light trusses. These are arranged with windows in the near-upright surfaces, and these face approximately N., so as to get the most even lighting (Fig. 5C). They may not be exactly N., but they give you an idea of the general direction.

If you know the time, and the sun is shining, it is easy to get a close estimate of directions. At noon you can assume that the sun is due S. At 6 am, it is E. and at 6 p.m. W.

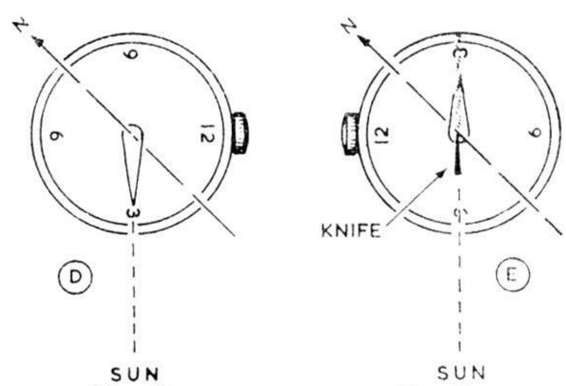


Fig. 6D. Fig. 6E.

It appears to curve through the sky from E. through S. to W. and intermediate points can be estimated according to the time, *e.g.*, at 9 am. it is S.E. Remember to allow for summer time if that is in force, making noon at 1 p.m. and using 7 instead of 6 o'clock.

There is a more accurate way of using a watch as a compass when the sun is shining. B.-P. gives it to us in its simplest form in *Scouting for Boys*. Hold the watch flat with the face up so that the sun shines on it. Turn it so that the hour hand points at the sun. Without moving the watch, use the edge of a piece of paper, or anything straight, to position a line through the centre of the watch to come midway between the hour hand and noon (or 1 p.m. if it is summer time). This line will run N. and S. with N. in the direction away from the sun (Fig. 6D).

The snag with pointing the hour hand at the sun is that you cannot be certain of your accuracy, particularly if the sun is high. You can be more exact by using a shadow. Hold a knife or a pin, or anything that will cast a narrow shadow, over the centre of the watch, and turn the watch so that the shadow falls along the hour hand. Divide the angle between the hour and noon, as before, and the resulting line will again run N. and S., still with the end farthest from the sun pointing N., but the watch will be the opposite way round. (Fig. 6E).

At night of course, the stars are a very good guide to direction. In the Northern Hemisphere there is the Pole Star over the North Pole and if we can locate it and face it, we know we are facing N. The best guide is the constellation known by many names, including "The Plough.' The stars are quite prominent. The two at the end are called pointers and if you follow the direction they are pointing you come to the Pole Star (Fig. 7F). A further guide is the Little Bear, made up of some rather fainter stars (Fig. 7G).

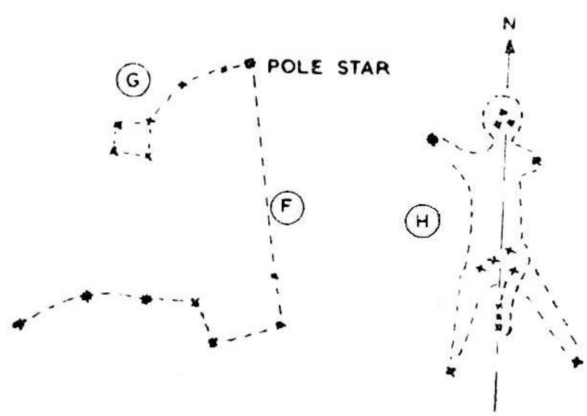


Fig. 7

Also in the northern sky is Orion, supposed to be a man with a belt and sword (Fig. 7H). A line through the sword and the head points N. However, Orion is much farther from the Pole Star than The Plough, and is more difficult to use. Remember that the Pole Star stays still and all the other stars appear to revolve around it. Consequently, do not expect to necessarily see a constellation the same way up as I have drawn it.

In the Southern Hemisphere there is no star exactly over the S. Pole, but in *Scouting for Boys* there is a diagram showing you how to use the Southern Cross constellation for finding S.

Contours.

One of the most useful features on a map, and often the least understood, is the indication of heights by contour lines.

Maybe they are not often appreciated because you cannot actually see them on the ground. On the 1-inch O.S. maps they are in brown at intervals of 50 ft. in height. The lines are broken occasionally to show a figure indicating the height above sea level. If your map is of a fairly flat part of the country the lines will be fairly widely spaced, but for a mountainous district they will be piled almost on top of each other.

A common way of teaching the meaning of contours is by using half of a large potato to represent a piece of countryside. The potato makes a miniature hill and the problem is to make a map of it. Even if you feel that you know all about contours, this is quite a good way of putting the idea over to your Patrol.

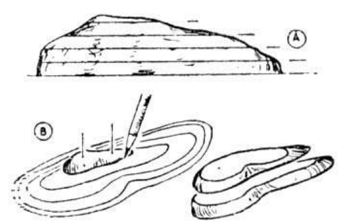


Fig. 8.

Cut the potato across at regular intervals, say every ¼ in. (Fig. 8A). Put the parts together and push two needles through all the parts and into your paper. Draw around the bottom piece, then lift the potato off the needles and remove the bottom layer. Replace the remainder and draw round the next layer, and so on until the top piece is done (Fig. 8B). Also mark the highest point. Mark in the heights. You now have a map of your potato, with the scale full-size, and with contours at ¼ in. intervals.

Contour lines on a real map show heights in exactly the same way. All places on a contour line are at the same height. If a fly walked around our potato keeping on the edge of one of the cuts, he would go neither up nor down hill and his route would be as shown on the appropriate contour line on our map.

Although you cannot see contour lines on the ground there is one landmark which will show you how they run. If you come across a canal in your hiking, examine the way it lies. A river will not do, as it slopes slightly on its way to the sea, but canal water is still. When canals were made, the engineers tried to keep the number of locks needed to change the water level to a minimum. Consequently each level piece of canal was taken as far as possible before a lock had to be made. Cuttings and embankments help this but, as far as possible, the engineers used the land as they found it, Which meant following contours. A canal does not wind because it had to miss Farmer Brown’s field, or because it looked prettier that way. It winds so that it can remain at the same level. Some of the summit levels, between a series of up-going locks and the next lot going down, are particularly good examples of this following of contours.

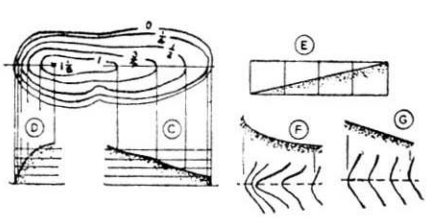


Fig. 9.

Suppose our fly wanted to climb the potato by the most gradual slope, we could look at our map and tell him, even if we had never seen the potato. The vertical height between contour lines is the same all round, but if they are far apart horizontally the slope is gradual (Fig. 9C), while if they are close it is steep (Fig. 9D). Gradients in Britain are usually quoted as “One in so-many.” A gradient of 1 in 4 means that for every 4 ft. forward you rise 1 ft. (Fig. 9E).

If our fly wanted to find a sheltering hollow in the side of the potato, the map would show him where it was. Inward dents in the lines show a hollow. If the lines get closer further into the hollow, it has a shallow entrance; and finishes with a very steep slope (Fig. 9F). lithe lines remain spaced like the surrounding parts, the hollow follows up a the same angle as the surrounding surface (Fig. 9G).

The spacing of contour lines gives a good guide to the varying amounts of slope. A glance at the contour lines crossing a piece of road will show where the hill is steep and where it is more gradual. Lines which get closer as you progress, mean that you may cycle some way up, but you will probably finish up by walking (Fig. 10H). If the closer part is near the start you will have the stiffest climb first, and an easier slope later (Fig. 10I).

In the early days of cycling, road books were popular. These gave sections of roads, so that the cyclist could see at a glance what hills to expect. Making your own section of a journey is interesting and helps you to understand contours. Using the same scale for heights and distances would be too fine for variations in height so the height scale has to be exaggerated. If lengths are 1 in. to 1 mile, heights could be $^{1}/_{8}$ in. for every 50 ft. The steepness of hills will be excessive, but you allow for that in reading the sections.

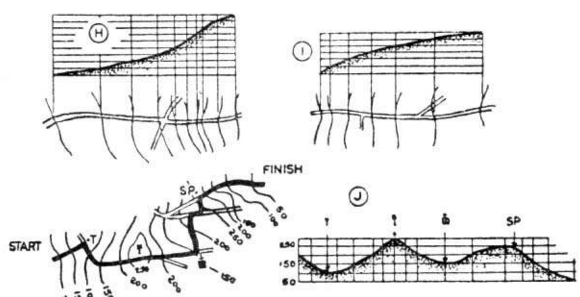


Fig. 10.

Draw a grid as long as your journey is to be and with enough height lines to take in everything. Let the bottom line be the lowest point on the road. Find the height of the start, from your map, then measure along the road to each place where a contour line crosses and mark this on the grid. Also mark in the names of places. Join up all the points, and you have a section of the route (Fig. l0J).

Scales.

To be quite at home with mapping you must understand scales. Obviously, a map cannot be made the same size as the land it represents. It has to be much smaller, and the scale tells you how much smaller. When you make a map, whether it is a carefully measured job or a very rough sketch, you should put on it two things—an indication of the direction of north and the scale. The scale may be very approximate in the case of a sketch, but put on a line with its ends marked, and print the length it represents beside it (Fig. 11A).

When you make a scale drawing of a job you intend doing, you may draw it full-size, or if that would need too big a piece of paper it may be drawn ½, ¼ or $^{1}/_{8}$ full-size. When you speak of scale in that way you are using a representative fraction and the scale of a map may be given in the same way. A 1-inch O.S. map is 1/63360 of full-size. If you work it out, that is the number of inches in a mile. The fraction is not so easily understood as the plain statement that the scale is one inch to one mile. Never say "One inch equals one mile." It two things are equal, they are the same as each other, and one inch and one mile are not.

Scales are usually quoted in words, but for convenience in measuring a length of scale is usually drawn in the margin of the map. Usually the greater part of the length is divided into miles, and one mile is divided into smaller parts—maybe quarter miles, or even smaller parts if it is a large scale. A point to watch is that “0’ is not at the end of the line. The whole miles and part miles are measured outwards in opposite directions from “0” (Fig. 11B).

Measurements on the scale are best taken with a pair of dividers. Set them to the two points on the map, then bring them to the scale. Put one point on a whole mile mark which will let the other end come in the part-mile section. You then read off the number of whole and part miles (Fig. 11C). If you have no dividers, you can do the same with a strip of paper. Put the paper between the points on the map and make pencil marks on its edge, then refer these marks to the scale.

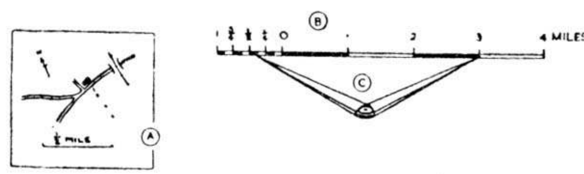


Fig. 11.

A scale to a straightforward proportion is easily drawn with a rule, and most maps you prepare can be tackled in this way. Sometimes you have to get distances off a map with no proper scale. Some old pictorial maps may have no scale. Aerial photographs are other things where you may have to make your own scale. Find two places on the map, of which you know the distance apart, either from another map or from local knowledge. Draw a line this length. Suppose the distance is 5½ miles. Check the length with a rule, to see if it can be divided up by measuring. If it cannot, draw a line from one end of it, and mark off 5½ miles to any convenient scale. Draw a line between the 5½ mile marks on each line (Fig. l2D). Use a set square, sliding on a rule to draw a parallel line through the 1 mile mark (Fig. l2E). Use a pair of dividers to step off the number of miles you want on the scale.

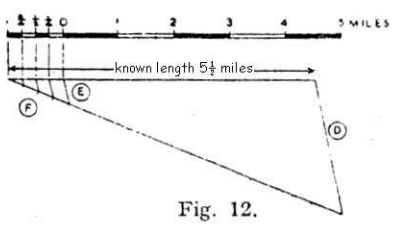


Fig. 12.

To divide up one mile into ¼ miles or furlongs, use a similar process. Draw a line branching off and divide it into four or eight. Connect the one mile marks and use the set square and rule to locate the other marks by drawing lines parallel to it (Fig. 12F).

Our English system of measurement, with 1760 yards in a mile and other odd divisions, may seem unnecessarily complicated. There is something to be said for working in thousands of yards, instead of in miles, and the 1-inch O.S. map has a scale divided in this way alongside the normal one in miles. In measuring hiking distances, try thinking in thousands of yards for a change, so as to get used to the method. For comparison, 7,000 yards is about 4 miles.

If you plan to tour abroad you must get used to metric scales. Metric scales are simpler than British ones. You can see one on your 1-inch O.S. map. Everything is in tenths. The kilometre (about $^5/_8$ mile) is the standard land measure, used instead of our mile. In it there are 1,000 metres (just over a yard). Each metre is divided into 100 centimetres, which are again divided into 10 millimetres. Metric scales are described as so many centimetres to so many kilometres but because everything is in tenths the representative fraction is easier to understand. 1/10,000 means that 10 cm represents 1 km (about same scale as 6-inch O.S. map). 1/50,000 means 2 cm to 1 km (a little bigger than 1-inch O.S. map).

Triangulation—Plane table.

Being able to read maps is important; being able to make good sketch maps is important; but what is most important if you are to call yourself a Map Maker is the ability to make an accurate map.

Map Makers make good use of triangles. A four-sided shape can distort, but you cannot push a three-sided figure out of shape. If you know the lengths of the sides, or of one side and two angles, or of two sides and one angle, you can reproduce the triangle, either full-size or to scale, and be certain that it is accurate. Navigators of ships and aircraft use triangulation in plotting their positions and courses on charts.

Maps are usually worked out from a base line, both on the ground and on the map. The positions of all the features are found by taking bearings from the ends of the base line. When these are transferred to the map, the two bearing lines and the base line form a triangle for each feature, and it is located positively in relation to the base line. The accuracy of the map depends on the accuracy of the base line, and in professional map-making the fixing of the two points which represent the ends of the line on the ground is quite a complicated process.

For our purposes a map can be made of a small area by triangulation, either by using a plane table or a compass. Both methods are basically the same, but with the plane table you sight the things directly over the map, but with the compass you take bearings and transfer them to the map with a protractor. For plane table work, all of the equipment can be improvised.

The plane table is a flat board, big enough to take the paper on which the map is to be drawn. This has to be supported level at a convenient height for working. A camera tripod is a good support. Incidentally, the three legs of the tripod again form a triangle, which cannot be pushed out of shape, and the tripod will not wobble, however uneven the ground.

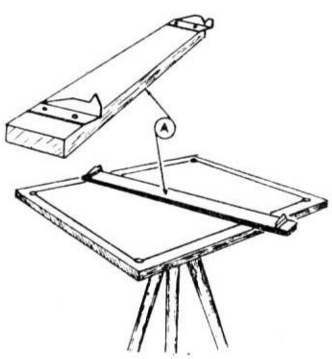


Fig. 13A.

Sighting is done with an alidade, which is merely a rule or straight edge fitted with sights. The longer the rule and the farther the sights are apart, within reason, the more accurate can you work. The sights may be made from pieces of tin tacked on. The important thing is that they should come over the drawing edge (Fig. 13A). No other tools are essential, but another rule for measuring and a compass for checking and setting the board may be useful. The paper should be fixed down with pins and drawing done with a sharp hard (2H) pencil.

The base line on the ground may be measured by pacing, using a Scout staff, or with a steel tape measure. If the ends of the line are not natural features, mark them by poles. The length of the base line and its position depends on the particular map. Suppose the map is to be of an irregular field, with a barn, pond and a few isolated trees. Arrange the base line where most of the features (all if possible) can be seen from both ends. Make the line reasonably long, but there is no need to stretch it to the limit. Experience will guide you, but about one-third of the length of the field is reasonable. Arrange it, if possible, so that no feature comes nearly in line with it (Fig. l4B).

To arrive at a scale, you have to estimate the over-all size of the field and choose a scale which will fit the paper. Draw the base line to this scale. Stand the plane table over one end of the base line and put the alidade over the drawing of the base line, then turn the table until you can sight the pole at the other end.

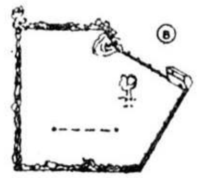


Fig. 14B

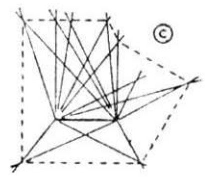


Fig. 14C.

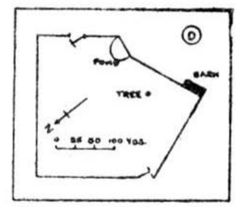


Fig. 14D.

Sight all of the features which are to be marked. Every time have the sighting line through the point of the map representing where you are standing. If there are a large number of sights, it is safest to number them on the map, and keep a list of them in a notebook. When all possible sights have been taken from the first point, move to the other position. Set the plane table by sighting the first point through the base line on the map, then take sights of all the features dealt with at the first station. Where these sight lines cross their partners from the first station will be the location of the features on the map (Fig. 14C).

Keep the pencil sharp and do all of the marking lightly. When you are satisfied that the sighting is complete and correct, the outlines may be drawn in, and minor features added freehand, by estimation.

To complete the map, ink in the details and erase the sight lines. Even better—trace the map, omitting all of the construction lines. Remember, too, that the map is not complete until it has a scale and an indication of north (Fig. l4D).

Triangulation—compass.

Whether you are to make a map by plane table or by compass triangulation depends on your equipment. As you could see from the last section working with a plane table, is quite satisfactory, and even the newest Troop, with no funds and no equipment, could turn out an accurate map of their camp site in this way.

For compass triangulation you need a sighting compass marked in degrees. This maybe a prismatic type or one of its cheaper alternatives. A liquid compass is best, otherwise you waste a lot of time waiting for it to settle down. For transferring the bearings to the map you need a protractor, which may be the oblong type which also serves as a rule, or a transparent semi-circular one. Better still is a completely circular transparent one, as its full circle of markings will match the compass rose.

The work should be done with a 2H pencil on a piece of paper mounted on a board, but it does not need to be fixed on a stand like a plane table. A notebook in which to list the bearings and to make calculations or sketches will be worth while.

Decide on the ends of the base line and mark them on the ground and on the map, as described in the last section. It is possible to take all time bearings and list them, then leave the actual drawing of the map until you get home, but it is safer to take a batch of bearings, then transfer them to the paper before moving on to the next lot.

The first bearing taken should be of the other end of the line. Suppose this is 95 degrees—put the protractor with its centre over the correct end of the base line and turn it so that the 95 degrees mark is on the line. Put a dot where 0 degrees comes. Remove the protractor and draw a line through this point and the end of the line (Fig. 15A). This line will run magnetic north and south. If your protractor is 0 degrees to 180 degrees only, plot any bearing less than 180 degrees to the east of the line and use the protractor to the west of the line for any bearing greater than 180 degrees, deducting 180 degrees from the compass bearing to get the protractor reading. A circular compass may be read direct all round with 0 degrees representing north.

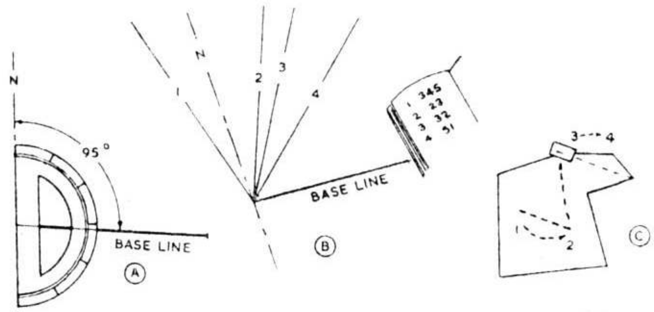


Fig. 15A. Fig. 15B. Fig. 15C.

Take each sight more than once, and if there is any difference in the bearing, use an average. Take a batch of bearings and list them in your notebook, with any details you wish to remember, and possibly the estimated distance away. Draw these sight lines or rays on the map and number them to agree with your list (Fig. 15B). When you have taken all the bearings you need, move to the second point and sight all of the features from there. Put a new N.-S. line through the second point on the map to serve as a base for the protractor, and plot all of the bearings. Where these cross their partners from the first point will be the locations of the various features. At this stage it is worth comparing compass triangulation within the plane table method described last time. Basically they are the same, and you should try both methods to get used to them.

There is no reason why the two methods should not be combined, with some bearings sighted directly with an alidade and others found by use of the compass and protractor. In practice there will be many places on a map which cannot be sighted directly from the ends of the base line, however carefully this is placed. In these circumstances, carry on as far as you can and draw the map as far as possible, using either method. If you can take a sight from one end of the base line only, do this and mark it on the map. With the map completed as far as possible you will have many features positively located besides the two marks at the end of the hash line which you started with. Any of these fixed points can be used to locate others which are as yet unknown.

Using the plane table method, move the table to the chosen point and erect it so that its base line is parallel to the original one. This may be done by checking its setting with a compass in the first place, and seeing that the setting is the same in the second place (Fig. l5C). Alternatively, put the alidade over the new position and any other known point, and move the table around until the sights are on the other object (Fig. 16D). Once the table is set, take whatever sights are necessary of objects previously inaccessible. If further sights are needed to locate them exactly, move to another known point and sight them again.

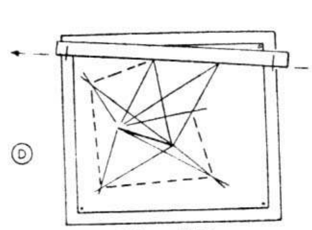


Fig. 16D.

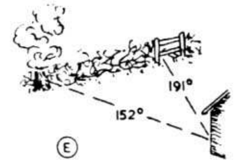


Fig. 16E.

Using compass triangulation, the fixing of points out of sight of the first stations is simple. Move to a point already fixed, but within view of the chosen point and take a bearing of it. Transfer this with the protractor. If a second bearing is needed, move to another known point and do the same again (Fig. 16E).

Mapping by field book.

When an explorer is travelling over strange country he has many things to do besides make a map, but a map is essential if he is to do his job satisfactorily. It need not be very detailed, but it should show the important points with a reasonable degree of accuracy. Something better than a freehand sketch map is required.

The method used is to take frequent bearings and to list them with distances and notes while travelling, and to use this basic information to draw the map later. You will see that it is a step following the compass and plane table triangulation. Bearings of the route followed are taken as well as sights of landmarks in view. If sights are taken from different points on the route, the resulting triangles will pinpoint the positions of the landmarks on the map.

We have to make a map by this method of two miles of road, showing features each side, to a scale of 4 inches to 1 mile. A bearing compass is needed, and the better the compass the easier and more accurate will be the work. Distances can be measured by pacing, although for extreme accuracy you could use a tape measure, and for longer distances you might have to rely on estimation. A cycle with a cyclometer will record longer distances down to one-tenth of a mile. For the badge test pacing should be acceptable.

An important thing is the field book in which you record all the information. Rule a narrow column down the centre of the page. Treat this centre column as the road you are travelling, ignoring all the twists and turns. If you think of it as a map of the route you are about to follow, you would start on it from the near end, so your notes start at the bottom (Fig. l7A). In the centre column go distances and bearings referring to the route itself, with observations to the left in the left-hand column and observations to the right on the other side. Do not cramp your work—it does not have to be all on one page.

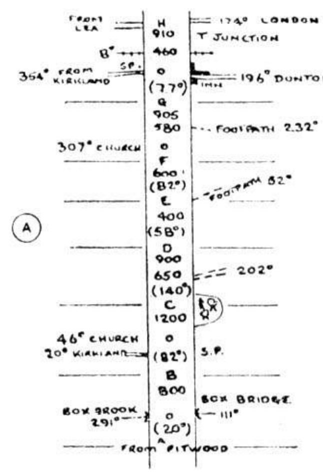


Fig. 17A

So that paces and degrees do not get confused, put the bearings in brackets as well as using the degree sign. Divide your route into sections, and mark them in some way, lettering them or using the names of roads. In each section or leg, number the paces right through from start to finish—do not start afresh every time you halt to record something. As you move into a new section start numbering again.

Every time you stop to record anything, note down the distance. It is always a help to have an assistant working with you to reduce the risk of errors. In the side columns make sure that what you write down gives the whole story.

If you think it will jog your memory, include little sketches or conventional signs.

Choose the lengths of sections to suit road bends, junctions and other obvious places. The number of sections will depend on the particular road. Remember as you work along that cross bearings of prominent landmarks may be possible from points widely different on the route and in separate sections. There is less risk of error in cross bearings that are somewhere near right-angles to each other than in those which are very acute or obtuse. Within reason, the more bearings you can take of an object, the better, as they serve to check each other. However, expect a slight error—it is unlikely that all bearings will cross at an exact point.

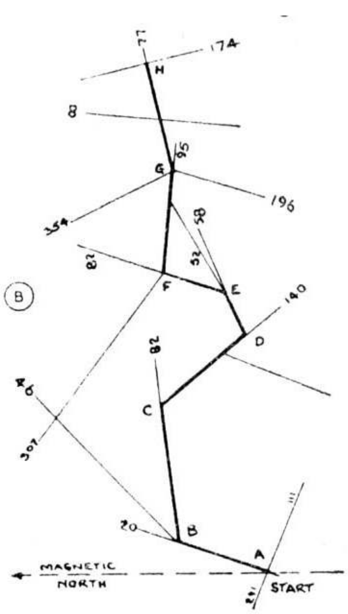


Fig. 18B.

To make the map from your field book, it is a help if magnetic N. and S. can run horizontally across your paper. This simplifies the use of the protractor. A T-square and a drawing board are also useful. With a picture of the map in your mind, arrange your starting point at the bottom or one side of the paper. Have the paper plenty big enough to suit your scale. For the sizes mentioned in the test, start to finish is going to be about 8 in.

Put a line representing magnetic N. and S. through your starting point, and always use the protractor from this or lines parallel to it. A T-square will serve as a movable parallel line. Work up the bearings and distances of your centre column (Fig. 18B). With these plotted, draw in lines representing bearings from your chosen points. These will locate the features viewed from the road. Add minor details freehand.

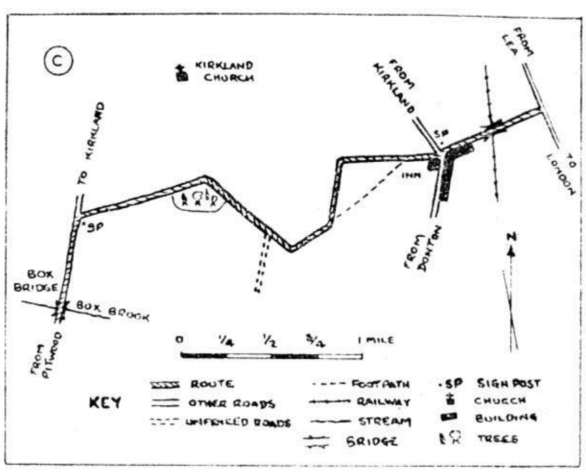


Fig. 19C.

Do all of this faintly with a soft pencil, as many of the lines will have to be rubbed out. Better still, trace the final map from it. When you are satisfied that your construction is correct, draw in the roads and other details. Keep road lines close and parallel, otherwise it is difficult to make the map look neat. Put a border around the map. Mark where roads are to and from. Add a scale and an indication of north. Even if you made the map sideways, it may be better to complete it with north at the top (Fig. 19C).

Put in a key so that anyone can understand the signs you have used.

Enlarging a map.

Suppose you find a new camp site for your Patrol and locate it on the 1-inch Ordnance Survey map. You can work out its grid reference, and you have the place positively located, but the the whole thing is rather small and difficult to use if you want to tell your Patrol all about the new discovery. It is possible to buy a map of the place, drawn to a larger scale, but if you are going to call yourself a map maker you will enlarge the map yourself. Of course, the method used suits enlargements to any size.

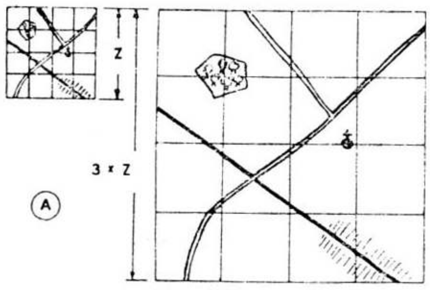


Fig. 20A.

One way is to cover the chosen part with a grid of lines, and to draw the enlargement with the help of a similar grid drawn three times as big. The size of the grid depends on the amount of detail in the particular area, but ¼ in. squares on the small grid may do (Fig. 20A). If the lines are drawn on the actual map, use a soft sharp pencil so that they can be erased afterwards. It is better to have the grid drawn on a piece of tracing paper. Besides avoiding marking the map it can be used several times.

The new map has to be drawn freehand. Examine one small square and notice the detail in it and where parts cross the grid lines. Repeat all this in a large square, estimating your distances. Where a conventional sign is used on the O.S. map, the exact location of the thing it represents is at the centre of the base of the sign. There is no need to enlarge the signs amid symbols, but they must be correctly located.

A more accurate method is by triangulation. Draw your square on the map and another three times as big on plain paper. Use a pencil compass instead of dividers. Set the compass to the distance of an object from one end of the base line (Fig. 21B). On a line drawn on scrap paper, step off this length three times and open the compass to this total distance (Fig. 21C). With the point on the end of the enlarged base line draw an arc (Fig. 21D). Go back to the other end of the map base line, set the compass to the distance of the object, enlarge it to three times again and draw another arc over the first one (Fig. 21E). Repeat this for all the other important points, and finally fill in minor detail by estimation.

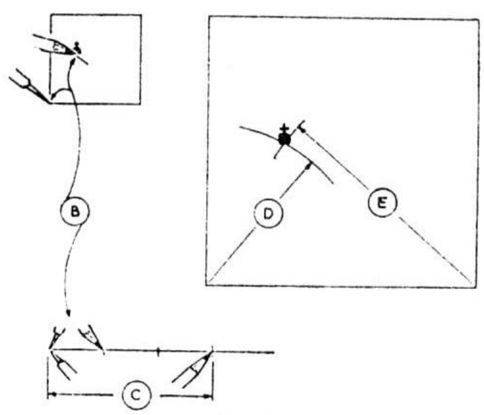


Fig. 21.

The two methods can be combined. Triangulation should give complete accuracy, but the grid will serve as a general guide. It also provides a check on any slip in setting the compasses. It is possible that a few points will come exactly on grid lines, so they may be fixed without work with the compasses.

To complete the enlarged map correctly, add a scale and a north sign. You may be able to introduce new features in the bigger space at your disposal, based on your own knowledge of the ground. This method may also be used in reverse; reducing a large map to a small one. Accuracy is always easier when making a large map, whether by compass triangulation, plane table or field book. Construction lines which get confusing in a small map, sort themselves out easily on a large scale. It is good cartography (the art of map making) to do the preliminary work big and reduce the size of the final map.

This is the last section. If you have followed me all through you will have had information on all the mapping that comes in Second and First Class tests and several proficiency Badges. Maybe you do not feel that you have advanced enough to tackle the badges yet, but whatever stage you are at I hope you get a lot of fun and satisfaction out of mapping. Some knowledge of mapping is useful to everyone, and we as Scouts should take a pride in our ability to use a map and compass or make our own maps.

The rest of the job is up to you. Study your 1-in. O.S. map and get to know what all the things mean. Take the map out with you whenever you can, especially when you go into country that is strange to you. Learn to set the map almost automatically. If you only have a cheap compass, you can do all the jobs that the better instrument will, but you cannot expect such accuracy. You do not need to go out into the wilds to make a survey. You can do it all on a smaller scale inside a hut, and working in that small space it is easy to check your results. If that works and all the Patrol get the hang of it, you can set out confidently to do the job on a big scale.

If you want to read a good yarn, with plenty of adventure, including mapping by the methods I have been writing about, get hold of “Secret Water,” one of the “Swallows and Amazons” series by Arthur Ransome.

NOTES

NOTES

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