V.

ON THE DISCOVERY OF A SCULPTURED STONE AT ST MADOES, WITH
SOME NOTES ON INTERLACED ORNAMENT. By J. ROMILLY ALLEN,
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The following paper contains a notice of the discovery of a sculptured
slab, built into the walls of the Session's House at St Madoes, in Perth-
shire, together with a description of the cross in the churchyard, and
concludes with an attempt to analyse and classify the different forms of
Celtic interlaced ornament.

St Madoes Session's House Slab.

St Madoes Church is situated on the north bank of the Tay, six miles east
of Perth, and is about five minutes' walk from Glencarse railway station.

In the early part of the year 1881, Mr Magnus Jackson of Perth
informed me that he had discovered what appeared to be the edge of a
sculptured stone, similar in character to the cross in the churchyard,
built into the walls of the Session's House adjoining the church. I there-
upon wrote to the late Sir John Richardson of Pitfour Castle, mentioning
the matter, and requesting his permission to be allowed to remove the
stone, which was immediately granted. Mr Jackson and I accordingly
went to the place in August, accompanied by a mason, who in the course
of a short time was able to get out of the wall two sculptured fragments
of stone, and build up the masonry again with less valuable archæological
materials. The sculptured fragments, when removed, were at once seen
to be the two halves of a cross slab, which had been split up the middle
and used as common rubble.

The shortest fragment is 2 feet 5 inches long, and the longest one 2 feet
10 inches long. When put together they form a sandstone slab 1 foot 9 inches
wide, the thickness being 4 inches. What remains of the sculpture is shown
on fig. 1. On the front is a cross of the usual Celtic form, with hollows
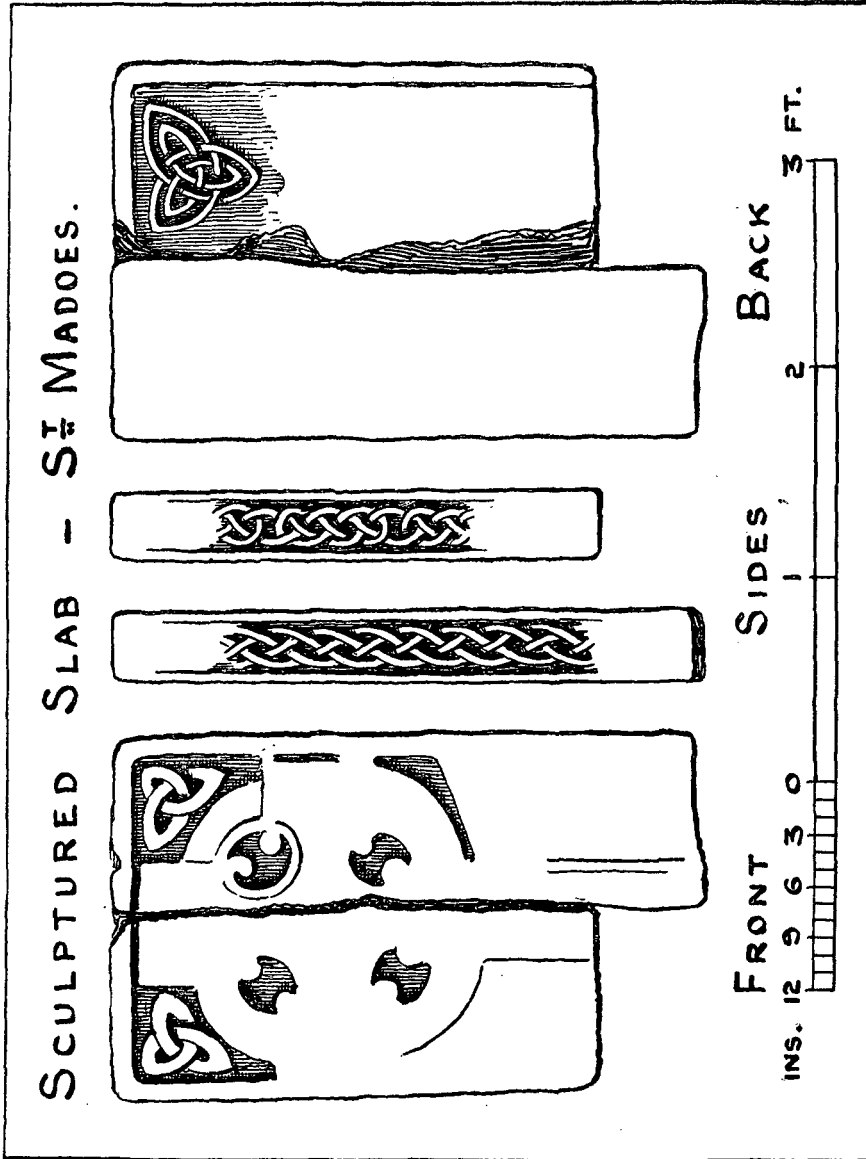where the arms meet, and a surrounding ring. On each side of the cross,

Fig. 1.

at the top, are triquetras, and below, on the right, are traces of carved work, but so obliterated that nothing can be made of it. The back has been entirely defaced, except at the right hand upper corner, where the triquetra figure occurs again, but with a double band instead of a single one, as on the other face. The pattern on the edges is a simple plait of four strands. It was this portion which was visible when the fragments were built into the wall, and which caught Mr Jackson's keen eye.[1]

Mutilated as the St Madoes slab unfortunately is, it is still of value from an archæological point of view. The occurrence of the triquetra three times on a single stone is by no means common. The knot which is known by the name of the triquetra corresponds in form to the equilateral triangle, having three pointed loops which enclose triangular spaces arranged symmetrically round a central triangular space. It may be derived from the interlacing of three equal circles, the outer portions being removed. Used as a Christian symbol, it probably signifies the Trinity. On Celtic crosses and slabs it is used both as a symbol and an ornament. In the latter capacity it is admirably suited for filling in triangular spaces, formed, for example, by a circle inscribed in a square, as on the Maiden Stone in the Chapel of the Gairoch, or by a cross inscribed in a circle, as at Laugharne in Caermarthenshire. When the triquetra obviously does not form a portion of the ornamental design, it may be fairly assumed that it is intended as a symbol.[2]

[1] Quite recently I noticed a fragment, with exactly the same plaited ornament upon it, built into the wall of the chancel of Otley Church, near Leeds, where are preserved other sculptured stones with interlaced work, all of great interest.

[2] The most remarkable instance of this in Scotland is on one of the crosses at Meigle (Stuart, vol. i. pl. lxxiii.), where the triquetra occurs in association with four other symbols of unknown import—namely, the fish, the so-called elephant, the head of a conventional animal similar to that on the Norrie's Law leaf-shaped silver plate ; the Z-shaped rod and serpent ; the mirror and comb. The fish may possibly symbolise—

$$Iησους$$
$$Χριστος$$
$$Θηου$$
$$Τιον$$
$$Σωτηρ.$$

The fish symbol is used on a cross slab at Fuerty in Ireland (Petrie's *Christian Inscr.*, vol. ii. pl. viii.), and is to be found in the books of Kells and Armagh. The
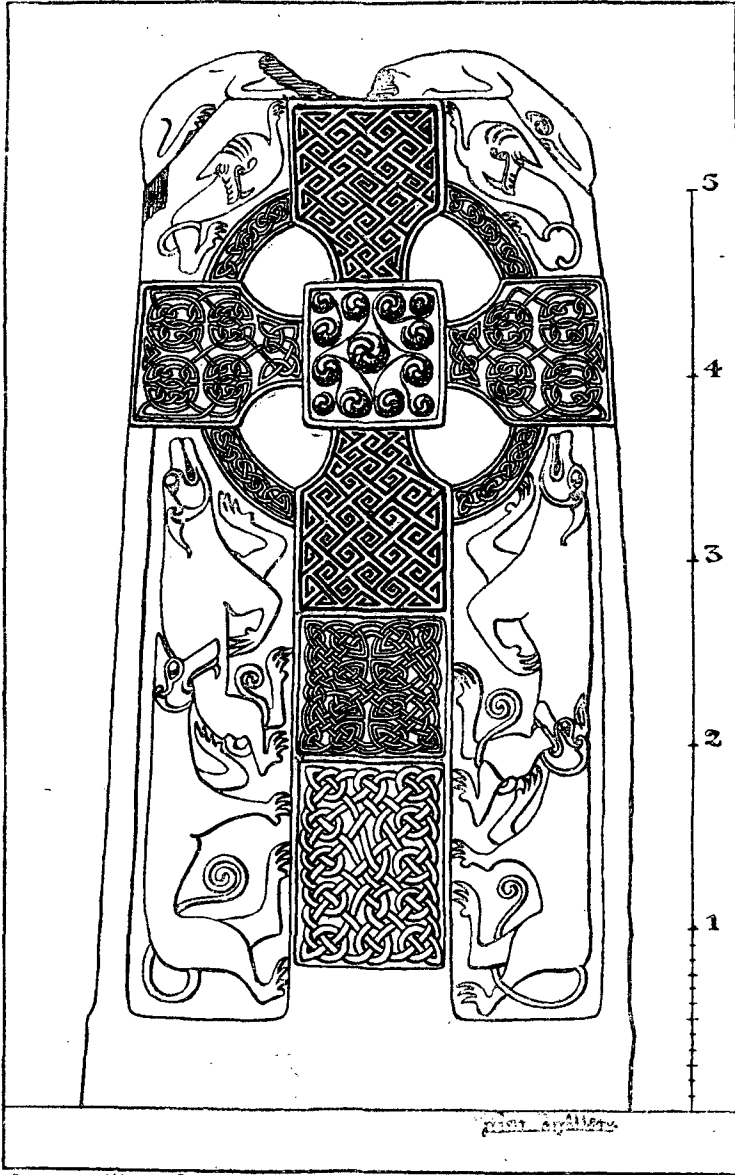
St Madoes Churchyard Cross.

The cross of St Madoes lay for many years neglected and unknown in the churchyard until, in December 1853, at the instance of Mr Muir of Leith,[1] it was erected on a substantial sandstone base, outside the west door of the church.   According to Dr Stuart,[2] nothing is known of the history of the cross, but he identifies St Madoes with St Madoch, who is supposed to have come from France and landed on the banks of the Tay hard by, where he made converts to the Christian faith, by whom the original church was built and dedicated to the saint.   The cross is a slab of red sandstone, 8 inches thick, 5 feet 6 inches high, and 2 feet 6 inches wide at the top, and 3 feet wide at the bottom.   Imbedded in the sandstone are several hard quartz pebbles, which were dressed down flat with the rest of the surface when the cross was carved.   The tool marks still remain sharp and distinct on the tops of the pebbles, which now project in some cases quite an eighth of an inch above the rest of the stone, thus showing the exact amount of disintegration which the ravages of time have effected.   If it were not for the fact of the recessed portions of the carving weathering together with the parts in relief, though probably not at the same rate, all traces of the ornament in these sculptured stones

triquetra is employed as a symbol on the wheel cross at Margam in Glamorganshire (Westwood's *Lapidarium Walliæ*, pl. xv.), where it is placed above figures of saints on each side of the shaft of the cross ; and at Llanfrynach (*Westwood*, pl. xxxix.), where it occurs twice in association with the figure of a dove.   On a cross at the Calf of Man (Cumming's *Runic Remains of the Isle of Man*, pl. xi.), the triquetra appears on the dress of the crucified Saviour.   The triquetra occurs on the breasts of three out of four of the figures of the Evangelists in the copy of the Gospels of Dimma, written in the sixth century, and now in the library of Trinity College, Dublin (Petrie's *Ecclesiastical Architecture of Ireland*, p. 324).   The triquetra is used on metal-work as an ornament on a bronze ornament found at Athlone, now in our Museum ; on the croziers of St Fillan and of St Damhnad Ochene (Petrie, p. 323). For various examples see the following :— Stuart's *Sculptured Stones of Scotland*, vol. i. pls. ii., lviii., lxxiii., xiii.; vol. ii. pls. ix., xxxviii., lxxxii., xcii.; Petrie's *Christian Inscriptions in the Irish Language*, vol. i. pls. v., xxxiv., xxxvi., li., liii.; vol. ii. pl. xvii. ; Westwood's *Lapidarium Walliæ*, pls. v., xv., xxxix., xlviii., lvi., lxxii. ; Cumming's *Runic Remains of the Isle of Man*, pls. iv., xi., xii.

[1] Muir's *Notes on Remains of Ecclesiastical Architecture*, p. 27.

[2] *Sculptured Stones of Scotland*, vol. i. p. 16.

would very soon disappear.   Even as it is, it is a great question whether
these exquisite monuments should be allowed gradually to perish by ex-
posure, when they might easily be placed under cover or coated with some
silicate solution.   The sooner casts are taken the better, as the sharpness
of the carving is rapidly going.   The design on the front of the stone
(fig. 2) consists of a cross of the usual Celtic form in relief, the central
square being the highest above the rest of the surface, then the shaft and
arms, and next the circular ring which connects the arms.   The circular
hollows at the intersections of the arms are considerably recessed.   The
central square, from which the arms diverge, is ornamented with thirteen
raised bosses formed by spirals, similar to those of the Celtic manu-
scripts.   The bosses are arranged symmetrically thus—a large central
boss with a quadruple left-handed spiral, surrounded by eight smaller
bosses with triple spirals, alternately right and left handed, and filling up
the four corners, are the four smallest bosses, with double spirals alter-
nately right and left handed.   These spirals may be realised by imagining
a wheel with elastic spokes, the axle being twisted round, while the
circumference is held stationary.   The character of the spiral will there-
fore depend on three things, namely—(1) the direction of the twist, (2)
the number of curved spokes, (3) the number of twists given to the
spokes.   In Celtic ornament the spirals run one into the other, and the
triangular spaces between the touching circles form trumpet-shaped ex-
pansions at the ends of the spirals.   In the Celtic MSS., such as the
book of Kells (Westwood's *Miniatures*, pl. ix.), the groundwork of the
spirals is white, but a great part of the interspace, where the trumpet-
shaped expansions occur, is black.   Much the same general effect is
obtained on the sculptured stones by engraving the spirals on raised
bosses, and leaving the remaining portion of the surface at a lower level.
Another difference between the MSS. and the stones, is that the MSS.
spirals are composed of a few lines, but have a great number of convolu-
tions, whereas on the stones the number of lines is greater but their con-
volutions fewer, this form being more suitable for carving in a coarse
material.   Spirals are to be found on the Irish stones, the earliest dated

Fig. 2. Sculptured Stone in the churchyard of St Madoes (obverse).
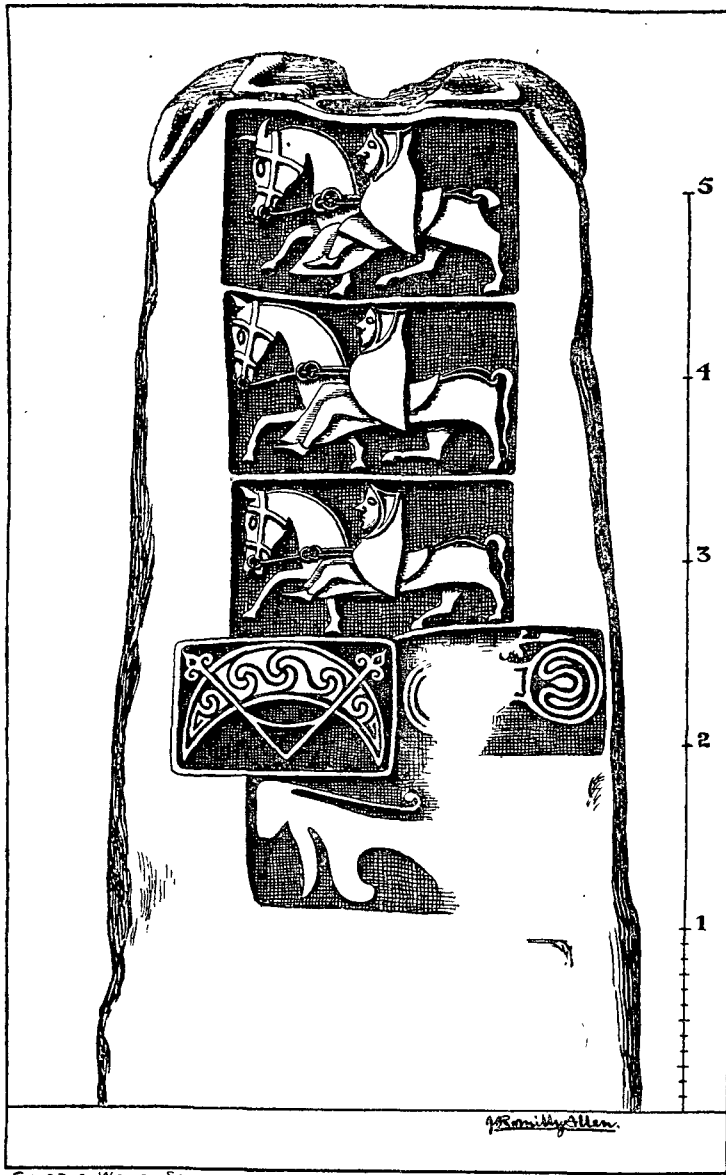
Fig. 3. Sculptured Stone in the churchyard of St Madoes (reverse).

specimens being at Clonmacnois, A.D. 887 (Petrie's *Christian Inscriptions*, pl. xxxi.), but in Wales there are none.   Spirals exist on several stones in Scotland, as at Dunfallandy, Hilton of Cadboll, and elsewhere, but I think those at St Madoes are almost the most perfect of all, both as regards design and execution.

The two vertical arms of the cross are covered with key patterns, like the Greek fret with square angles, but running diagonally.   Key patterns are common to most of the Welsh, Scotch, and Irish stones, but the specimen now under consideration is much more finely executed than is generally the case ; in fact, the work resembles engraving more nearly than carving.

The horizontal arms of the cross, the connecting ring, and the two lower panels of the shaft are decorated with interlaced ornament.   The element, which is repeated four times to form the patterns on each of the side arms, consists of a penanular band with two breaks at opposite sides of the circle, where it bends inwards and forms a series of knots, which are symmetrical on each side of the diameter.   The special class of patterns to which these interlacements belong is described in the latter part of the present paper (see No. 171, p. 260).

The knot-work on the ring connecting the arms of the cross is irregular in design.   The central panel of the shaft is approximately square, and contains an arrangement of four symmetrical knots with pointed ends, and composed of a double band.[1]

The bottom panel of the shaft is oblong, and covered with a broader interlaced band than the one above, looped round the edges, but irregular in the middle.   There are a few irregularities also in the interlacements of the panel above.   Variations in the design, such as these which are apparently meaningless, do not occur in the MSS., although they are frequently to be noticed on the stones.   The explanation may be that the design was set out by a draughtsman, and that the mistakes are due

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[1] In Stuart's *Sculptured Stones of Scotland* (pls. lv. and lvi.) a single band only is shown ; there is also a mistake in the interlacements of the left arm of the cross, and on the back the cruppers of the horses are omitted altogether.

to the carver's want of skill in following out the lines set before him. Slight variations are often found in the best work, with the object of preventing symmetry becoming too exact and therefore monotonous; but the irregularities referred to do not, I think, come under this head, being too meaningless and too easily detected. At the same time other parts of the execution of the St Madoes stone are so faultlessly carried out that it is difficult to understand mistakes occurring here.

The remaining portion of the face of the stone is filled in with conventional animal forms. Above the cross on each side are beasts with pointed ears and twisted tails, biting their own backs. The canine teeth are highly developed, and the wrinkles on the nose are like those exhibited by a ferocious bull-dog when showing his teeth.

On each side of the shaft of the cross are pairs of long straight-backed animals, the lower one biting the thigh of the one above. The tails are curled under the bellies, and the paws are armed with long claws. The ears are conventionalised in a very curious manner, and assume the forms of triple spirals. All the groups of animals are symmetrical on each half of the stone.

The edges of the slab have been left plain, and do not appear even to have been dressed smooth.

At the top the square corners are bevelled off at an angle of 45°, and here are placed two conventional beasts facing each other in a crouching position, ready for a spring. Their heads have unfortunately been defaced.

The back of the stone (fig. 3) is divided into six panels, three containing figures of horsemen and three enclosing symbols. The three figures of men on horseback seem to be all similar, with the exception that the horse on the top panel has his tail cropped, whereas in the other two cases the tails are long and wavy. The manes of all the horses are cropped. The horse-trappings, including cruppers, ring bits, reins attached to double rings, saddles, and horse-cloths, are very clearly shown, but there seem to be no stirrups. The horsemen wear short, stiff, pointed cloaks, with cowls sticking up like horns on each side of the head.

Cloaked and cowled figures on horseback occur on stones at Mortlach and Eilanmore (Stuart, vol. i. pls. xiv. and c.). The horned cowl appears on a figure on a fragment at St Vigeans in connection with a pastoral staff and the double disc symbol (*Proc. Soc. Ant. Scot.*, vol. ix. pl. xxxiii., No. 14). It is also seen on the Burra Stone (*Proc. Soc. Ant. Scot.*, vol. xv. p. 201), and on the Bressay Stone (Stuart, vol. i. pl. xcv.). A cowl of this description thrown back from the head is shown on a slab at St Vigeans (Stuart, vol. i. pl. lxx.). Arguing from analogy, the horsemen on the St Madoes Stone are probably intended for priests.

Immediately below the horsemen are two panels containing symbols; that on the left-hand side is the crescent and V-shaped rod with floriated ends. The crescent is filled in with spiral ornamentation. The panel on the right contains the Z and double disc symbol. The stone is a good deal worn at this point, but enough remains of one of the discs to trace the concentric penannular circles within it. Below the two panels just described is a third enclosing the so-called elephant symbol. The meaning of these symbols is at present shrouded in mystery.

The V and crescent occurs more frequently than any other symbol, being found on 28 pillar stones, 20 cross slabs, 3 caves, 1 metal ornament and 1 bone, making a total of 52.

The Z and double disc occurs on 18 pillar stones, 14 cross slabs, 1 cave, and 3 metal ornaments, making a total of 34.

The so-called elephant or long-jawed beast occurs on 13 pillar stones, 19 cross slabs, and 3 caves, making a total of 35.[1]

The V and crescent and Z and double disc occur in combination altogether 9 times.

The V and crescent and long-jawed beast occur in combination altogether 9 times.

The Z and double disc and long-jawed beast occur in combination altogether 6 times.

All these symbols occur together only at St Madoes and Glenferness;

[1] Stuart's *Sculptured Stones of Scotland*, vol. ii. p. lxxiv.

also at Dunfallandy and Hilton of Cadboll, only the double disc has no Z.

The special peculiarity of the St Madoes stone is that the symbols occur in connection with horsemen, and that the number of both horsemen and symbols is the same.   Symbols and horsemen occur together on the following stones :—Mortlach, Elgin, Cadboll, Shandwick, Kirriemuir, Dunfallandy, Fowlis Wester, Largo, Fordoun, Balluderon, Aberlemno (two stones), Cossins, Abbotsford, Gask, Meigle (three stones), Migvie, Rossie, making a total of twenty.   The number of horsemen vary from one to five, and the symbols from one to three.   In some cases I cannot help thinking that the symbols have some direct reference to the horsemen, although their numbers do not usually correspond.

At Cadboll, Kirriemuir, and Dunfallandy the symbols are placed in front of the horse's head, perhaps suggesting the idea that the thing symbolised was leading the horseman onwards, or acting as his guardian angel, or simply standing as a title for the horseman.   The examples at Rossie, Fordoun, and Balluderon are remarkable, as some of the horsemen are enclosed in the panels of the shafts of the crosses, the symbols being immediately to the right or left, and apparently having some connection one with the other.

On the stones where horsemen occur, the following symbols are also found :—1. V and crescent, seven times ; 2. V and horse-shoe, once ; 3. Z and double disc, seven times ; 4. Z and serpent, twice ; 5. Z and horse, once ; 6. long-jawed beast, eight times ; 7. flower, once ; 8. bird, once ; 9. bull's head and serpent, once ; 10. mirror and comb, once ; 11. double disc, twice ; 12. triple disc, once.

Having now described in detail the chief features of the sculpture with which the St Madoes stone is decorated, all that remains to be considered is its probable age.   Mr Anderson has shown in his Rhind Lectures[1] that the date of any monument can only be determined by direct historical evidence about that particular monument itself, and that the province of archæology is to ascertain to what special type the monument belongs,

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[1] *Scotland in Early Christian Times* (1st ser.), p. 20.

and not its age. The archæologist having arranged monuments according to their types, the historian finds out the date of certain specimens, which, if sufficiently numerous, are enough to fix the limits of duration in time of any particular type in a given area. In the absence, there-fore, of direct historical evidence with regard to a particular monument, all that can be said is, that its date lies between the period when the type to which it belongs first appeared and the period when the type ceased to exist. The character of a type seldom remains constant throughout its whole existence; but there is generally a point of maxi-mum excellence of workmanship and design, on one side of which we find an advance towards perfection, and on the other a tendency towards that degradation which precedes extinction. Rudeness of workmanship indicates generally that a monument belongs either to the former or the latter periods referred to, but it is often difficult to say which ; and when it is considered that rudeness of workmanship may be due to other causes, such as distance from centres of culture ; and also when it is borne in mind that a particular type may survive in an out-of-the-way district, or where the surrounding circumstances have a special fitness for it long after it has disappeared elsewhere, I think it will be seen how almost impossible it is to give even approximate dates without direct historical evidence.

With regard to the St Madoes stone there is unfortunately no tradition on record of any kind. It belongs to a type of upright cross slabs, covered with Celtic ornament, and bearing symbols of unknown meaning, which are found on stones in the east of Scotland only. Both the work-manship and design are of a very high character, and belong neither to the early period when the style was being gradually developed, nor to the late period when the interlaced patterns were degenerating into leafy scroll-work, but to that time when Celtic art was at its best. The question therefore arises, When did Celtic art reach its highest development, and on what historic evidence are the proofs founded ? Mr Anderson has expressed it as his opinion that the typical forms of Celtic ornamentation —namely, knot-work, key patterns, and volutes—originated in the MSS.,

and subsequently found their way to stone and metal-work.[1] First, therefore, let us consider the dates of the MSS. There is only one Scotch MS. of this class, and the art it exhibits is rude.   I refer to the *Book of Deer*, which Professor Westwood, on account of its palæographical peculiarities, ascribes to the ninth century.[2] The finest art-work of the Irish MSS. is in the *Book of Kells*, the first historic record of the existence of which is in the year 1006, but which is thought by Professor Westwood and Dr Reeves to be as old as the seventh century.

Next in beauty of its ornamentation to the *Book of Kells* comes the *Book of Durrow*. It was written by one named Columba,[3] and if this is the celebrated saint (which is doubtful), it must be of the sixth century.   The cumdach or cover for the *Book of Durrow* was made between 877 and 916, and the MSS. must therefore be at least as old as the ninth century.[4] The *Gospels of Lindisfarne*, although executed by Saxons, belongs to the Scotic school of art, and to the period when the illuminations had reached their highest perfection.   It was written between 698 and 721 by Eadfrith, bishop of Lindisfarne.[5]

Next, with regard to the sculptured stones. There is only one inscribed stone of this type in Scotland which records the names of Drosten, Foret (?), and Forcus.   By comparing its palæographical peculiarities with the slabs and crosses at Clonmacnois in Ireland, it would appear to belong to the type which existed in Ireland in the ninth century.[6] In Petrie's *Christian Inscriptions in the Irish Language* (p. 13) a list is given of eighty-one sepulchral slabs whose dates are known by historical evidence, varying from A.D. 628 to 1273.   The first instance of a key pattern occurs on a slab (pl. xii.) of the date of 806.   The first example of a spiral pattern is (on pl. xxxi.), date 807, and of interlaced work (on pl. xxxv.), date 889.   On the tombstone of St Fiachraich (pl. xxxvii.), date 921, the patterns become elaborate.   Of the free standing high crosses of Ireland

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[1] *Scotland in Early Christian Times* (2nd ser.), p. 109.

[2] *Book of Deer*, Spalding Club, Preface, xviii.

[3] *Scotland in Early Christian Times* (1st series), p. 145.

[4] *Ibid.*, p. 146.   [5] *Ibid.*, p. 150.   [6] *Ibid.* (2nd ser.), p. 195.

five are dated, namely, Monasterboice, 924 ; Clonmacnois, 914 ; Tuam (two crosses), 1106.[1]

Two Welsh inscribed stones with key patterns and interlacements at Llantwit Major, in Glamorganshire, commemorating Samson and Howel ap Rhys, are from historical and palæographical evidence ascribed by Professor Westwood to the close of the ninth century.[2]

The crosses of the Isle of Man are known by historic evidence to have all been erected between the years 888 and 1226.[3]   They are inscribed in Runes, and ornamented with interlaced work.

The dated examples of Celtic metal-work which remains are of later date than either the MSS. or the stones : some of the chief specimens are the cumdach of Dimma's Book, 1150–1220 ; cumdach of the Stowe Missal, 1023–1052 ; the Dommach Airgid, 1319–1353 ; Shrine of the Bell of St Patrick's Will, 1091–1105 ; Processional Cross of Cong, 1123 ; Crozier of Kells, 967–1047 ; Crozier of Lismore, 1090–1113.

The following are the conclusions therefore with regard to Celtic Christian art :—

1. No Christian work of art of any kind found in Ireland is earlier than the fifth century, or found in Scotland than the sixth century.

2. Celtic art in the MSS. reached its highest point of development in the seventh century (example the *Book of Lindisfarne*), and therefore the origin of interlaced work may be put at an earlier date.

3. Celtic art on the sculptured stones had commenced in the ninth, and at the beginning of the tenth century had attained its greatest perfection (as for example the crosses of Monasterboice, Clonmacnois, and tombstones of St Fiachraich and Berechtuire of Tullylease), and lasted to the end of the twelfth century.

4. Celtic art in metal-work of the best kind existed in the eleventh and twelfth centuries from historic evidence, and probably commenced at a much earlier period.

As the cross of St Madoes belongs to the best period of Celtic sculp-

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[1] Petrie's *Christian Inscriptions*, vol. ii. p. 151.

[2] Westwood's *Lapidarium Walliæ*, p. 11.

[3] Cumming's *Runic Remains of the Isle of Man*, p. 4.

ture on stone, it is probable that its age lies somewhere between the beginning of the tenth century and the end of the twelfth.[1]

The Analysis and Classification of Celtic Interlaced Ornament.

The sculpture on the Christian stones of Scotland, which were erected between the seventh and twelfth centuries, may be arranged under the following heads :[2]—

1. Interlaced ornament, . . . ⎫
2. Key patterns, ... ⎬ Pure geometrical ornament.
3. Spiral ornament, ... ⎭

4. Conventional animals, with inter- ⎫ Geometrical ornament, de-
    twined bodies, limbs, and tails, ⎪ veloped into animal and
5. Conventional foliage in scroll-work ⎬ leafy shapes.
    form, ... ⎭

6. Figures of human beings, . . ⎫
7. Figures of animals, . . . ⎪ Pictorial representations.
8. Figures of objects, . . . ⎬
9. Figures of ideal forms, . . ⎭
10. Symbols.

In the present paper I propose to deal with the subject of interlaced ornament only, and to arrange and classify all the different patterns which occur upon the sculptured stones of the Celtic period, so as to show how the most complicated kinds of knot-work have been gradually developed from the simpler forms of interlacements, such as the twist and plait.

A great deal of ingenuity has been wasted by various authors in speculating as to the probable origin of Celtic interlaced work, which

[1] The drawings which illustrate this portion of the paper have been carefully reduced to scale from rubbings divided into inch squares, and corrected with the aid of photographs taken by Mr Magnus Jackson of Perth.

[2] See Mr Anderson's Classification in *Scotland in Early Christian Times*, 2nd series, p. 132, which is much the same; also Professor Westwood's in the *Journal of the Archæolog. Inst.*, vol. vii. p. 17.

would have been far better employed in studying the details of the orna-
ment itself.   The fact is that the idea of interlaced bands applied to
decorative purposes may have been suggested in a variety of different ways,
as for example by any twisted, plaited, or woven fabric, or by braidwork
patterns sewn upon garments.   Mr Anderson has pointed out that this
species of ornament is to be found upon the works of art of most periods
and of most nations,[1] the only difference between Celtic knot-work and
that produced elsewhere being, that in the former case it was made one
of the leading features of the style of decoration, and was developed with
an amount of ingenuity quite unparalleled, whereas in the latter case only
the simpler kinds of interlaced patterns occur, and they generally occupy
a very subordinate position in designs where more favoured forms pre-
dominate.   The other authors who have dealt with this subject in the most
rational manner are Professor Westwood[2] and the Rev. J. G. Cumming.[3]

The class of decoration known as interlaced work consists in covering
a surface with one or more narrow bands, formed into twists, plaits, loops,
or knots recurring at regular intervals.   Whenever one band crosses
another, the former laps either under or over the latter, and in Celtic
work these overlappings follow each other in regular succession and with
unerring precision under, over, under, over, &c., one band never crossing
over two or more other bands at a time.

I propose to divide interlaced ornament broadly into two classes,
namely, plait-work and knot-work.   The former includes all patterns
consisting of bands twisted or plaited together, and all patterns derived
therefrom by the process hereafter described as " stopping off."

The latter includes all patterns made by the repetition of an elementary
knot at regular intervals, the ends being joined so as to form one or more
continuous bands.   I think it possible, as will be seen later on, that
knot-work was simply developed out of plait-work.

The shape of the space to be filled in has now to be considered; this

[1] *Scotland in Early Christian Times*, 2nd series, p. 111.

[2] *Journal of the Archæolog. Inst.*, vol. vii. p. 17, and vol. x. p. 285.

[3] *Archæologia Cambrensis*, 1866, p. 156.

may be either rectangular, square, triangular, or circular. When the space is rectangular (which is the commonest case) the knots are arranged in one or more parallel rows, and the bands joined across at intervals, so as to connect the rows together.

When the space is square it may be filled in either in the same way as a rectangular space, or it may be divided by diagonal lines into four or more triangles, each containing an elementary knot.

When the space is triangular it is generally filled up entirely with one three-cornered knot.

When the space is circular the knots are arranged symmetrically in concentric circular rows.

Although the elementary twists, plaits, and knots of which Celtic interlaced work is composed are very simple and comparatively few in number, yet the general effect produced is often one of almost bewildering complication. This is due to the several variations of pattern which can be made by the following means :—

1. The same elementary knot may be repeated and combined in several different ways, either by altering its position, that is by turning it round so as to face in various directions, or by altering the direction of the spiral twist of the cords composing the knot, that is, by making the knots either right or left handed. The number of variations which can be obtained from any particular knot depends on the laws of symmetry. These laws apply not only to knots, but to all geometrical figures whatsoever, and determine the number of different patterns that can be produced by their combination ; it may be as well therefore to state clearly what is meant by symmetry. In the geometry of plane figures two kinds of symmetry are recognised, namely, central and axial symmetry. A figure is said to be symmetrical with regard to a centre when it has corresponding points in every part of it on opposite sides of the centre, and at the same distance from it. A figure which has central symmetry remains unchanged, if turned in the plane of the paper round the centre of symmetry through an angle of 180°. A figure is said to be symmetrical with regard to an axis when it has corresponding points on

opposite sides of the axis or centre line, and at the same distance from it. A figure which has axial symmetry remains unchanged, if turned round the axis of symmetry through an angle of 180°, that is, taken off the paper and turned upon itself. It may help to realise the foregoing if the symmetry of the capital letters of the alphabet be analysed, thus—

<div align="center">A H I M O T U V W X Y</div>

are symmetrical with regard to a vertical axis, and if turned over sideways upon themselves, or reflected in a looking-glass, remain unchanged.

<div align="center">B C D E H I K O</div>

are symmetrical with regard to a horizontal axis ; and if turned over upon themselves upwards or downwards, instead of sideways as in the previous case, remain unchanged.

<div align="center">H I N O S X Z</div>

are symmetrical with regard to a centre, and when turned upside down remain unchanged.

<div align="center">F G J L P Q R</div>

are quite unsymmetrical. It will be observed that some letters, such as H I O X, possess both kinds of symmetry. Applying the above principles to knots, it will be possible to specify the number of variations of which any particular knot is capable if its conditions of symmetry are known, and the number of these variations determines how many patterns can be made by combining them in different ways. What has been described as central symmetry is called the right- or left-handedness of a knot, because when a curve, such as the letter S (which has central symmetry), is turned over upon itself, the direction of the spiral twist of the curves is reversed, and it becomes left-handed, thus, ꙅ.

In Celtic ornament the knots are arranged either in horizontal or vertical rows, and therefore these are the only two directions taken account of in altering the position of a knot. The variations of which the different kinds of knots are capable are as follows :—

If a knot is unsymmetrical (as those marked C, L, and M on the plate, p. 242), it can be varied in only eight different ways, for it can be placed in four positions, facing to the right or left, or up or down, and in each of these positions it may be made a right- or left-handed knot.

If a knot has central symmetry only (as those marked E, F, H, and K on the plate, p. 242), it can be varied only in four different ways, for it can be placed in two positions, facing either vertically or sideways, and in each of these positions it may be made a right- or left-handed knot.

If a knot has axial symmetry only (as those marked A, B, D, and N on the plate, p. 242), it can be varied only in four ways, for it can be placed in four positions, facing to the right or left, or up or down; but it cannot be a right- or left-handed knot.

If a knot has both central and axial symmetry (such as that marked G on the plate, p. 242), it can be varied only in two ways, for it can be placed in two positions, facing vertically or sideways, but it cannot be a right- or left-handed knot.

The possible combinations which result from these variations can be calculated mathematically by the theory of permutations; and when the ends of the cords come out in the right direction for joining on to the ends of the next, all these combinations are practicable.

2. Knots can be arranged in two or more parallel rows, which gives rise to more combinations as regards the position or direction of twist of the knot than are possible with single rows.

3. The knot can be made with two or more parallel bands instead of a single one.

4. In patterns where the knot is composed of a double band, one can be crossed over the other instead of being carried forward parallel (see figs. 92, 118, and 119).

5. In patterns where the knot is composed of a double band, one can be joined up to the other at intervals so as to reduce the two bands to a single one in the intermediate portion (see figs. 133 and 139).

6. An additional band can be woven through or placed beside the elementary knot, and by this means it is often possible to combine knots

whose ends do not come out in a suitable direction for joining on to those of the next.

7. Different elementary knots can be combined in one row, instead of the same knot being repeated over and over again.

8. The curved loops of the knots can be made pointed like a Gothic arch.

9. Straight bands, with square or sharp angles, can be substituted for curved ones, and the angles of the crossing of the bands can be also considerably varied.

The following is a description of the illustrations which accompany this portion of the paper:—

PLAIT-WORK.

Twists, figs. 1 to 5.
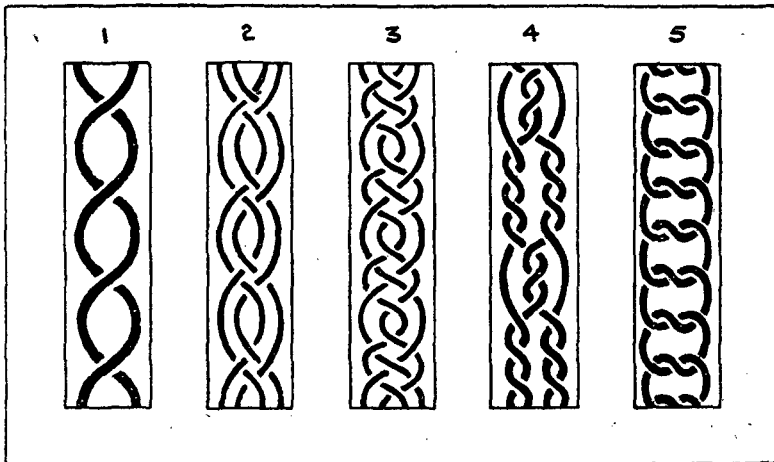
FIG. 1.—Twist. This is the simplest form of interlacement, and consists of two bands, which lap over and under each other at regular intervals. A twist may also be regarded as being composed of two waved lines placed one upon the top of the other. It is generally used in Celtic decoration for ornamenting the edges of stones, or in any position where a narrow

border is required.   It may here be remarked that the illustrations are drawn with a view to showing the methods of interlacement in the clearest way possible, and not with any idea of reproducing the decorative effects of the sculptured stones or the MSS.; the bands are therefore shown far apart instead of close together.

FIG. 2.—Twist, with double parallel bands instead of single ones.

FIG. 3.—Two twists combined.   This pattern can be produced by drawing two twists on tracing paper and placing one upon the top of the other.   A double band twist (fig. 2) and a four-cord plait (fig. 22) may be obtained in the same way, by altering the position of the upper sheet of tracing paper.

FIG. 4.—An ingenious arrangement of four bands, combined alternately into two twists parallel to each other, and into a single twist with two bands at each side.

FIG. 5.—Twists placed horizontally, and the ends joined so as to form a vertical border pattern having the general appearance of a chain.   Compare with figs. 7 and 156, which at first sight are somewhat similar.

Looped Cords, figs. 6 to 12.
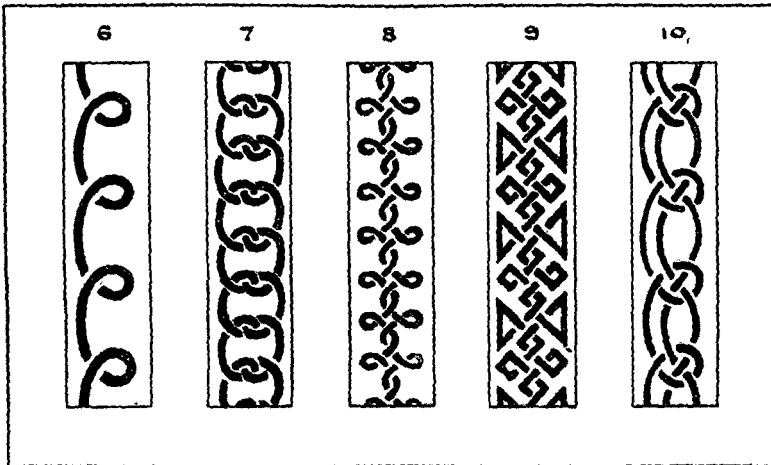
FIG. 6.—Cord with loops at equal intervals on the same side.

FIG. 7.—Two cords looped on same side combined, with loops facing towards each other.

FIG. 8.—Two cords looped on same side combined, with loops facing away from each other.

FIG. 9.—The same pattern as the preceding, but with the loops made alternately square and triangular.

FIG. 10.—A cord looped on the same side combined with a twist.
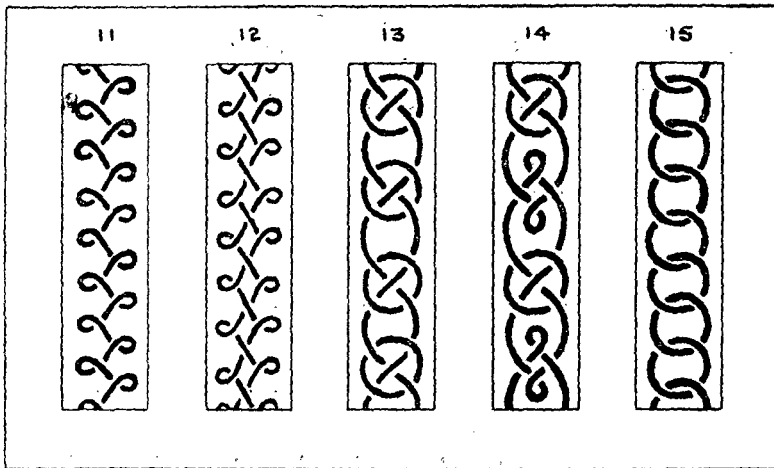
FIG. 11.—A cord with loops at equal intervals on opposite sides.

FIG. 12.—Two cords looped on opposite sides combined, the same pattern being the result whichever way the loops are made to face.

Twists and Rings, figs. 13 and 14.

FIG. 13.—A twist, with the crossings of the bands emphasised by rings placed round them. The same principle is also applied to plaits (see fig. 32).

FIG. 14.—The same as the preceding, except that every other crossing of the twist is looped in a peculiar manner instead of having a ring round it.

Chains of Rings, figs. 15 to 18.

FIG. 15.—A chain, composed of circular rings linked together so as to form a continuous pattern.

FIG. 16.—A row of rings threaded upon a straight band.

FIG. 17.—A chain of linked rings threaded upon a straight band.

Fig. 18.—A pattern developed from the preceding, and consisting of two bands
pierced with circular holes at equal intervals and narrowed between each,
interwoven one with the other. This is a very peculiar pattern, and
occurs in Great Britain only in the Isle of Man and the adjacent parts of
Cumberland and Anglesey. As the stones in this district are partly
Scandinavian, and as the same ornament occurs on a rune-inscribed fort at
Gallstad Church, Westgotland, and is not found on any of the purely
Celtic stones or MSS., this design may be fairly said to be of Scandinavian
origin.[1]

Miscellaneous Patterns derived from Twist, figs. 19 and 20.
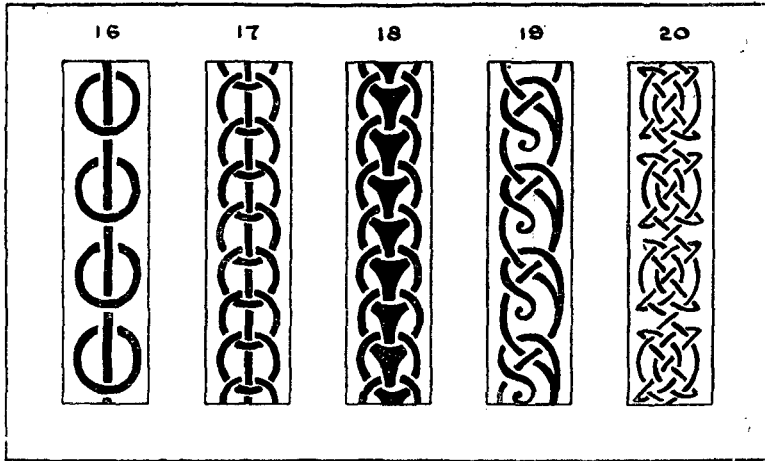
Fig. 19.—A twist partially developed into a leafy scroll. This pattern is
entirely confined to the stones of the Isle of Man.

Fig. 20.—A twist combined with an interlaced ring recurring at intervals.

Plait, fig. 21.

Fig. 21.—A three-cord plait. A plait consists of three or more cords passing
under and over each other in regular succession, and is exactly the same
as a plain woven fabric, except that the cords run diagonally instead of
lengthwise and crosswise. A three-cord plait may be made by combining
a twist with a waved line, and a four-cord plait by combining two twists.

[1] German Catalogue of the Stockholm Museum, by Oscar Montelius, p. 121.

Stopped-off Plaits, figs. 23 to 28.

The process which I term stopping-off a plait consists of joining up any pairs of cords instead of carrying them forward, thus leaving blank spaces in different positions.

FIG. 22.—A four-cord plait, stopped off so as to leave a vertical space in the centre of the plait at regular intervals.

FIG. 23.—A six-cord plait, stopped off so as to leave a horizontal space in the centre of the plait at regular intervals.

FIG. 24.—A six-cord plait, stopped off so as to leave a cross-shaped space in the centre of the plait at regular intervals.
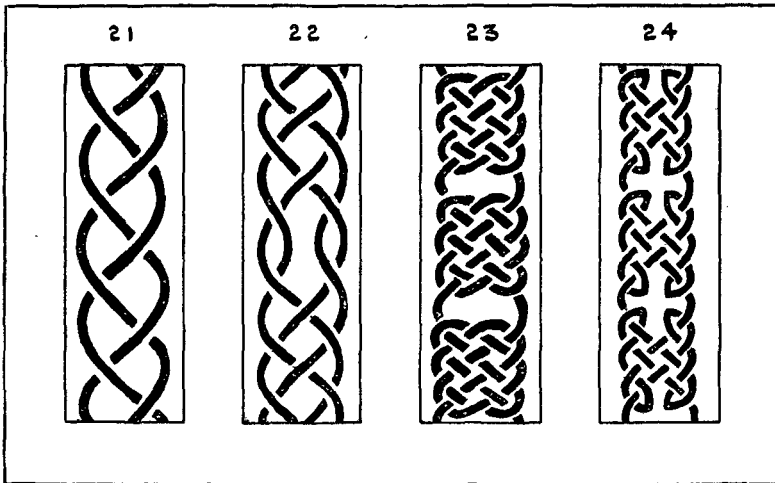
FIG. 25.—A four-cord plait, stopped off so as to leave spaces at regular intervals on one side of the plait only.

FIG. 26.—A four-cord plait, stopped off so as to leave spaces at regular intervals on each side of the plait alternately.

FIG. 27.—An eight-cord plait, stopped off so as to leave spaces at regular intervals on both sides of the plait.

FIG. 28.—An eight-cord plait, stopped off so as to leave two vertical spaces in the centre of the plait, the eight cords being combined into one twist and two three-cord plaits.
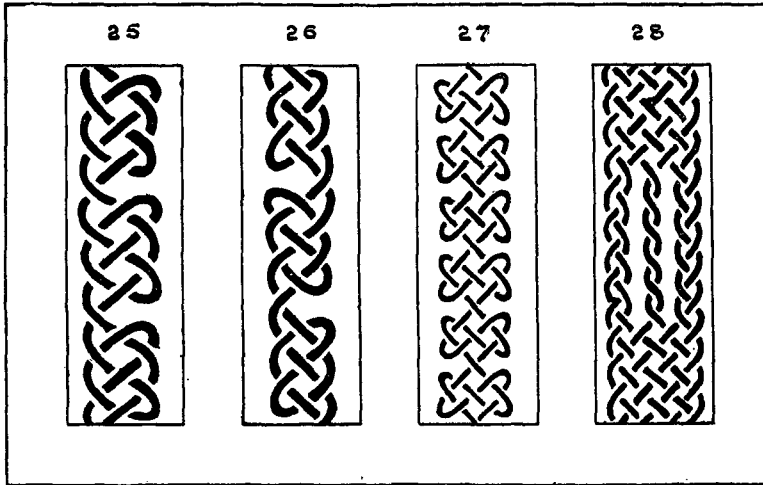
Plaits looped along the edges, figs. 29 to 31.
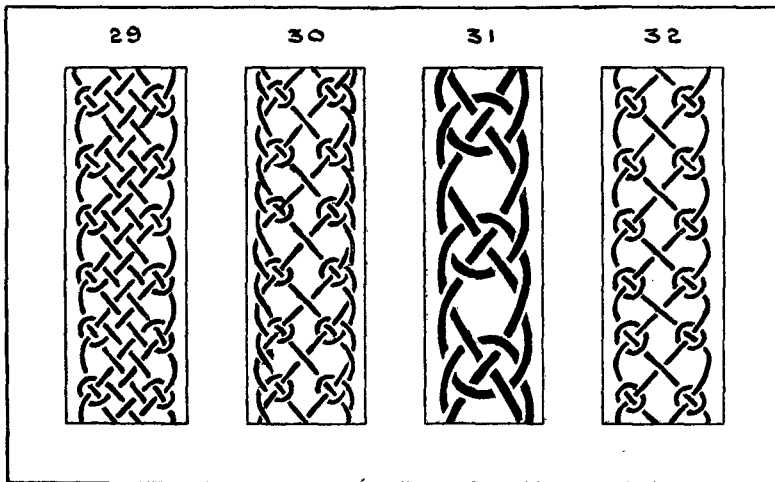
FIG. 29.—A ten-cord plait, stopped off so as to form loops along each side facing outwards.

Fɪɢ. 30.—The same as the preceding, but with the loops facing inwards.

Fɪɢ. 31.—A six-cord plait, stopped off so as to form loops in the centre.

Plait and Rings, fig. 32.

Fɪɢ. 32.—A four-cord plait, with the crossings of the bands emphasised by rings round them. This pattern presents a very similar appearance to those on figs. 29 and 30; and as both occur on the stones of the south-west of Scotland and rarely elsewhere, it is probable that one was derived from the other.
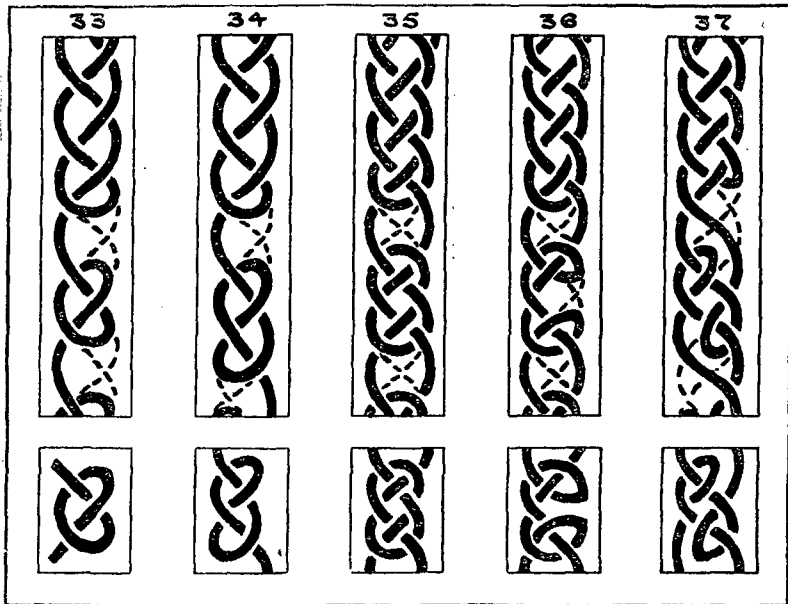
Development of Knot-work out of Plait-work, figs. 33 to 37.

It is possible that the knots which are used in Celtic ornamentation were derived from plaits by the process of stopping off, as shown in the accompanying illustration.

Fɪɢ. 33.—Development of elementary knot A (see the plate on p. 242) from a three-cord plait.

Fig. 34.—Development of knot H (plate on p. 242) from a three-cord plait.
Fig. 35.—Development of knot G (plate on p. 242) from a four-cord plait.
Fig. 36.—Development of knot D (plate on p. 242) from a four-cord plait.
Fig. 37.—Development of knot F (plate on p. 242) from a four-cord plait.

Note.—Knot C (plate on p. 242) cannot be derived from a plait by stopping off, but it may have been suggested by knot D which can. The only difference between knot C and half knot D, is that the former has a quarter of a turn more spiral twist than the latter, causing the end of the cord to come out at the top instead of at the side.

KNOT-WORK.

The knots which occur in Celtic ornament are different from those used by sailors or for the practical requirements of everyday life; and although they can be tied in string, when the ends are pulled a confused tangle is generally the result. These knots, therefore, must be looked upon simply as geometrical arrangements of curved lines following a continuous path, but crossing and recrossing at intervals, the variations being due to the numbers of crossings and changes in direction of the path.

In Celtic work the elementary knots are seldom composed of more than two cords; and when the number is greater, the extra cords are either placed at the side to join on to the next knot or woven through it in straight lines. The present investigation is consequently confined to knots formed of either one or two cords. The one-cord knots are looked upon as two-cord knots with two of the ends joined up, and the same method of investigation is applicable to both, being as follows:—Consider the two cords at starting always to lie along the diagonals of a square, and the intersection of the diagonals or the centre of the square to be the first crossing, which is taken as a datum to work from. The knot is then formed by bending one or both of the cords spirally round the centre, and after a certain number of crossings and revolutions, joining two of the ends if it is to be a one-cord knot, and leaving all four ends loose if it is to be a two-cord knot.

Different Ways of beginning to form a Knot, figs. 38 to 42.

Fig. 38.—One end of one cord bent round the other.
Fig. 39.—Both ends of one cord bent round the other in the same direction.
Fig. 40.—Both ends of one cord bent round the other in opposite directions.
Fig. 41.—One end of each cord bent round the other in the same direction.
Fig. 42.—One end of each cord bent round the other in opposite directions.

Methods of Crossing and Changing Direction, figs. 43 to 46.

When one cord crosses over another, it may do so in any of the following ways:—

1. One cord may pass under or over the other.
2. One cord may twist round the other, thus reversing its direction.
3. One cord may make a right-handed loop round the other.
4. One cord may make a left-handed loop round the other.
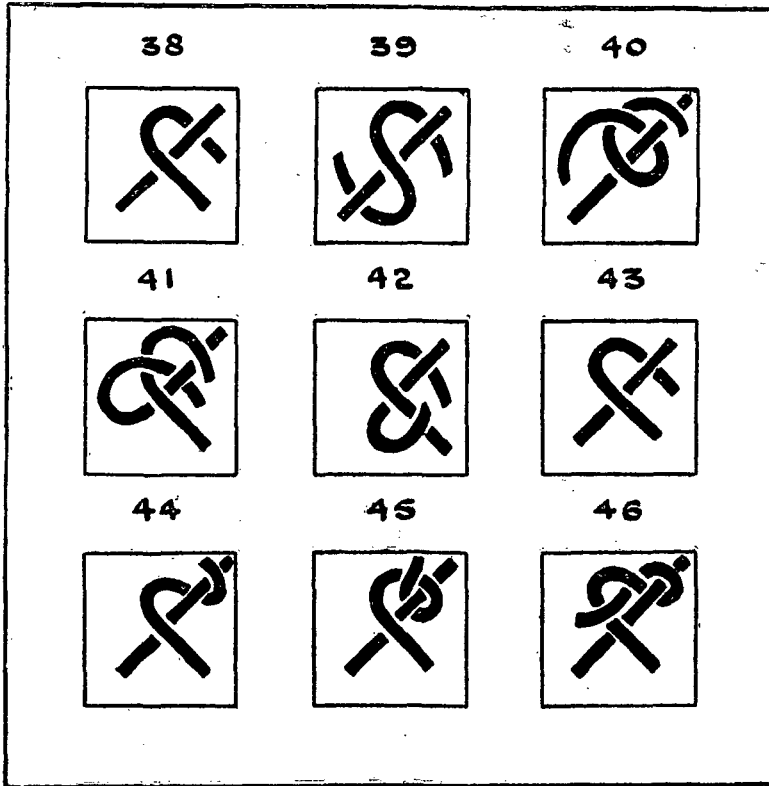
FIG. 43.—Plain crossing.
FIG. 44.—Twist crossing.
FIG. 45.—Right-handed loop crossing.
FIG. 46.—Left-handed loop crossing.

Note.—In the knots which follow, one cord is bent round the other in a plain spiral curve, preserving the same direction all through; but further complications may be introduced by causing the direction of the spiral to be reversed by making one cord twist or loop round the other. A cord may also loop round itself or make an S curve, so as to change its direction between any two crossings.

<div align="center">One-cord Knots, figs. 47 to 61.</div>

All the following knots are formed by placing the two cords along the diagonals of a square, and taking the loose end which lies at the left hand upper corner, and bending it round spirally to the right, finally joining it with either the upper or lower end of the other cord. When the spiral twist is single, that is, when it makes only one turn round the centre, no variations are possible; but when the spiral twist is double, the inside spiral can run parallel to the outside one, or cross over it in each quarter of the square, thus giving rise to a fresh series of knots after each crossing.
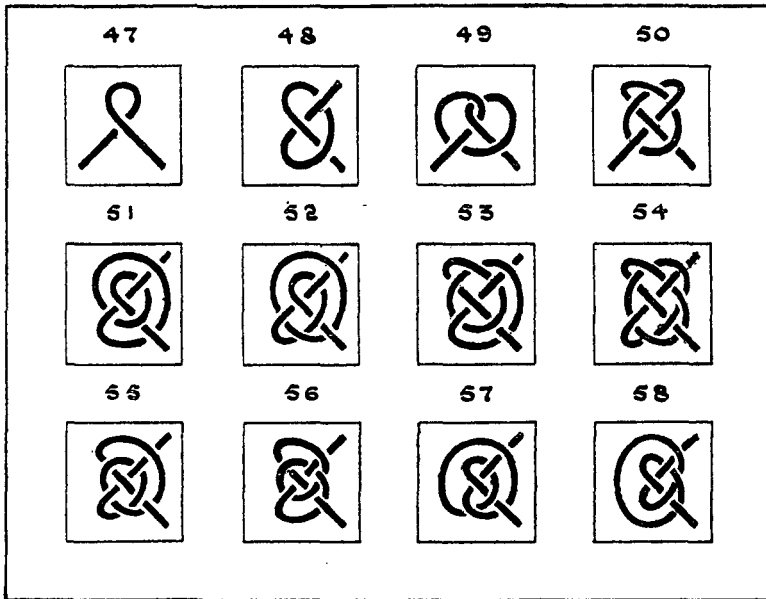
FIG. 47.—Upper end of first cord, bent round spirally to the right and joined with upper end of second cord, thus forming a simple loop.

FIG. 48.—Upper end of first cord bent round spirally to the right, and joined with lower end of second cord, thus forming the simplest kind of knot.

FIG. 49.—Upper end of first cord bent round twice spirally to the right, and joined with upper end of second cord.

FIG. 50.—The same as the preceding, except that the inside spiral crosses the outside one twice instead of once.
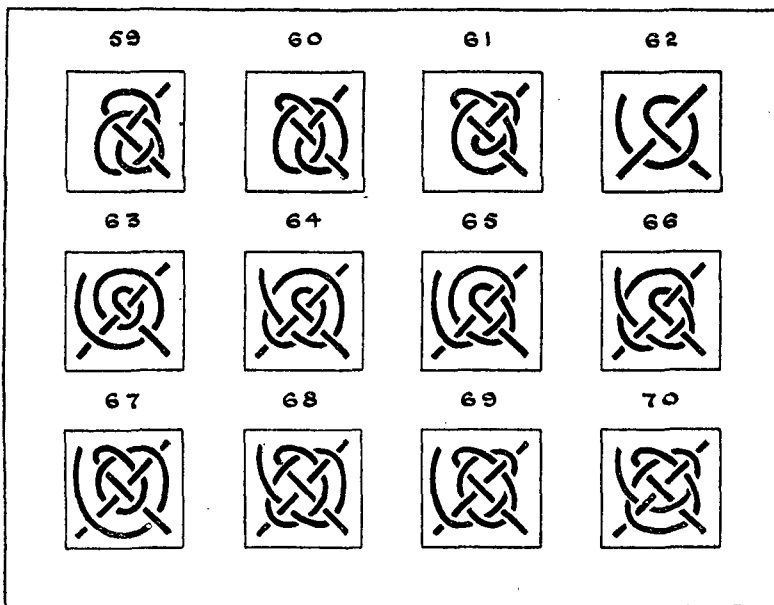
FIGS. 51 TO 61.—The upper end of the first cord bent round twice spirally to the right and joined with the lower end of the second cord, the variations being produced by the inside spiral crossing over the outside one in different quarters of the square.

Two-cord Knots formed by bending one end of one cord round the other,
figs. 62 to 74.

FIG. 62.—The upper end of the first cord bent round once spirally towards the right, whilst the second cord remains unaltered.

FIGS. 63 TO 74.—-The upper end of the first cord bent round twice spirally towards the right, whilst the second cord remains unaltered, the variations being produced by making the inside spiral cross over the outside one in different quarters of the square.

Two-cord Knots, formed by bending both ends of one cord round the other in the same direction, figs. 75 to 78.
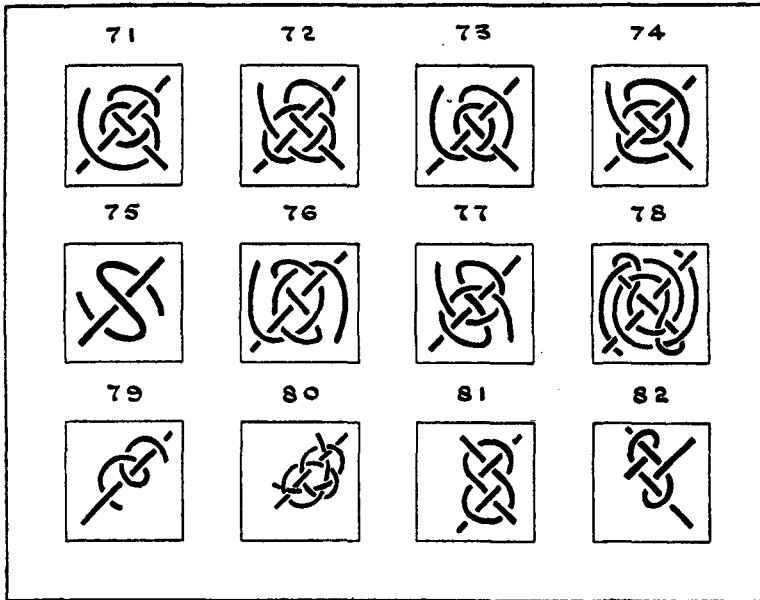
Two-cord Knots, formed by bending both ends of one cord round the other in opposite directions, figs. 79 and 80.

Two-cord Knots, formed by bending each end of both cords round the other in opposite directions, figs. 81 and 82.

Elementary Knots used in Celtic Ornament, see the plate on p. 242.

The number of possible knots which can be formed out of one or two cords, although large, is strictly limited by geometrical conditions. The ones which occur in Celtic ornament are only a small portion of the total possible number of knots, and the result of a minute examination of all the accessible illustra-

tions of Celtic sculptured stones and MSS. is comprised in the twelve elementary knots A to N (see below), which form the basis of the whole system of decoration. The methods used for producing patterns of great apparent complication out of such simple elements have already been explained, and will be fully understood later on. The artists who illustrated the MSS. probably learnt to draw all the elementary knots with ease (as a stitch in knitting or needle-work is got off by heart) before they attempted to commence their work.

PLATE OF ELEMENTARY KNOTS (A TO N).

A.—The simplest kind of one-cord knot, the same as that on fig. 48.
B.—A one-cord knot, the same as that on fig. 49.
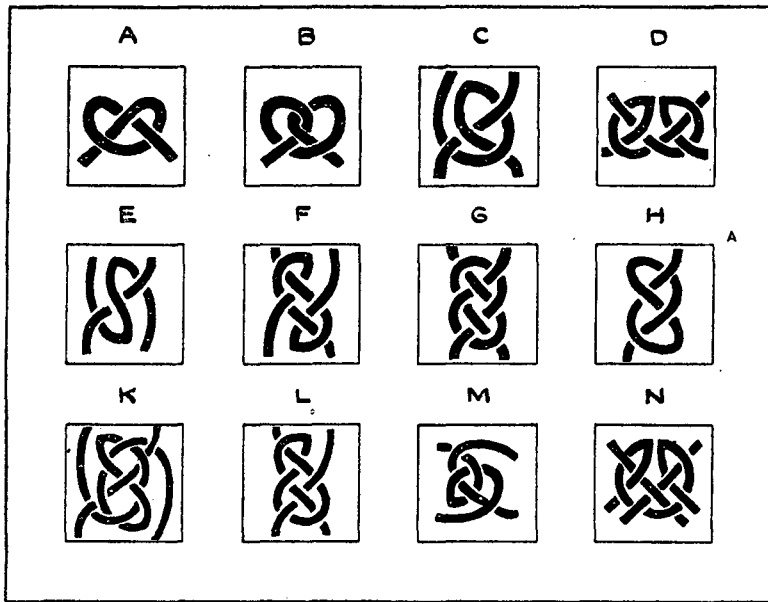
C.—A two-cord knot with a single spiral twist, the same as that on fig. 62.
D.—A double knot, made by placing two knots together like C, but with a quarter of a circle less spiral twist. It may also be looked upon as a single knot composed of two cords, made by bending two ends of each cord round the other in opposite directions.

E.—A two-cord knot, identical with that on fig. 75.

F.—A two-cord knot, identical with that on fig. 82.

G.—A two-cord knot, identical with that on fig. 81.

H.—A one-cord knot, probably derived from a three-cord plait by stopping off.

K.—A two-cord knot, identical with that on fig. 76.

L.—The upper half of this knot is the same as F and the lower the same as G.

M.—A two-cord knot, identical with that on fig. 79.

N.—A single cord with two loops in it through which two crossed bands are woven.

Combinations of Elementary Knot A, figs. 83 to 95.

This knot has axial but not central symmetry, and is therefore capable of four variations only, as it can be placed facing to the right or left, or up or down, but has no right- or left-handed twist.
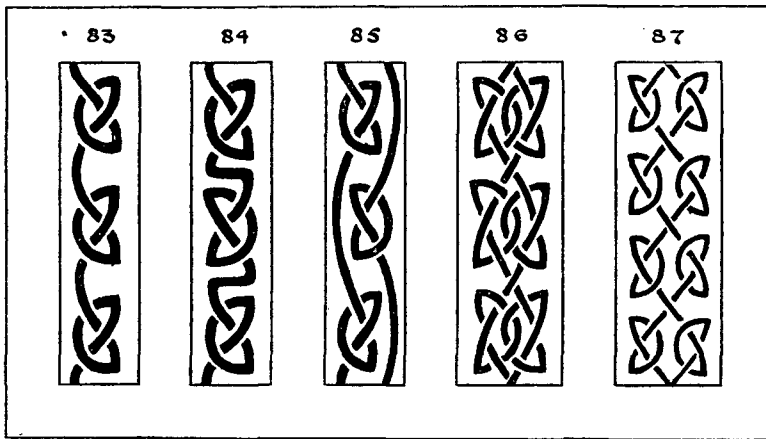
FIG. 83.—Knot A in single row, all facing to the right.

FIG. 84.—Knot A in single row, facing alternately to the right and left. The ends of the bands in this case do not come out in the proper position for joining on to the next ones, and an awkward bend has to be introduced between each knot.

FIG. 85.—Knot A, combined with an additional band placed at one side of it, in single row facing alternately to the right and left. This makes a pattern consisting of two distinct bands, knotted at intervals on the same

side, and placed facing each other.   Compare with fig. 94, where, by adding a second additional band and introducing loops, a pleasing ornament is produced.

FIG. 86.—Knot A in double row, facing outwards, the inner bends of the knots being made to overlap.

FIG. 87.—Knot A in double row, facing outwards, without overlapping as in the previous case.

FIG. 88.—Knot A in double row, facing inwards, two additional bands being interwoven so as to connect the two rows together, which would be otherwise disconnected, as will be seen by placing two such patterns as that shown on fig. 83 facing each other.
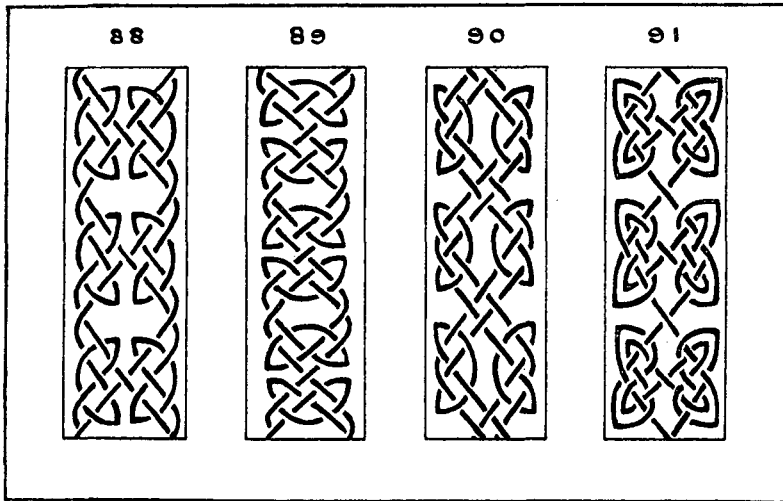
FIG. 89.—Knot A in single row, facing alternately upwards and downwards, two additional bands being added to enable the pattern to be made continuous, which would not be otherwise possible.

FIG. 90.—Knot A in double row facing outwards, and with two additional bands interwoven.

FIG. 91.—A variation lying between the patterns on figs. 87 and 93.   Compare also with fig. 160.

FIG. 92.—A variation on fig. 93, by making the two bands of the knot cross over each other instead of letting them run on parallel.

FIG. 93.—Knot A, with double parallel bands instead of a single one, in double rows, facing outwards.

FIG. 94.—Knot A in single row, facing alternately to the right and left, and combined with three extra bands, two woven through the knot and the other placed at the side; loops are also introduced at intervals.
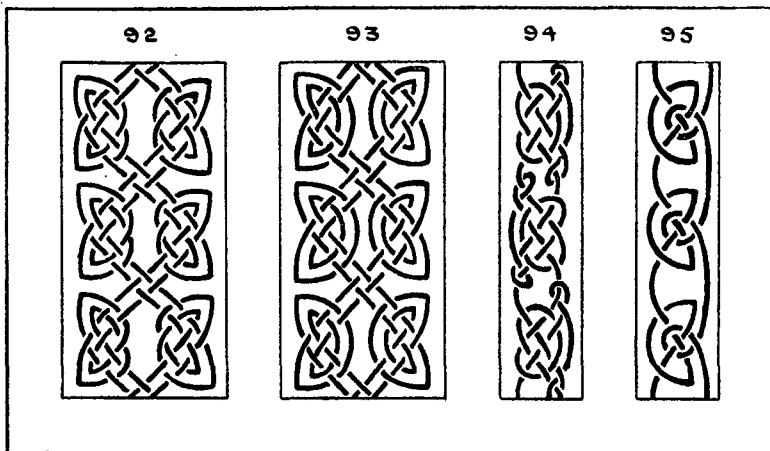
FIG. 95.—Knot A in single row, all facing to the right, combined with a cord looped on one side at intervals and interwoven with it.

Combinations of Elementary Knot B, figs. 96 and 97.

This knot has axial but not central symmetry, and is therefore capable of four variations only, as it can be placed facing to the right or left, or up or down, but has no right- or left-handed twist. All the possible combinations which result from the variations of the different knots are not always shown, but only a sufficient number to illustrate the principle involved. Many combinations are useless on account of the ends of the bands coming out in a position or in a direction unsuitable for joining on to the ends of the next knot.

FIG. 96.—Knot B in single row, all facing to the left.

FIG. 97.—Knot B in double row, facing outwards.

Combinations of Elementary Knot shown on fig. 50.

This knot has axial but not central symmetry, and is therefore capable of four variations only, as it can be placed facing to the right or left, or up or down, but has no right- or left-handed twist.

Fig. 98.—Knot (fig. 50) in single row, all facing to the right.
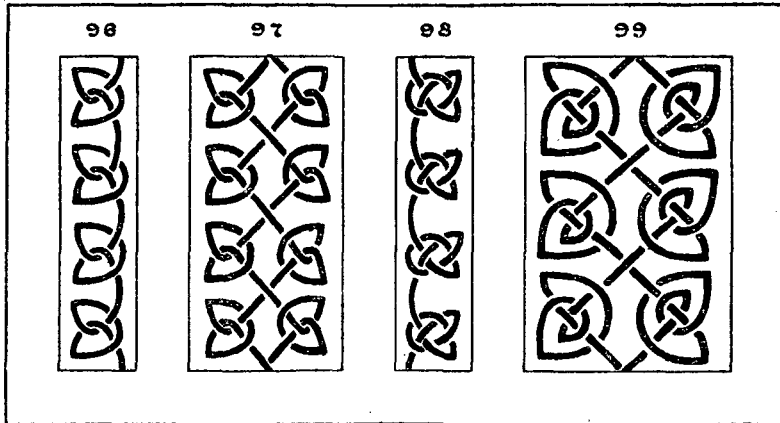
Combinations of Elementary Knot shown on fig. 51.

This knot is wholly unsymmetrical, and is therefore capable of eight variations only, as it can be placed facing to the right or left, or up or down, and can have a right- or left-handed twist in each of these positions. A large number of combinations result from these variations, only one of which, however, is shown.

Fig. 99.—Knot (fig. 51) in double row facing outwards, one row being all right-handed knots and the other all left-handed.

Combinations of Elementary Knot B distorted, fig. 100.

Knot B has been shown to have axial symmetry, but it can be distorted by enlarging one of the loops, and thus be made wholly unsymmetrical, and is then capable of being right- or left-handed. In comparing two knots to see whether they are the same, count the number of spaces between the cords, noticing their relative position and the number of sides or cords bounding each space. This will be found necessary, as by a slight amount of distortion a knot may be rendered almost unrecognisable.

Fig. 100.—Knot B distorted in double row facing outwards, each row being composed of right- and left-handed knots alternately, and one extra band interwoven through each knot.

Combinations of Elementary Knot C, figs. 101 *to* 120.

This knot is entirely unsymmetrical, and is therefore capable of eight variations only, as it can be placed facing to the right or left, or up or down, and can be made right- or left-handed in each of these positions.
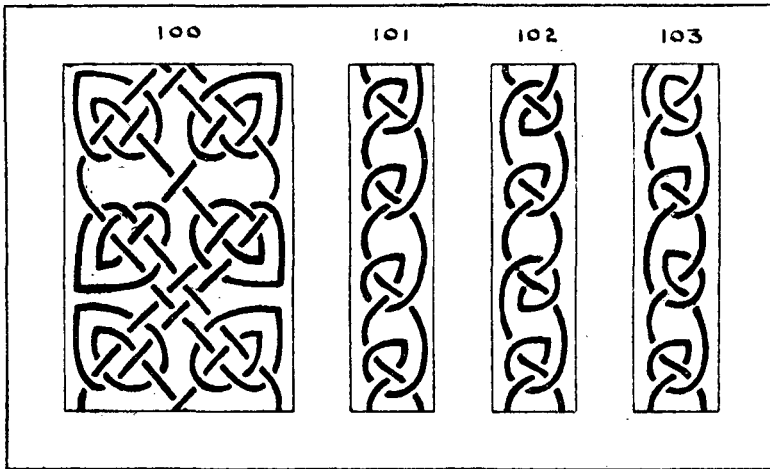
Fig. 101.—Knot C in single row, all right-handed, and all facing upwards.

Fig. 102.—Knot in C in single row, all right-handed, but facing alternately upwards and downwards.

Fig. 103.—Knot C in single row, alternately right- and left-handed knots, but all facing upwards.

Fig. 104.—Knot C in single row, composed of a right-handed knot facing upwards, and a left-handed knot facing downwards alternately.

Note.—This exhausts the combinations in single row, because when the knot is placed sideways the ends of the cords do not come out in the proper direction for joining on to the ends of the next knot.

Fig. 105.—Knot C combined with an extra band on one side, in single row, composed of right-handed knots facing upwards, and left-handed knots facing downwards alternately.

FIG. 106.—Knot C combined with an extra band on one side, in single row,
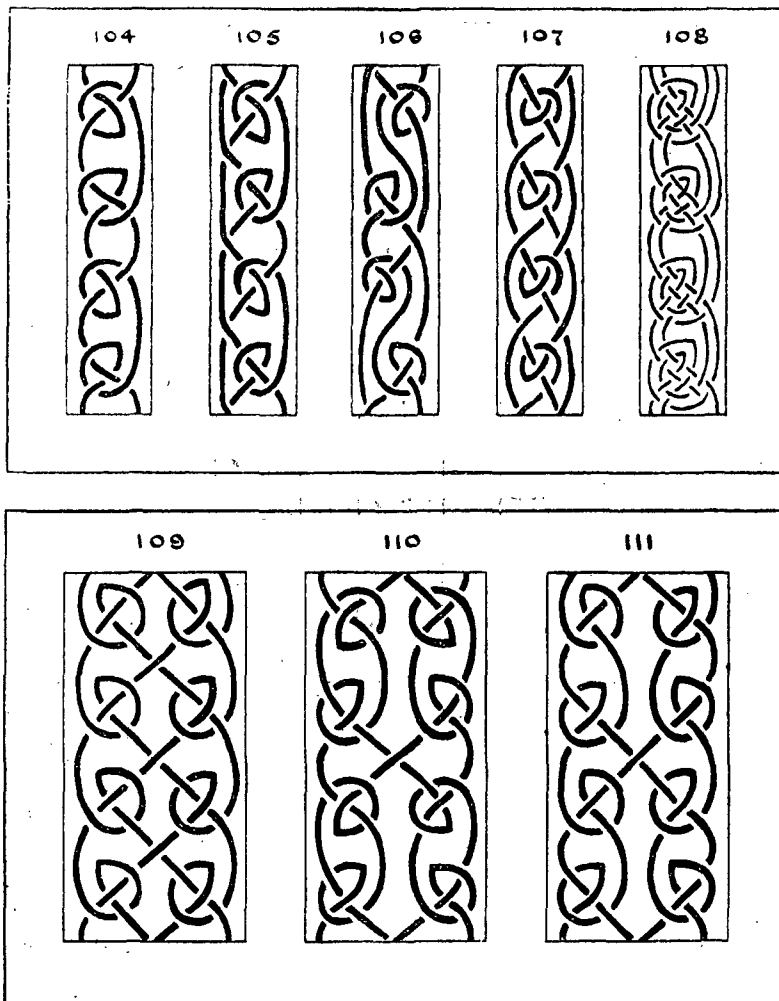
composed entirely of right-handed knots, facing alternately upwards and downwards.

Fig. 107.—Knot C combined with two extra bands, one on each side, in single row, composed entirely of left-handed knots facing downwards.
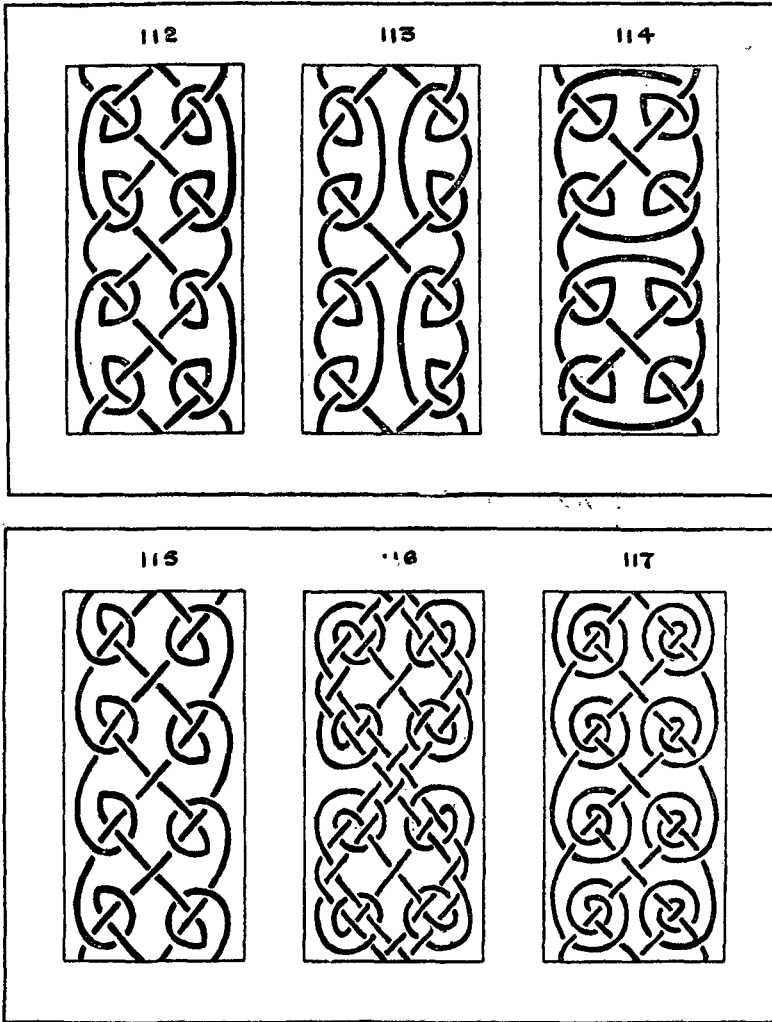
Fig. 108.—The same as fig. 101, but with double band.

FIG. 109.—Knot C in double row, composed of fig. 101 and its symmetrical opposite.

FIG. 110.—Knot C in double row, composed of fig. 102 and its symmetrical opposite.

FIG. 111.—Knot C in double row, composed of fig. 103 and its symmetrical opposite.

FIG. 112.—Knot C in double row, composed of fig. 104 and its symmetrical opposite, placed facing upwards.
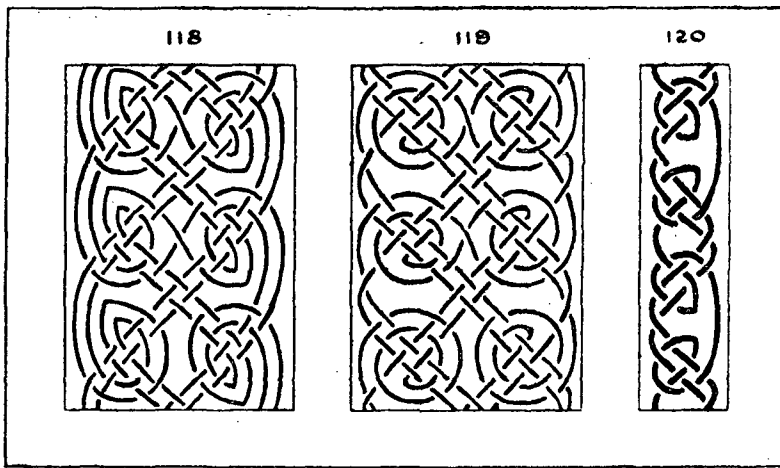
FIG. 113.—The same as the preceding, but with the knots facing outwards.

FIG. 114.—Knot C in double row, composed of pairs of knots like those on fig. 112, placed sideways.

FIG. 115.—Knot C in double row, one composed entirely of left-handed knots, facing upwards, and the other of left-handed knots, facing downwards.

FIG. 116.—The same as fig. 112, but with an extra band interwoven round each row.

FIG. 117.—The same as fig. 109, but with a double spiral twist instead of a single one.

FIG. 118.—The same as fig. 115, but knots formed with a double band, and a variation introduced by crossing the bands in places instead of letting them run on parallel.

FIG. 119.—The knots arranged as in fig. 115, but with a double spiral twist as

in fig. 117, and an extra band interwoven through each row, a variation
being made by crossing the bands, as in the preceding case.

FIG. 120.—The same as fig. 104, but with an extra band interwoven.

Combinations of Elementary Knot D, *figs.* 121 *to* 131.
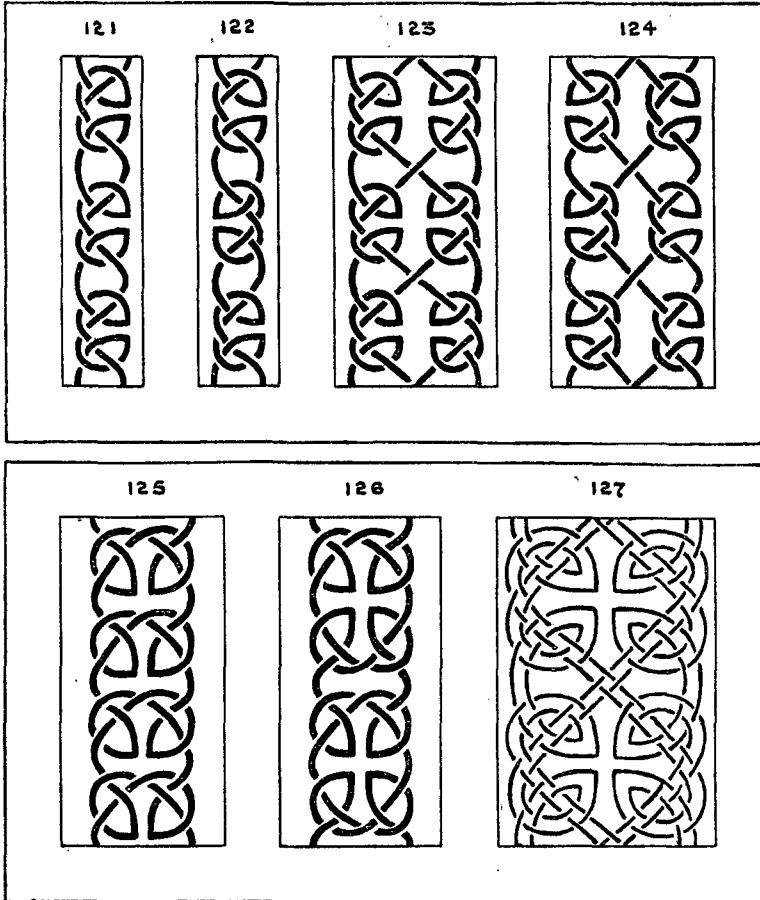
This knot has axial but not central symmetry, and is therefore capable of
four variations only, as it can be placed facing to the right, left, up, or down,
but it cannot have a right- or left-handed twist.

FIG. 121.—Knot D in single row, all facing to the right.

FIG. 122.—Knot D in single row, the knots facing alternately to the right and left.

FIG. 123.—Knot D in double row, the knots all facing inwards.

FIG. 124.—Knot D in double row, the knots all facing outwards.

FIG. 125.—Knot D in single row, the knots all facing downwards.

FIG. 126.—Knot D in single row, the knots facing alternately upwards and downwards.

FIG. 127.—The same as fig. 123, but with double band.

FIG. 128.—The same as fig. 123, but with extra interlaced band in each row.
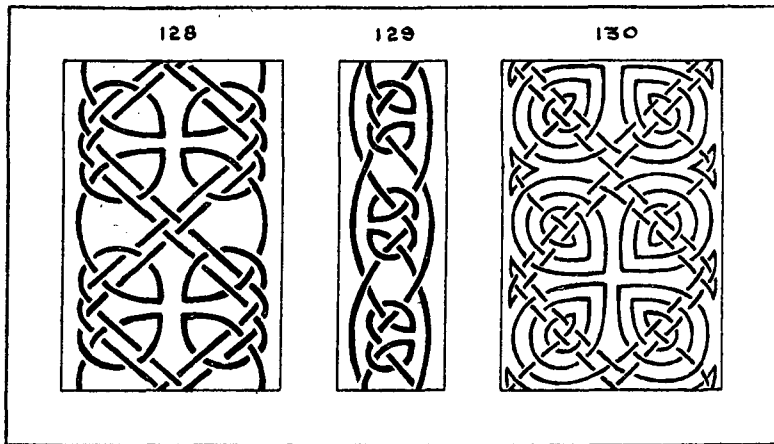
FIG. 129.—Knot D combined with an extra band on each side in single row, facing alternately to the right and left.

FIG. 130.—The same as fig. 126, but with triple spiral twist.

FIG. 131.—Knot D distorted by making one loop smaller than the other, arranged in double row with knots facing inwards, and with extra band interwoven through each knot.

Combinations of Elementary Knot E, *figs. 132 to 134.*

This knot has central but not axial symmetry, and is therefore capable of four variations only, as it can be placed either vertically or sideways, and in each of these positions it can be made either a right-handed or a left-handed knot.

FIG. 132.—Knot E in single row, all the knots being right-handed and facing vertically. Right and left-handed knots may also be arranged alternately in a single row, though this combination is not shown. The knots will not combine when placed sideways, as the ends of the bands come out in a direction unsuitable for joining on to the ends of the next knot.
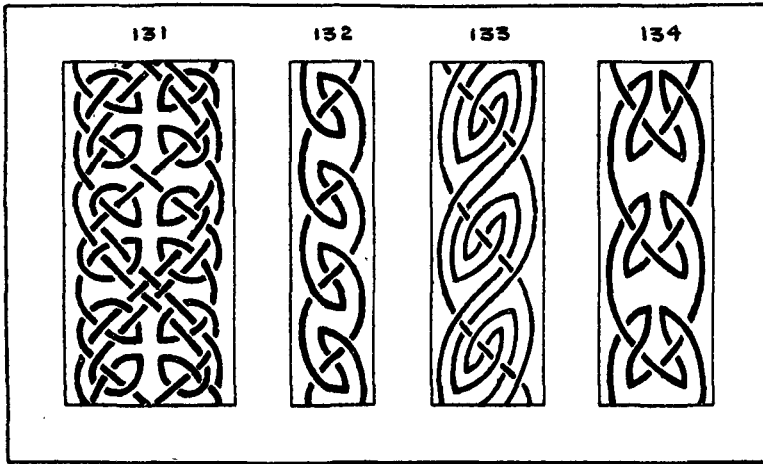
FIG. 133.—Knot E in single row with double twist, and combined with extra band at the side.

FIG. 134.—Knot E in double row, the left hand row consisting of left-handed knots placed vertically, and the right hand row consisting of right-handed knots placed vertically.

Combinations of Elementary Knot F, figs. 135 to 139.

This knot, like the preceding, has central but not axial symmetry, and is therefore capable of four variations only; as it can be placed either vertically or sideways, it can have a right- or left-handed twist in each of these positions.
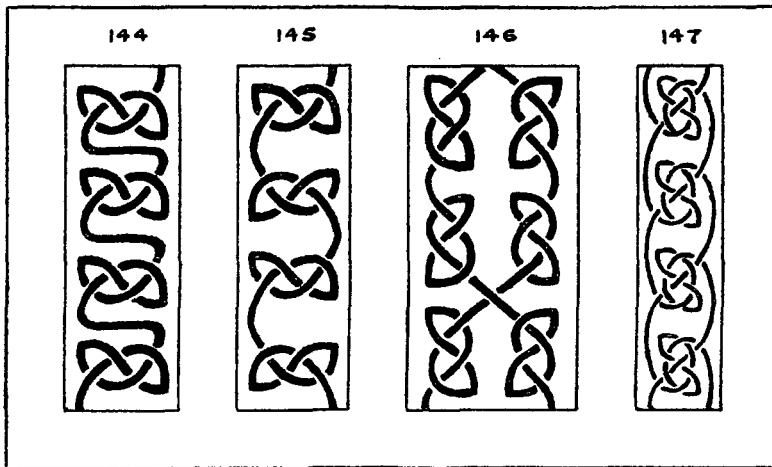
FIG. 135.—Knot E in single row of right-handed knots placed vertically.

FIG. 136.—Knot E in single row of right- and left-handed knots alternately, all placed vertically. A combination may also be made out of right- and left-handed knots alternately, all placed sideways.

FIG. 137.—Knot E in double row, one entirely composed of right-handed knots and the other of left-handed ones, all placed vertically.

Fig. 138.—The same as fig. 135, but with a double band.
Fig. 139.—A variation midway between fig. 135 and fig. 138.
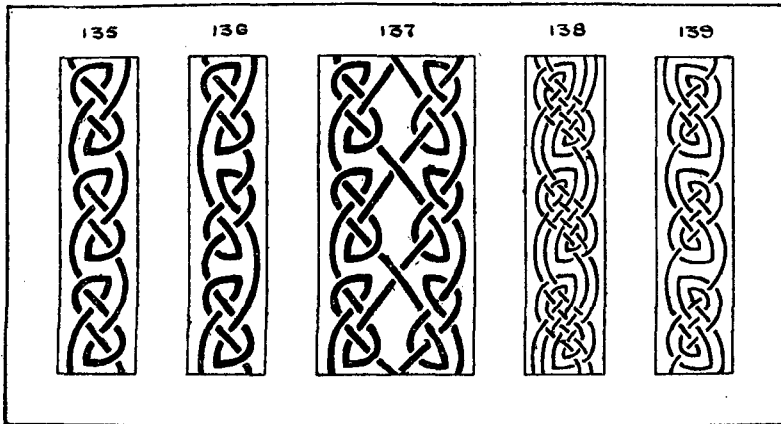
Combinations of Elementary Knot G, *figs.* 140 *and* 141.
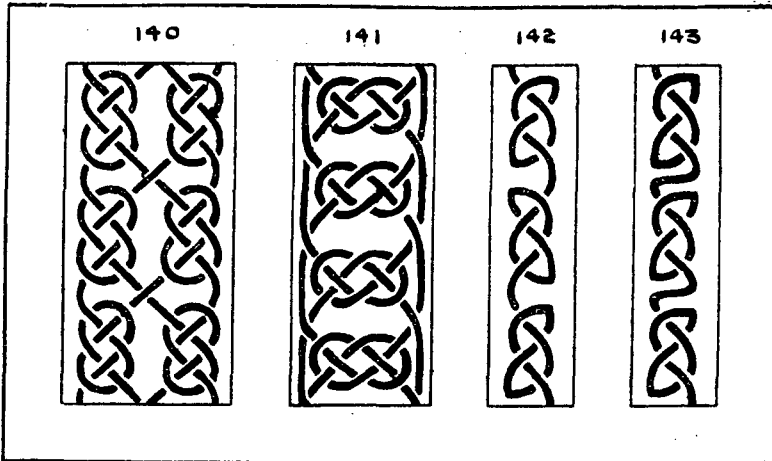
This knot has both axial and central symmetry, and is therefore only capable
of two variations, as it can be placed either vertically or sideways, but has no

right- or left-handed twist. The number of combinations which result are necessarily fewer than those obtained from any other.

FIG. 140.—Knot G in double rows placed vertically.

FIG. 141.—Knot G in single row placed sideways, and combined with an extra band at each side.

Combinations of Elementary Knot H, *figs.* 142 *to* 146.

This knot has central but not axial symmetry, and is therefore capable of four variations only, as it can be placed either vertically or sideways, and in each of these positions the twist can be made right- or left-handed.

FIG. 142.—Knot H in *single row of right-* and *left-handed knots alternately*, all placed vertically.

FIG. 143.—Knot H in single row of right-handed knots, all placed vertically.

FIG. 144.—Knot H in single row of right-handed knots, all placed sideways.

FIG. 145.—Knot H in single row of right- and left-handed knots alternately, all placed sideways.

FIG. 146.—Knot H in double row, each of right- and left-handed knots alternately, all placed vertically.

Combinations of Elementary Knot K, *fig.* 147.

This knot has central but not axial symmetry, and is therefore capable of four variations only, and it can be placed either vertically or sideways, and may have a right- or left-handed twist in each of these positions.

FIG. 147.—Knot K in single row of left-handed knots placed vertically.

Combinations of Elementary Knot L, *figs.* 148 *to* 151.

This knot, like C, is altogether unsymmetrical, and is therefore capable of eight variations only, as it can be placed facing to the right, left, up, or down, and can also have a right- or left-handed twist in each of these positions.
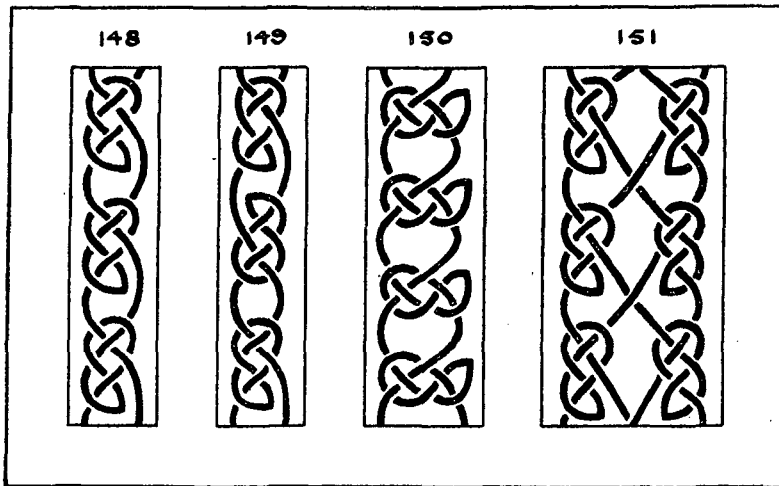
FIG. 148.—Knot L in single row of right-handed knots, all facing downwards.

FIG. 149.—Knot L in single row of right-handed knots, facing alternately upwards and downwards.

FIG. 150.—Knot L in single row of right-handed knots, all facing to the right.

FIG. 151.—Knot L in double row, one of right-handed and the other of left-handed knots, all facing downwards.

A large number of other combinations, not shown, may be made as in the case of knot C, by varying the position and right- or left-handedness of the knot.

Combinations of Elementary Knot M, *fig.* 152.

This knot is altogether unsymmetrical, and is therefore capable of eight variations only, as it can be placed facing to the right, left, up, or down, and may also have a right- or left-handed twist in each of these positions.

FIG. 152.—Knot M in single row of left-handed knots, all facing upwards.

Combinations of Elementary Knot N, *figs.* 153 *to* 155.

This knot has axial but not central symmetry, and is therefore capable of four variations only, as it can be placed facing to the right or left, or up or down ; but the knot cannot have a right- or left-handed twist.
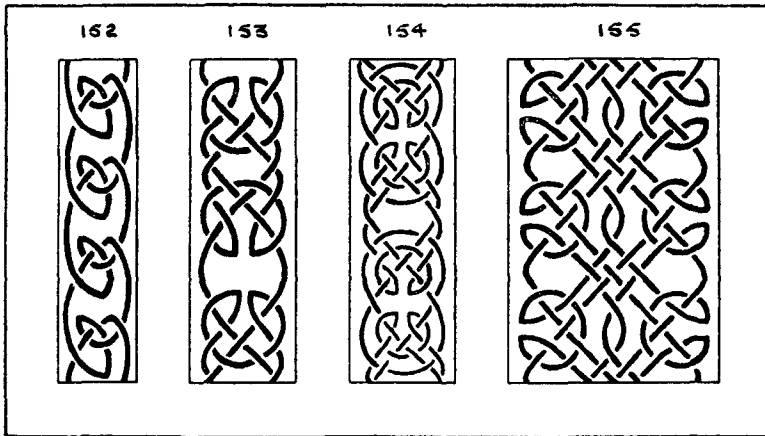
FIG. 153.—Knot N in single row of knots, facing alternately upwards and downwards.

FIG. 154.—The same as the preceding, but with an extra band round the outside.

FIG. 155.—Knot N in double row of knots, facing outwards.

Combinations of Crossed Rings, figs. 156 *to* 160.

A crossed ring is the same shape as the figure 8.

FIG. 156.—Crossed rings in single row, placed sideways and overlapping, so as to form a chain.

FIG. 157.—Crossed rings in single row, placed vertically and overlapping, so as
    to present the appearance of a series of knots.
FIG. 158.—Crossed rings in single row, placed vertically, and combined with
    an interlaced band, taking the form of a waved line. This pattern may
    have been derived from a three-cord plait by stopping off.
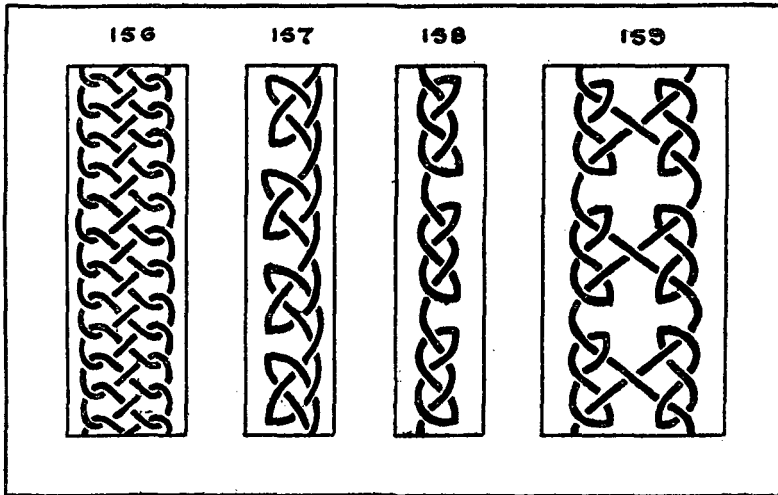
FIG. 159.—Crossed rings in double row, combined with interlaced bands.
FIG. 160.—The same as the preceding, but with additional rings interlaced.

Combinations of Miscellaneous Knots, figs. 161 *to* 166.

    The following patterns do not occur sufficiently often to be treated as types
of a class, and are therefore considered as miscellaneous.

FIG. 161.—Pattern composed of two bands of the form of lines waved diagonally,
    placed one above the other, and interlaced.
FIG. 162.—Pattern somewhat similar to the preceding, but the waved bands
    having S-shaped curves.
FIG. 163.—Pattern composed of two bands formed into concentric circles, with
    twists where the bands cross.
FIG. 164.—The element from which this pattern is made up is like knot D,
    with loops introduced.

FIG. 165.—Ths element here resembles a cross, with loops at the ends of the four arms.

FIG. 166.—The element of this pattern consists of two cords, looped spirally round a third.
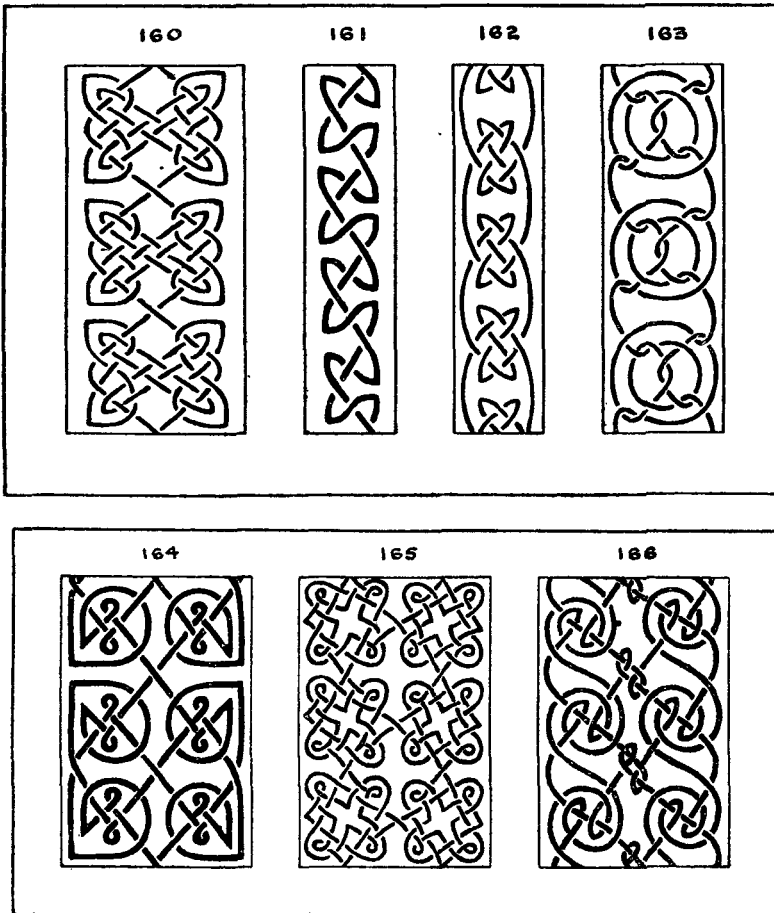
Circular Elementary Knots, figs. 167 *to* 184.

On the following figs. are shown a special type of more elaborate elementary

knots than those previously described, to which I have given the name of circular knots, because they always have a circular band running round the outside, with breaks in it where it turns inwards and forms itself into ordinary elementary knots, which are all enclosed within the encircling band. Two bands generally cross each other at right angles, passing through the centre of the circle. The ends of the bands come out singly or in pairs at four points on the circumference of the circle, with an angle of 90° between each. These knots may be classified—

    1. According to form of the knots enclosed within the circular band.
    2. According to the number of breaks in the encircling band.
    3. According to the way in which the breaks are made.

The idea of these circular knots may have been suggested by the combination of elementary knot A shown on fig. 89, where the backs of the knots are circular.
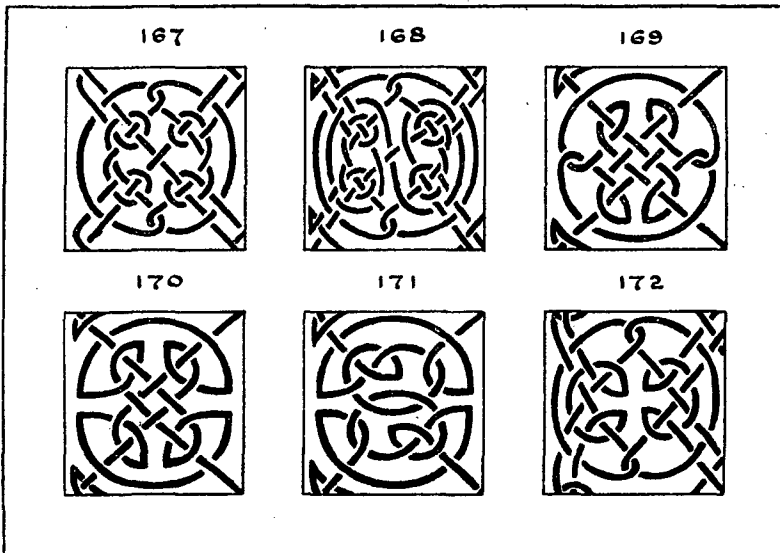
The elementary knots of circular form which follow can all be made into patterns by combining them in single or double rows in the same way as has been explained for the common elementary knots.

FIG. 167.—Encircling band with two breaks, where one cord twists round the
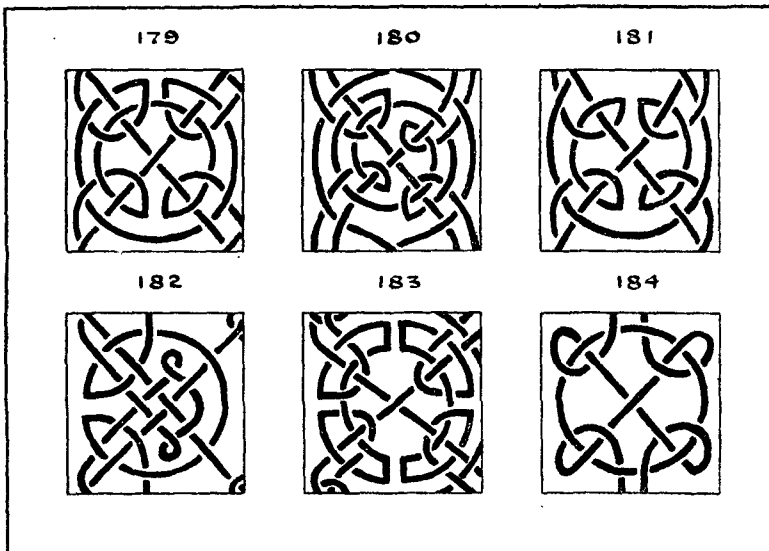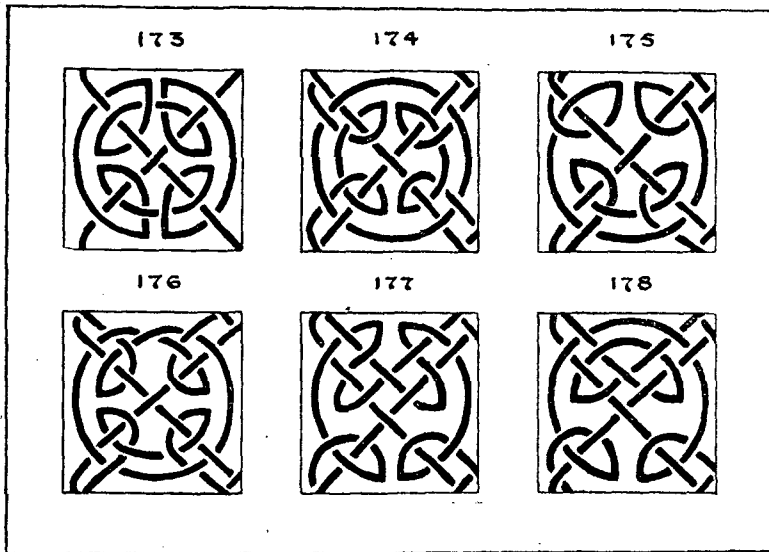
other and turns inwards, enclosing two ordinary elementary knots D facing each other on each side of the diameter.

FIG. 168.—The same as the preceding, but with an extra S-shaped band introduced.

FIG. 169.—Encircling band with two breaks, where one cord twists round the
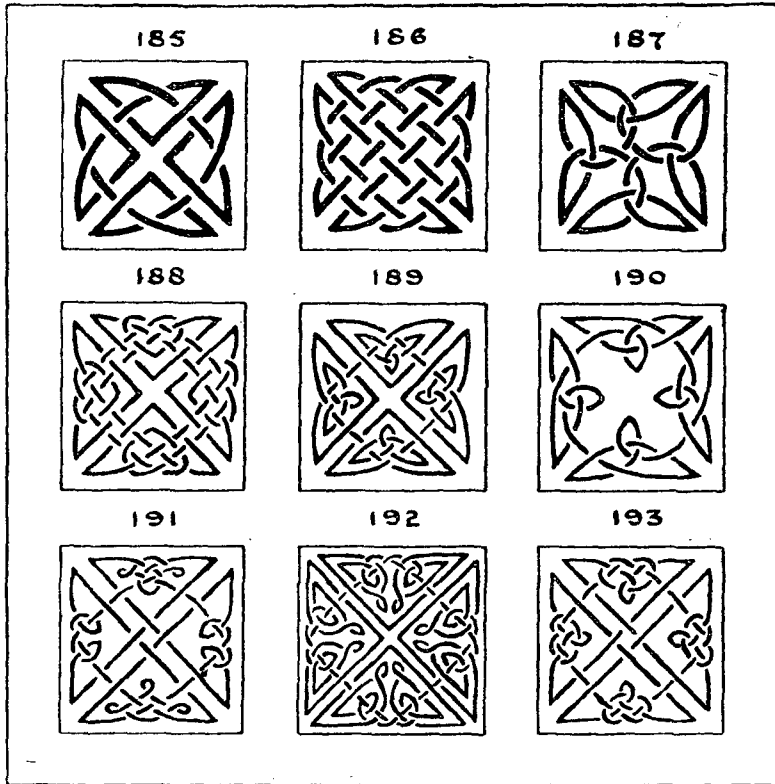
other and turns inwards, enclosing the knot derived from plait-work shown on fig. 24.
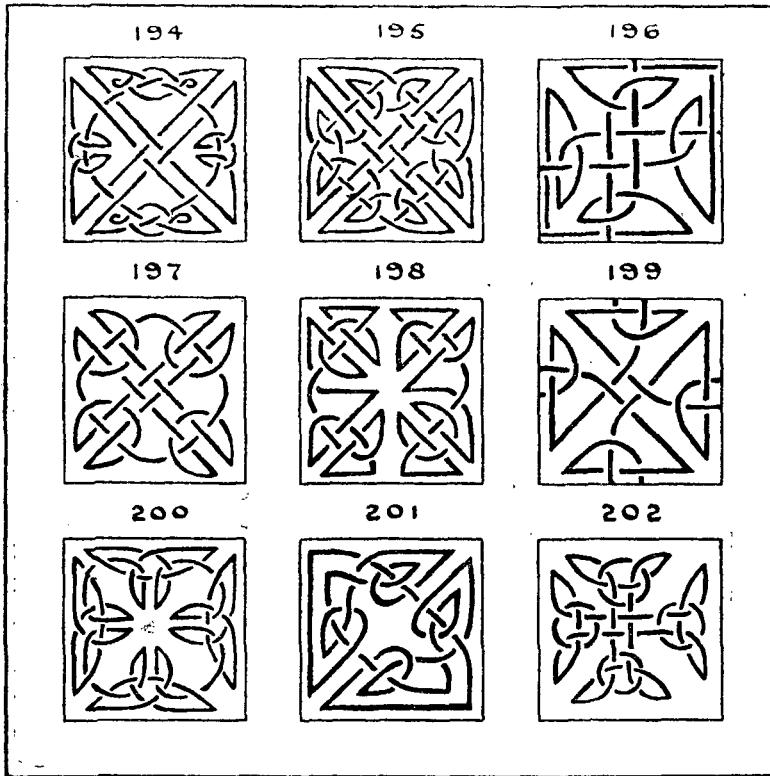
FIG. 170.—The same as the preceding, but with open breaks where the encircling band turns inwards.

FIG. 171.—Encircling band with two open breaks, enclosing two ordinary

elementary knots C and other interlacements, formed by one cord making twists round the other.

FIG. 172.—Encircling band with two twisted breaks, enclosing two ordinary elementary knots N facing each other on each side of the diameter.

FIG. 173.—Encircling band with two open breaks, where the band turns in-

wards and forms itself into pointed loops round two bands which cross each other at right angles through the centre. The backs of the loops being rounded makes the knot, taken as a whole, present the appearance of two concentric circles.

FIGS. 174 TO 184.—Different variations of the preceding.

Squares divided diagonally, and filled in with Knot-work, figs. 185 to 202.

In the following figs. squares are filled in with knot-work by repeating the same element in each quarter of the square which has been divided by the two
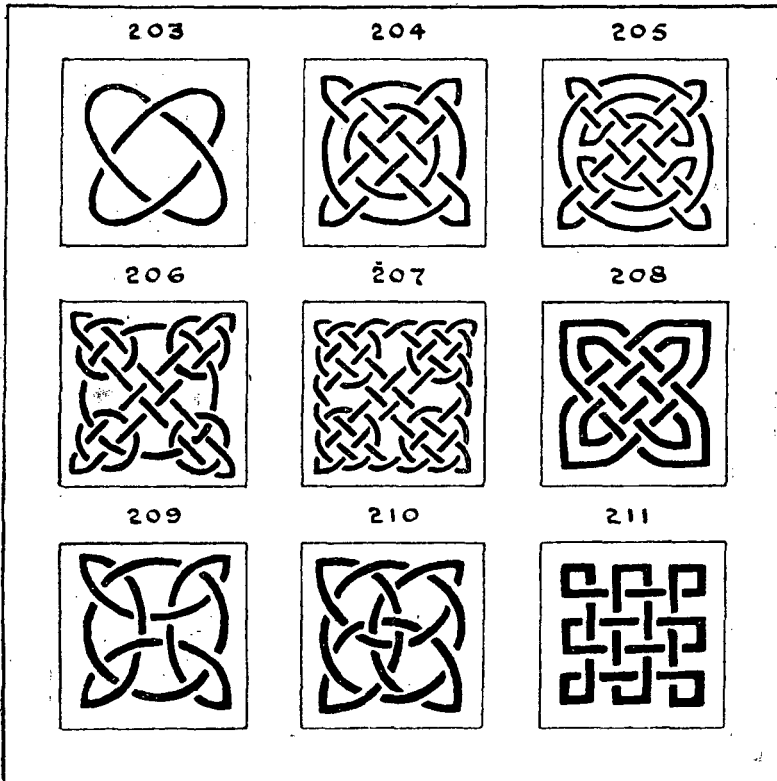
diagonals into four triangles.   The elements are knots, such as those previously described, with their shape slightly altered, so as to fit into the triangle, and in some cases with loops and rings added.

Patterns formed of interlaced Rings, figs. 203 to 211.

In the following figs. are shown the various combinations that may be made out of three kinds of rings—

       1. Circular ring.
       2. Elliptical ring.
       3. Ring looped in four places.
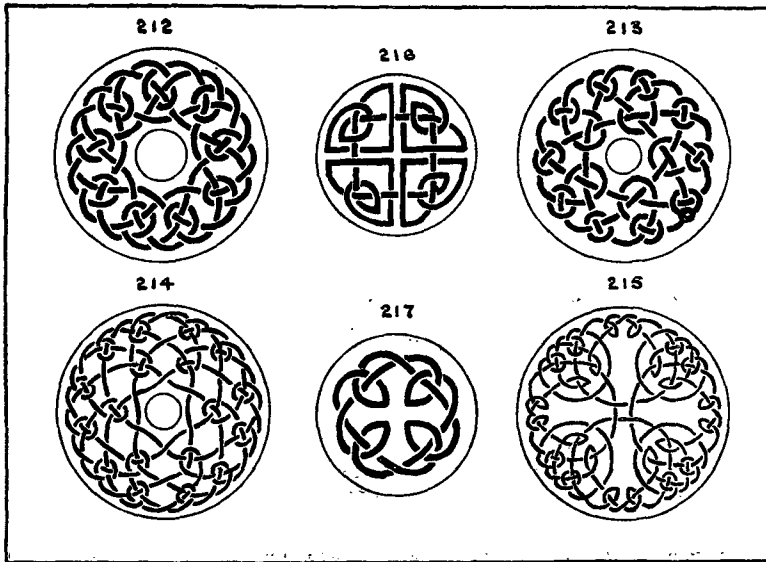
Knot-work filled into circular Spaces, figs. 212 to 215.

The elementary knots in the followings figs. are arranged in concentric circular rows.

FIGS. 212 TO 215.—Founded on loops and rings.
FIG. 216.—Founded on elementary knot C.
FIG. 217.—Founded on elementary knot D.

Knot-work filled into triangular Spaces, figs. 218 to 222.

FIG. 218.—Founded on elementary knot D.

FIG. 219.—Symmetrical three-cornered knot, known as the triquetra.
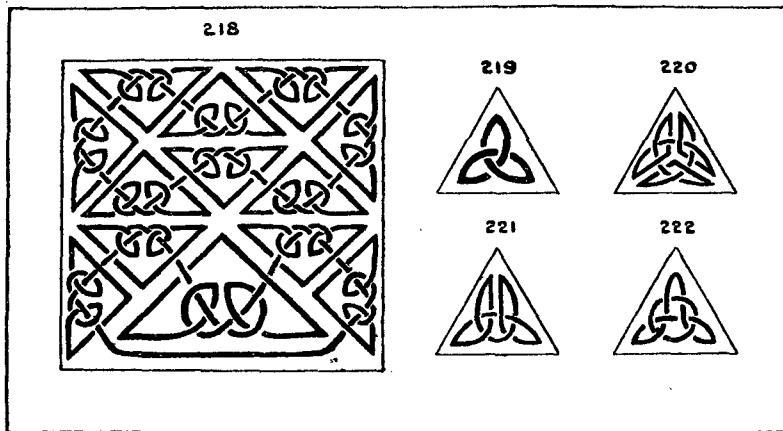
FIG. 220.—Elementary knot A repeated three times, so as to fit into an equilateral triangle.

FIGS. 221 AND 222.—Irregular interlacements fitting into an equilateral triangle.

This concludes the technical description of the knot-work on the diagrams; it only now remains to state the names of places where the different examples occur. I simply give the localities, and to save giving the authorities in each special case, I may mention that the Scotch stones are to be found illustrated in Dr Stuart's *Sculptured Stones of Scotland*, published by the Spalding Club; the Irish ones in O'Neill's *Crosses of Ireland* and Petrie's *Irish Inscriptions;* the Welsh ones in Professor Westwood's *Lapidarium Walliæ;* and those of the Isle of Man in the Rev. J. G. Cumming's *Runic Remains of the Isle of Man.* For the illuminated MSS. see Professor Westwood's *Miniatures* and the publications of the Palæographical Society.

## LOCALITIES WHERE THE DIFFERENT SPECIMENS OF ORNAMENT OCCUR.

FIG. 1.—Stanley and Mountblow House (Scotland), also eighteen examples in Wales (see Westwood's *Lapidarium Walliæ*).

FIG. 2.—Rothesay (Scotland), Clonmacnoise (Ireland).

FIG. 3.—Zürich Cathedral (Switzerland).

FIG. 4.—Rothesay (Scotland), Corwen (Wales).

FIG. 5.—Docton.

FIG. 7.—Rossie Priory.

FIG. 9.—Meigle (Scotland).

FIG. 10.—Penannular brooch found in Co. Roscommon (Ireland), *Jour. Archæolog. Assoc. Ireland*, 1874–5, p. 158.

FIG. 12.—Cross in Leeds Parish Church.

FIG. 13.—Liberton, Rothesay, Bressay, Drainie, Inchinnan (Scotland); Aycliffe and Gainford (Durham); Norham, Warden, Hexham (Northumberland); Kirk Michael (Isle of Man); Llantwit and Llandevaelog (Wales).

FIG. 14.—Church of S. Maria, Cologne.

FIG. 15.—Rothesay (Scotland), Maen Achwynfan (Wales).

FIG. 16.—Warkworth (Northumberland).

FIG. 17.—Govan (Scotland), Warkworth (Northumberland).

FIG. 18.—Kirk Michael (Isle of Man); Gosforth, Dearham (Cumberland); Penmon (Anglesey); Gällstadt Church, Westgotland (Sweden).

FIG. 19.—Kirk Michael (Isle of Man).

FIG. 20.—   (Ireland).

FIG. 21.—Mountblow House and Stanley (Scotland), and six places in Wales.

FIG. 22.—Benvie (Scotland).

FIG. 23.—Book of Kells (Trin. Coll., Dublin).

FIG. 24.—Rosemarkie (Scotland), St Oswalds and Billingham (Durham), Clonmacnoise and Kilklispeen (Ireland), Hunterston Brooch (*Proc. Soc. Ant. Scot.*, vol. vii. pl. lvii.).

FIG. 25.—Latin Gospels (Imp. Lib., Paris).

FIG. 26.—Tullibole (Scotland).

FIG. 27.—Kirkholm and St Andrews (Scotland).

FIG. 29.—Whithorn, Kirkinner (Scotland), Gospels of Durrow.

FIG. 30.—Whithorn, St Madoes, and Brodie (Scotland).

FIG. 31.—Whithorn, Jordan Hill, and Jedburgh (Scotland); Llanbadaon Vawr (Wales).

FIG. 32.—Wigtown and Monreith House (Scotland).

FIG. 86.—Zürich Cathedral (Switzerland).

FIG. 87. Jordan Hill, Kirriemuir, Jedburgh, Scoonie, Inchbrayock (Scotland);
    Jarrow, Aycliffe, and Billingham (Durham); Landough (Wales).

FIG. 88.—St Vigeans, Denino, Brodie, Nigg, Abbotsford, and Glamis Manse
    (Scotland), Psalms of Cassiodorus, manu Bedæ.

FIG. 89.—St Andrews and Meigle (Scotland).

FIG. 90.—Govan (Scotland).

FIG. 91.—St Gall MSS.

FIG. 92.—Tynemouth (Northumberland).

FIG. 93.—Glamis (Scotland).

FIG. 94.—Gospels of Durrow.

FIG. 95.—Alnmouth (Northumberland).

FIG. 97.—Book of Durrow.

FIG. 99.—St Andrews.

FIG. 100.—St Andrews.

FIG. 101.—Aberlemno and Arthurlee (Scotland); Old Scotch Bagpipes, date
    1409 (*Proc. Soc. Ant. Scot.*, vol. xiv. p. 121).

FIG. 102 —Billingham (Durham), Hunterston Brooch.

FIG. 103.—Penannular Brooch found in Sutherlandshire (*Proc. Soc. Ant. Scot.*,
    vol. x. p. 587).

FIG. 107.—S.E. Cross at Monasterboice (Ireland).

FIG. 108.—Commentaries on the Psalms, manu Bedæ.

FIG. 109.—Farnell and St Andrews (Scotland); Aycliffe (Durham); Lindis-
    farne (Northumberland).

FIG. 112.—St Vigeans and Dyce (Scotland), Gainford (Durham).

FIG. 115.—Llanfihangel, Ystrad, and Silian (Wales).

FIG. 116.—Alnmouth (Northumberland).

FIG. 117.—Nigg, Meigle, Abbotsford, and Strathmartin (Scotland); Alnmouth
    and Lindisfarne (Northumberland); West Kirby (Cheshire); Penally
    (South Wales).

FIG. 118.—Cross at Kells (Ireland).

FIG. 119.—Book of Durrow.

FIG. 121.—Coldingham (Scotland).

FIG. 122.—Isle of Canna (Scotland); Norham (Northumberland); Latin
    Gospels (Imp. Lib., Paris).

FIG. 123.—St Andrews and Farr (Scotland); Jarrow (Northumberland);
    Chester-le-Street (Durham); Eyam (Derbysh.).

FIG. 124.—Bewcastle (Cumberland).

FIG. 125.—Rosemarkie (Scotland), Lindisfarne (Northumberland).

FIG. 126.—Lindisfarne.

FIG. 127.—Bewcastle (Cumberland); Gospels of Mac Regol.

Fig. 128.—Aberlemno (Scotland); Bewcastle (Cumberland); Gospels of St Petersburg.

Fig. 129.—Thornhill (Scotland); S.E. Cross, Monasterboice (Ireland); Ilkley (Yorkshire).

Fig. 130.—Dunfallandy (Scotland).

Fig. 132.—Eilanmore and Jordan Hill (Scotland); Llandough, Llantwit, Penally, and Llandaff (Wales); Penannular Brooches found in Perthshire and Sutherlandshire (*Proc. Soc. Ant. Scot.*, vol. x. p. 587, and vol. xiv. p. 450); Ancient Scotch Bagpipe, dated 1409 (*Proc. Soc. Ant. Scot.*, vol. xiv. p. 121); Sword-hilt found in grave mound at Ultuna, Sweden (*Proc. Soc. Ant. Scot.*, vol. x. p. 591).

Fig. 133.—Gospels of Durrow.

Fig. 134.—MSS. of St Gall.

Fig. 135.—St Oswalds and Billingham (Durham); Penally (South Wales); Penannular Brooch from Isle of Mull (*Proc. Soc. Ant. Scot.*, vol. xiii. p. 68); Golden Gospels (Stockholm).

Fig. 139.—Gospels of Durrow.

Figs. 140 and 141.—Cossins, St Vigeans, Kirriemuir, Monifieth, Crieff, Govan, and Meigle (Scotland); Gainford (Durham); Llandough, Llanbadarn Vawr, Margam, and Llanynnis (Wales).

Fig. 143.—Gospels of Durrow.

Fig. 146.—Aycliffe (Durham).

Fig. 147.—Clonmacroise (Ireland).

Fig. 148.—The Psalms by Cassiodorus, manu Bedæ.

Fig. 151.—Monasterboice (Ireland).

Fig. 152.—Gospels of Durrow.

Fig. 154.—S.E. Cross, Monasterboice (Ireland).

Fig. 155.—Golspie (Scotland); Psalms of Cassiodorus.

Fig. 158.—Inchinnan (Scotland).

Fig. 159.—Barrochan (Scotland), Norham (Durham).

Fig. 160.—MSS. of St Gall.

Fig. 161.—Sword-hilt found at Ultuna, Sweden (*Proc. Soc. Ant. Scot.*, vol. x. p. 591).

Fig. 162.—S. Cross, Clonmacroise (Ireland).

Fig. 163.—Gospels of Durrow.

Fig. 164.—Meigle and Glamis (Scotland).

Fig. 165.—Gospels of Durrow.

Fig. 166.—S. Cross, Monasterboice, and S. Cross, Clonmacroise (Ireland).

Fig. 167.—Brodie, Glamis, and Gattonside, near Melrose (Scotland).

Fig. 168.—Gospels of Durrow.

FIG. 205.—Jarrow (Northumberland).

FIG. 206.—Fowlis Wester (Scotland), Norham (Northumberland).

FIG. 207.—Kilkerran (Scotland).

FIG. 208.—Barrochan (Scotland).

FIG. 209.—Meifod and Maen Achnynfan (Wales); St Peter's Church, Northants; Zürich Cathedral ; Chessmen from Isle of Lewis.

FIG. 210.—Zürich Cathedral.

FIG. 211.—Icelandic wooden mangling implement (Indus. Mus., Edinburgh).[1]

FIG. 212.—Nigg (Scotland).

FIG. 213.—Rosemarkie (Scotland).

FIG. 214.—Hilton of Cadboll (Scotland).

FIG. 215. —Rossie Priory (Scotland).

FIG. 216.—St Vigeans, on two stones (Scotland), Aycliffe (Durham).

FIG. 217.—Dupplin Castle, Kilmartin, and Ellanmore (Scotland).

FIG. 218.—Dunfallandy (Scotland).

FIG. 219.—Chapel of the Garioch, Dupplin Castle, Meigle, Govan, St Andrews, Oronsay (Scotland); Warkworth and Warden (Northumberland); Kirk Michael, Calf of Man, and Douglas (Isle of Man); Lantwit, Margam, Llanfrynach, Langharne, Penally, and Meifod (Wales); Clonmacloise, on six stones, and Killameny (Ireland).

FIG. 220.—Glendalough (Ireland).

FIGS. 221 AND 222.—St Fillan's Crozier.
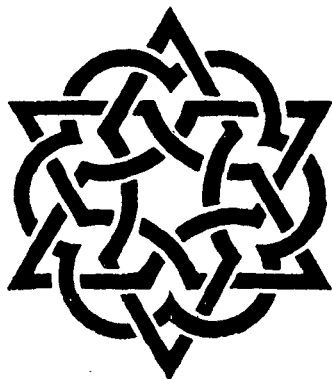
The " Lacy Fret " (Whitaker's *Hist. of Whalley, Lancashire*, p. 97).

[1] This peculiar figure, formed of interlaced rings, seems to have been used as a symbol, for it occurs opposite All Saints' day upon a Staffordshire clog almanack, illustrated in Gough's *Camden*, vol. ii. p. 499.