PLATE I-A
Woolen band from the author's collection.
Scale: ¾

COPTIC WOOL-WEAVES WITH PATTERNS IN UNDYED LINEN

By R. J. CHARLESTON*

NO CORPUS of material which has descended to us from ancient times has been more comprehensive than the mass of Egyptian textiles of the first Christian centuries which have made their way into Western museums. The wealth of the evidence which they provide for comparative study is bewildering. Yet the evidence, surpassing in quantity, is deficient in quality. It is an exasperating circumstance that among the mass of textiles which stuff our museums, scarcely any can be properly "placed" by the testimony of accurate archæological observation.[1] In default of archæological evidence, the remaining criteria left to the student of textiles are mainly those of technique and of style, and by far the greater part of these Egyptian textiles being executed in the tapestry technique, the student is mostly forced to considerations of style as the sole foundations of his thesis.

There are, however, certain classes of loom-woven textiles found in Egypt. Presumably by reason of their relative infrequency, they have tended to be neglected to the advantage of the tapestries, yet the unravelling of the technical tale they have to tell should throw light on the development of the loom in Egypt, a matter of no mean importance. For if this question were settled once and for all and the attribution of certain textiles finally established, their value as cultural documents would be enormously enhanced. There are, however, only four such classes known to the present writer—silk textiles,[2] a class of thick woolen fabrics probably used for furnishings,[3] twill weaves in wool or hair,[4] and a class of brocade weaves which it is proposed to consider in this article.[5]

These fabrics (Plates I and II) consist of woolen bands of varying widths, woven of blue or red wool with a pattern in undyed linen thread.[6] They were used as ornaments on the tunics which were the common wear in Egypt during the whole of the Christian period. They have often been stitched onto a tunic already decorated with tapestry bands,[7] and although this fact often provides us with a useful terminus *post quem*, we should beware of fixing too rigid a date for these pieces. The Egyp-

* Captain Charleston, who received his B.A. from Oxford University in 1938, has worked, in an honorary capacity, in the Nordiska and the National Museums in Stockholm, Sweden. At the time when this article was written he was stationed in southeast Asia at Headquarters of the Ceylon Army Command. (Ed.)

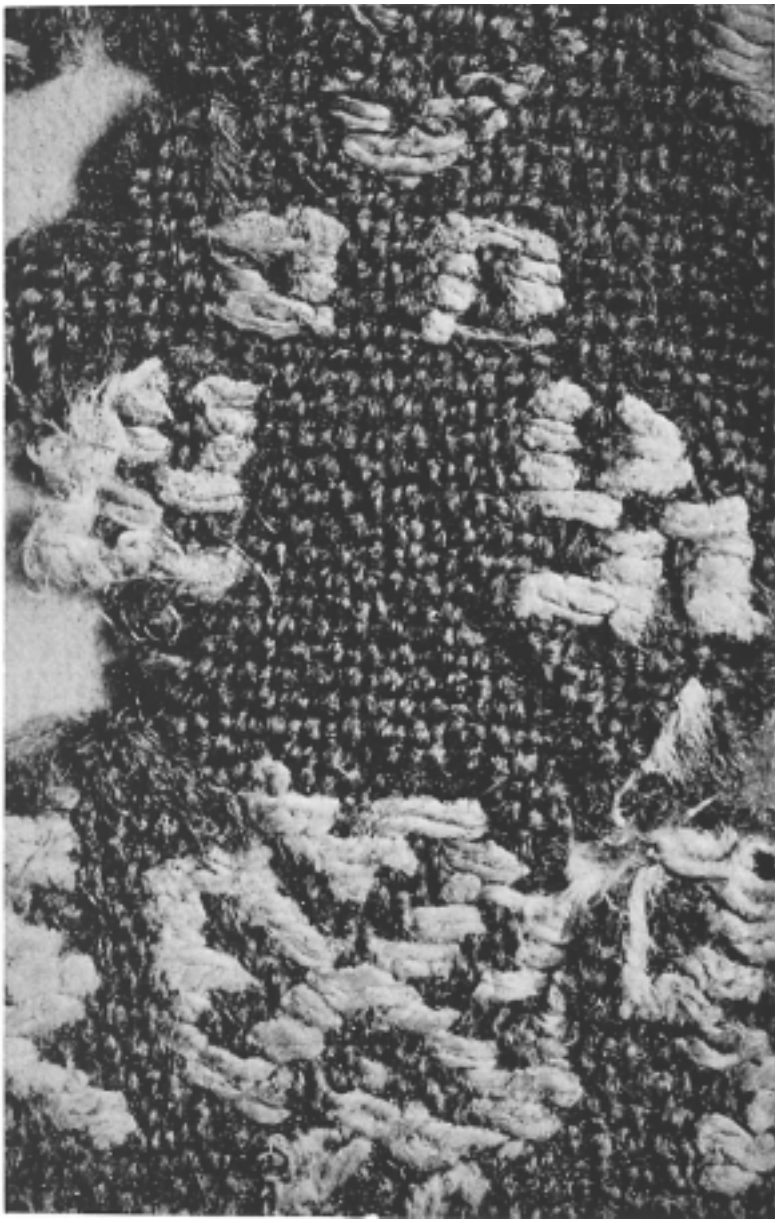

PLATE I-B

Detail of the textile, Plate I-A.
Magnified approximately three times.

tian appears to have been thrifty with his clothes, and an ornament of the type in question may well have been added to a tunic considerably older. But, in general, the testimony of the tapestries is well borne out by the fact that these bands form a style of decoration which falls late in the development of the Egyptian tunic.[8] They are used for shoulder-squares, at the tunic-hem, as cuff-bands, and seem in particular to have had a great vogue as decorations for the neck-opening, a part of the garment which at earlier dates was left undecorated. More conservatively, they were used for the *clavus* bands and were often woven especially into shape as roundels.[9]

As indicated above, they were woven with a pattern of undyed linen on a background of blue or red wool. Other specimens of a related type were woven in two or more contrasting colors of wool, but I have not had the opportunity of examining such pieces, and cannot therefore say whether they are technically, as they are without doubt stylistically, similar to the class discussed here. In two pieces in the Bankfield Museum,* however, green wool has been used, in one (No. 2, Plate II-A) both as a contrasting color border running in the warp direction and as a pattern weft emphasizing the central feature of the design; in the other (No. 12, Plate I-C) as an equal pattern-forming partner with the undyed weft.[10] The dye used for the blue wool appears to have been indigo.[11] The wool seems almost invariably to have been spun with an S-twist and doubled with a Z-twist, the undyed wefts invariably being spun with a soft S-twist.[12] The warps are, for the most part, two-ply, the wefts single-ply.[13] The colored woolen wefts of the ground are occasionally woven in pairs, the undyed pattern weft being invariably doubled or trebled in the pick. The fineness of the weaves varies considerably. In the pieces examined, the warp-count varied from 20-50 ends per inch, the weft-count from 20 picks per inch to as much as approximately 80 in Bankfield Museum No. 11 (Plate I-C), where the cloth has the appearance of a tapestry-weave, so closely is the weft beaten up. This, however, is exceptional, the average being approximately 25 per inch. Selvedges are usually normal, but occasionally two or more warp-threads are grouped together and bound by several turns of the weft-thread as it came to the edge of the piece.[14] In many cases it appears that the bands were woven in a larger piece and then formed by cutting down the edge of the pattern repeat. Thus Bankfield Museum Nos. 3 and 4 (Plate II-A) have a normal selvedge on one side, but are turned in and hemmed at the other.[15]

* Halifax, Yorkshire, England. (Ed.)

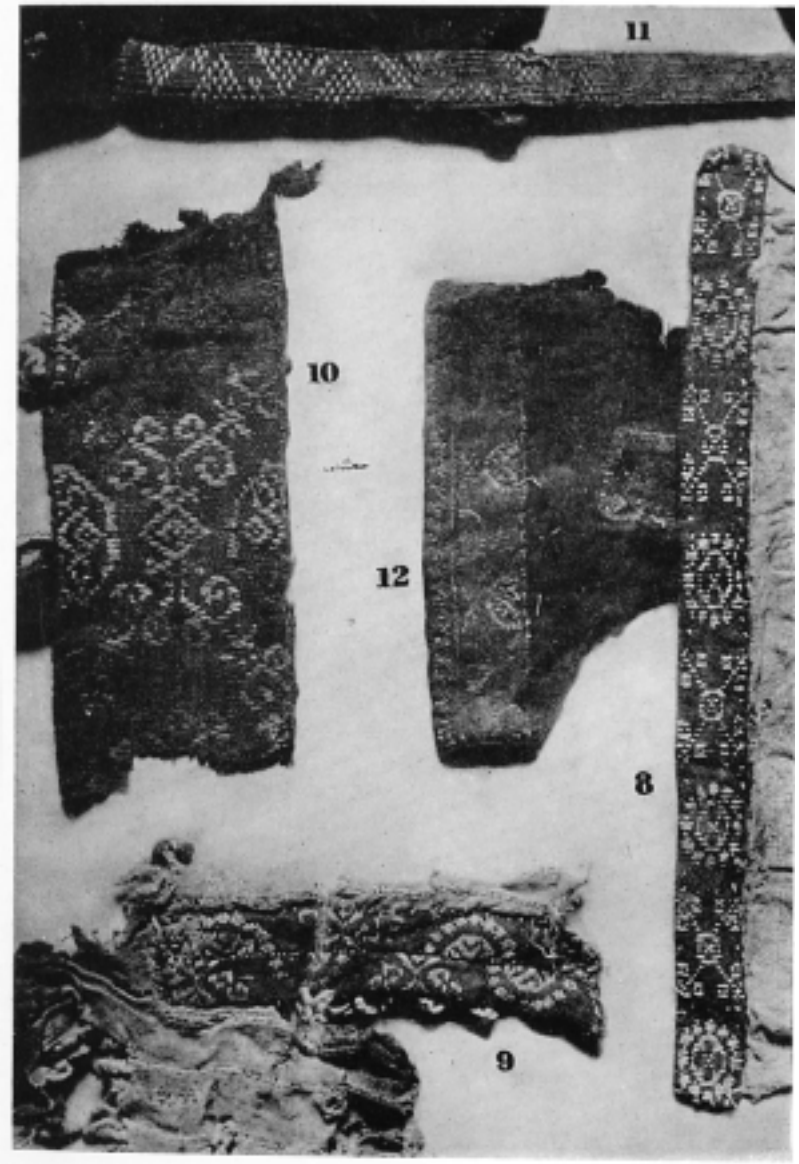

PLATE I-C
Woolen bands from the Bankfield Museum, Halifax, Yorkshire, England.
Scale: c. ½

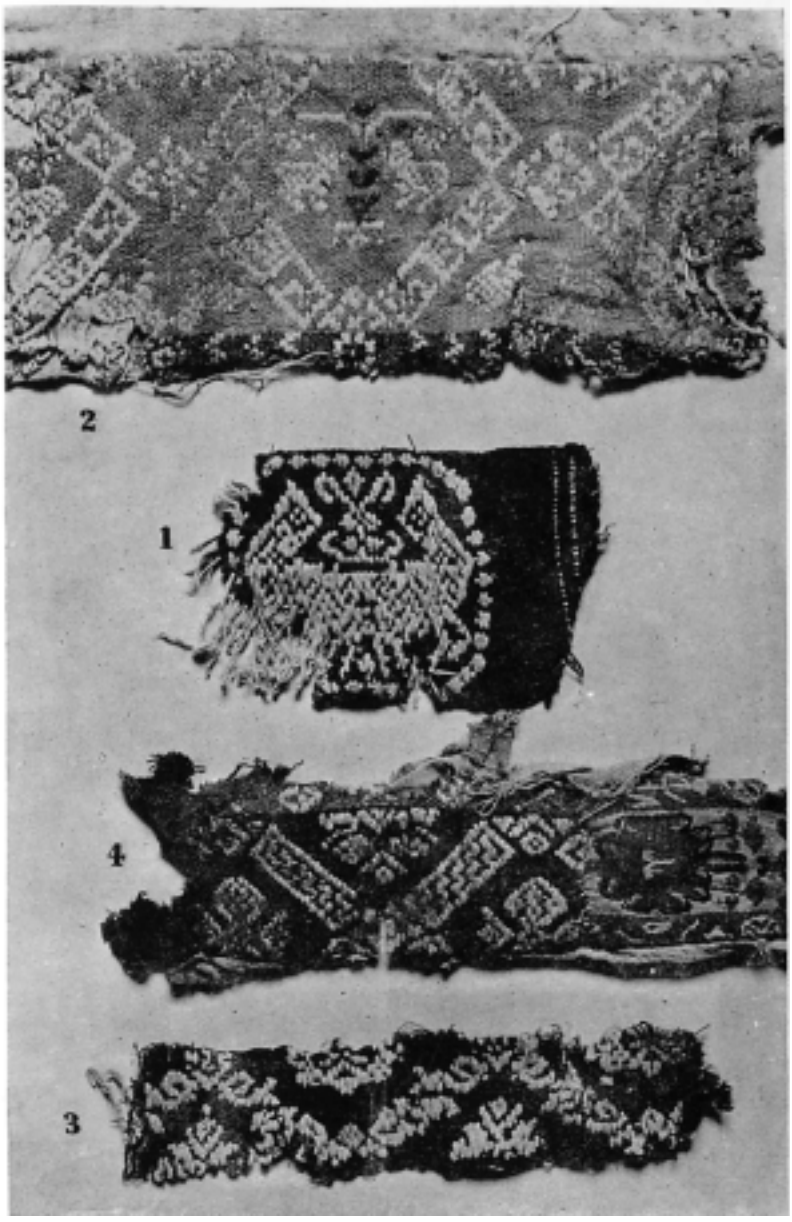

PLATE II-A

Woolen bands from the Bankfield Museum, Halifax, Yorkshire, England.
Scale : c. 3/8

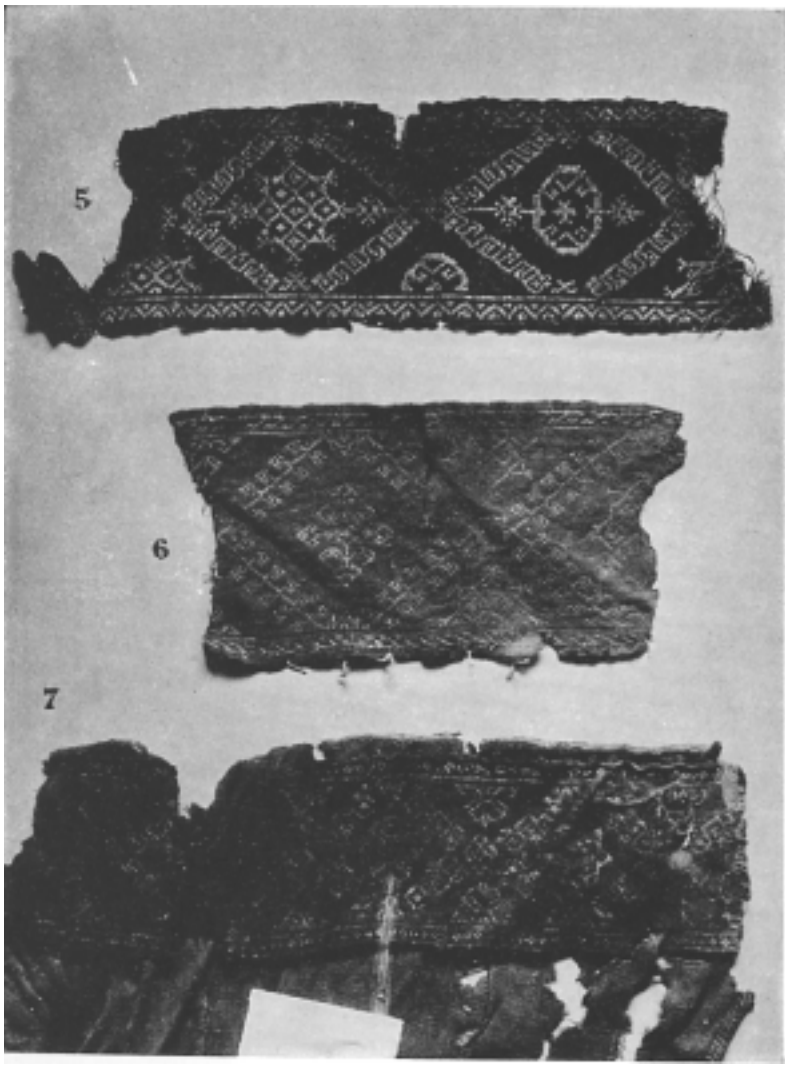

PLATE II-B
Woolen bands from the Bankfield Museum, Halifax, Yorkshire, England.
Scale: c. ⅓

In those cases where a group of colored warps is used to form a color-contrast at the edge of the piece, the weft threads continue straight across the piece. Thus in the body of the fabric, *e.g.*, red weft crosses red warp, at the edge red weft crosses green warp. From the point of view of pattern, however, these bands are treated separately, and usually form a border of small rosettes, checkers, etc.[16]

The weaving of these bands presents points of considerable interest and importance. I have been fortunate enough to be able to dissect in its entirety the piece shown in Plate I-A,B, and the resulting draft is shown in Fig. 1.[17] The general method of weaving was as follows. The ground is a plain weave of blue wool threads. In the patterned portions of the cloth every pick of the wool weft is followed by a pick of the linen pattern-weft. Between the pattern-bands three picks of wool weft run consecutively. The linen weft is brocaded, that is to say, it runs the breadth of the piece behind the cloth when not needed on the surface; the backs of these fabrics thus often reveal a mass of parallel linen threads.[18] At the limit of the pattern-pick the linen weft is secured either by the last warp over which it has passed if the next pattern-pick begins with a different warp, or by the next background-weft if the edge of the design follows the same warp (cf. Fig. 2, A & B). Throughout the fabric the pattern wefts invariably cross over an even number of warps before passing to the back of the cloth.[19]

The pattern is disposed over 58 warp-threads and is symmetrical about the two center warps. The pattern-repeat occupies 56 picks of pattern-weft and is a simple reversed design, lifts 30-56 being identical with lifts 2-28, but woven in opposite sequence.[20]

In dealing with the woolen "furnishing" fabrics mentioned on page 71, Mrs. Grace M. Crowfoot and Mrs. Joyce Griffiths [21] concluded that some of the weaves could have been made on a four-heddle loom resembling the modern hand-loom, but that the more complicated patterns would have required either more heddles or some draw-loom attachment; in any case, that a horizontal loom would be needed.[22]

How was our fabric woven and decorated?

There seem to be four possibilities, which may be discussed in ascending order of probability—embroidery, hand-insertion on the loom, heddle-weaving, and draw-loom weaving.

It is technically possible for the fabric to have been decorated by means of embroidery, but this possibility is, to my mind, quite precluded by the

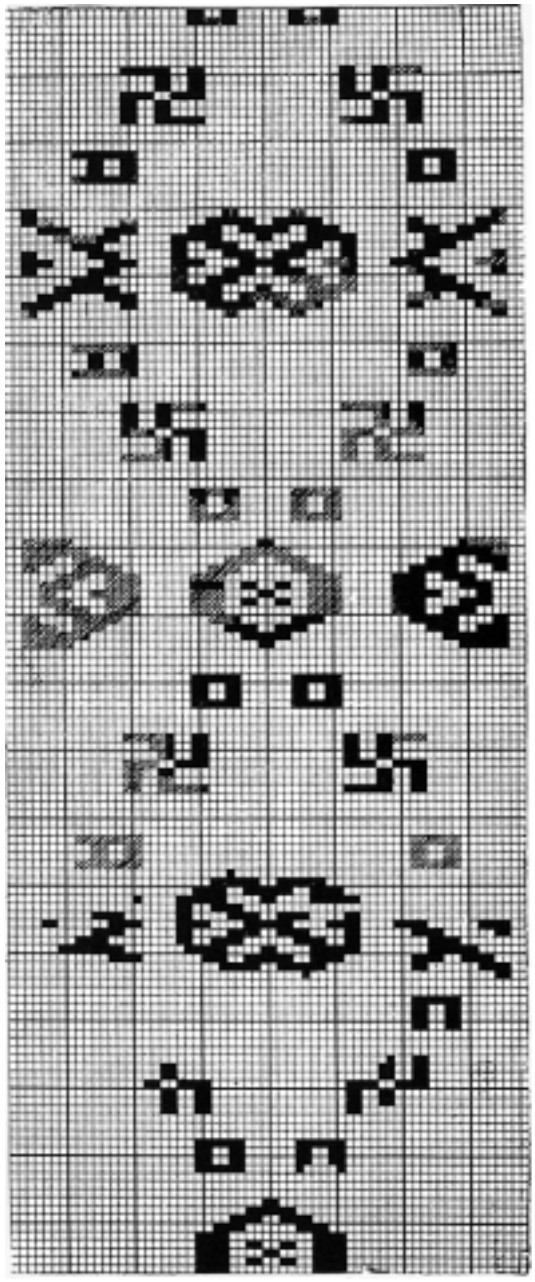

FIG. I

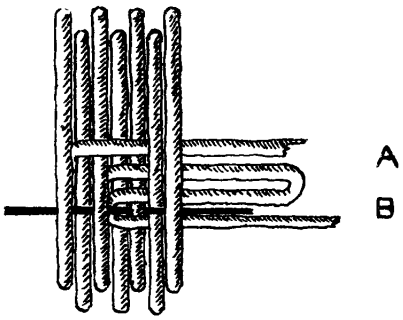

FIG. 2
Detail of weaving technique.

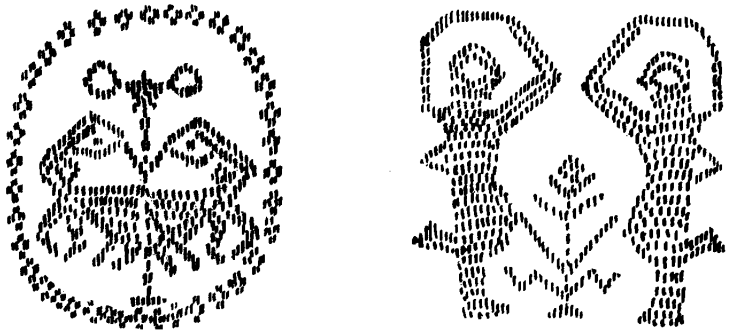

FIG. 3
Weaves with paired figures from Karâra.

facts, first, that never once in the whole dissection, involving some 200 wefts, was any blue background thread—warp or weft—split by the pattern thread, and secondly, that the pattern is formed of a normally coarse and uneven linen thread, usually doubled and sometimes even trebled, totally unsuitable for embroidery. Further, this would be an embroidery method involving an unparalleled extravagance of material (contrast the *palkari* work of Northern India, which contrives to cover great surface areas with long stitches, yet leaves scarcely a trace on the back of the material). Nor do I know of any embroidery in which the stitches slavishly follow the direction of the wefts of the background material, in entire disregard of the specific freedom of the needle to wander where it will. (See also note 18.)

It is equally possible to brocade by hand fabrics of this nature, but here again a close consideration of the cloth itself weighs heavily against a probability. In the first place, there is the heavy wastage of material. If one is weaving by picking out warps with the fingers or by a rod (and the number of *fixed* shed-rods employable in such a fabric would be limited), the natural tendency would be, in such close work, to use a separate bobbin or ball of thread for each unit of the pattern. Thus, for each of the little hollow-square motifs which follow the swastikas in the design, a separate bobbin would be used, with a consequent fourfold saving of thread—a not inconsiderable ratio. Secondly, if these braids are, as I think, cheap imitations for the many of the silk fabrics which were the prerogative of the few (see below, p. 85), quantity would be one of the aims of production, and quantity is not economically achieved by the methods more appropriate to tapestry. These braids were clearly sold by the yard and chopped into the lengths necessary for the recognized tunic-ornaments. Their patterns are exactly repetitive and smack of large-scale production. Lastly, and most significantly, our fabric reveals errors which to my mind could only arise in a method of weaving by which the pattern is fixed in the setting-up of the weave, and necessarily repeated in the same form throughout the length of the warp, any error in the setting-up being unavoidably perpetuated. A glance at Fig. 1 will illustrate my meaning. In the left-hand half of the pattern there is clearly something amiss. The swastika is not placed symmetrically to the pattern axis (*i.e.*, the axis running between the two central warps), and this displacement is carried on down [23] into the small hollow-square motif, and from there to the first three picks of the half-lozenge which occupies the outer elbow of the trellis. There it rights itself, and for

five picks of the pattern weft once more balances the answering pattern on the right-hand side, only thereafter to lapse into the prior error once again. This is not reasonable in a pattern put in by hand. If the weaver rectified his error in the middle of the motif, it is reasonable to suppose that he might continue the error in order to make that particular motif symmetrical; but would he then, being aware of a mistake, continue it right down his piece? The unlikelihood of this is heightened by the fact that something has clearly gone amiss with the hollow-square motif. It is not only asymmetrically placed: it is misshapen. What weaver, making such a mistake in the first pick, even if lazy enough not to go back and rectify it, would then repeat it in the fourth pick, and then, apparently, repeat the whole performance yet again in the corresponding motif further down the trellis? These errors, to my mind, make it almost certain that in fact a mechanical set-up was used.

This brings us to the third alternative—a heddle-weave on a loom resembling the modern hand-loom. We are forced to assume that for the setting-up of such a weave, the weaver must have had a pattern, and that pattern on point-paper, or something very much resembling it. For to work out such a set-up, it is necessary, generally speaking, to observe the behavior of each warp-thread throughout one repeat of the pattern, and to thread all warps of the same behavior in the one heddle. For this is not a weave of, say, the Swedish Rosengång type, in which the warps are entered in a repeated set sequence, and a number of patterns produced by variation in the order of depressing the treadles. Our textile is subservient to a pattern clearly not of a spontaneous textile growth.

One can only assume, further, that the pattern followed would be correctly drafted. If a pattern known to be susceptible of weaving on four heddles were drafted with one or two errors, and handed to a stranger for strict entering, he might find that he would require, for example, six heddles to weave it as it stood. In the case before us, it would take seventeen heddles [24] to weave the textile symmetrically, but twenty-five to weave it as it is. This is *reductio ad absurdum.* On the other hand, if the weaver worked from a correct, symmetrical, pattern, errors of entering would show up in an entirely different way. And, indeed, from the first sight, it is fairly obvious from the general nature of the material that we have here two separate systems—a two-heddle system for the background fabric, and a pattern-system—a state of affairs foreign to the heddle-weave as such.

Lastly, a draw-loom. It is clear that in the dual system before us the

warps used for pattern-building were controlled in pairs, and on first analysis it seemed as if the two outside pairs might be under a single control, the next pair under another, and so on until finally the two center threads would be left to a separate draw-cord of their own. Such a system would mean fifteen controlling cords and the possibility of weaving an indefinite number of patterns on the same warp by means of different combinations of draw-cord lifts. This possibility, however, is invalidated once more by the error of centering, which would then necessarily affect the central motifs, which are in fact symmetrical about the pattern-axis. It seems, therefore, that each pair of warps (excluding a pair at each selvedge over which no pattern is disposed) had its own draw-cord (*i.e.*, twenty-nine in all): that these draw-cords were pulled in groups for each pattern-lift and that these groups did not vary, *i.e.*, that the elements of the pattern were repeated mechanically throughout the fabric.[25]

If the conjecture proposed in the preceding paragraph be correct, it is not difficult to account for the errors of weaving which seem so fatal to the other propositions. For wherever the initial error occurred (probably with the swastikas, for in the open expanse of the cloth the lack of adjacent motifs would make the asymmetry less obvious), it would be carried on by the weaver running his eye down his draw-cords and harnessing that which lay in the required line judged from the previous motif. Thus, granted the error in the top swastika on the left-hand side, to start the next motif of the hollow-square the weaver would observe from his pattern that its right-hand edge lay on the same cord as the left leg of the swastika, and harness it accordingly, then work from that point to the two adjacent cords to the left (or three in this instance: it is possible here that the weaver, coming to the edge of his cloth, regulated the left-hand edge of this hollow-square by a count from the selvedge, but the point is difficult to decide: it is significant that this seeming slip marks the alignment where the edge of the motif would actually have fallen if no error had been made). The mistake would then be carried down as far as the central picks of the half-lozenge motif, where possibly the proximity of the central rosette on the one side and of the small pattern-filling (close to, and therefore possibly checked by, the selvedge) on the other, would make it as easy to work by centering as by the other method. The actual mistakes would probably appear only when the first repeat was run off,[26] and possibly by then it would be considered uneconomical to go back to correct the harnessing.

All these indications point to a state of industry in which a certain extravagance in materials was offset by the increasing output possible on a loom capable of mechanical pattern-production. If the services of a draw-boy were used, a considerable speed in weaving could be attained, the weaver beating up the pattern weft, and putting in and beating up the background weft, while the draw-boy sorted out his groups of cords for the next lift. The draw-loom which I have envisaged would, furthermore, be flexible in its pattern-production. By a rearrangement of the draw-cord groups almost any pattern of the same type could be produced.

Mr. A. F. Kendrick has observed "traces of the influence, in some of the later specimens, of the silk weavings from tunics of the 6th century," [27] an observation he had already foreshadowed in 1917 when discussing the silks found in Egypt.[28] There seems little question of the correctness of this view. An examination of certain silks found at Akhmîm and Antinoë, or preserved in the treasuries of some Western Churches, reveals an essential similarity with our pieces. They are characterized by diaper-patterns composed of various central motifs enclosed in lozenge-shaped frames of different types. Some are composed of a trellis of small designs (crescents, crosses, checkered squares, etc.), some of closed frames incorporating other such motifs, while some are formed of running scrolls of foliage.

The characteristics of these silks are closely reproduced in the woolen weaves. The first type is well represented by the piece shown on Plate I-A, whose swastikas and small squares may be seen in Figs. 9, 37 and 48 of von Falke's book,[29] the last two named also having as a central motif the four-petaled rose which appears on the wool-weave in question;[30] the lozenge device which appears at either edge of the wool textile is shared with a piece in the Michigan collection,[31] and may perhaps be derived from the central motif of V. & A. No. 580,[32] itself possibly a derivative of a pattern on a silk from Antinoë in the Berlin Kunstgewerbe Museum [33] which corresponds very closely to this piece in the general nature of its pattern, with its imbricated outline enclosing floral motifs. This fragment, too, by its use of reserves of pattern-color for the display of designs executed in the color of the main ground-weave, is strongly reminiscent of V. & A. Nos. 570, 578, 589,[34] the last-named of these having the same pattern repeated first in white on blue and then in blue on white. Furthermore, of these pieces, Nos. 578 and 589 both contain a star-device to be found in another Antinoë silk from Berlin.[35] The crosses and checkered squares of the Antinoë silk mentioned above (von Falke, Fig. 10),

are seen again, the former on V. & A. No. 574,[36] the latter on the piece shown on Plate I-A (in a slightly altered form). Again, the specimens V. & A. Nos. 570 and 585 display a motif of four springing stems very reminiscent of the pattern in white on blue of the Antinoë silk illustrated by von Falke, Fig. 14 (*cf.* also Bankfield Museum No. 8, Plate I-C). The heart-shaped device on the Michigan piece No. 194 is apparently derived also from the silks.[37]

The list of these similarities could be extended considerably, but scarcely without tedium. It remains only to be noted that the lozenge frame-device is continued in the wool-weaves, although the technique does not permit of rendering any small patterns other than simple cross-checker-, etc., designs,[38] and that the running-stem framework is equally inherited.[39]

The most intriguing branch of this family is one which departs entirely from the diaper tradition. There are two representatives of the type illustrated in German books. The first[40] displays two horse-like animals grouped about a central plant-motif, their heads turned back over their shoulders, with each a bird crouched beneath its feet. Curious hook-like projections protrude from their necks and chests, heart-shaped and quatrefoil patterns mark the joints of hind- and fore-legs, and over their quarters hover curious shapes which might be intended for wings. The whole group is surrounded by a roundel formed by plant-scrolls. There are two identical roundels on the fragment, and the pattern is rendered mainly in white on a red ground, the central motif only being in green and yellow.[41] The second of these pieces is from a grave at Karâra and was found by the German expedition of 1913-14 (Fig. 3, page 79).[42] Here two similar animals face *toward* a central plant-form, there are no birds, and the "wings" are replaced by a circle floating in the air. The roundel is composed of a series of small checkers reminiscent of *e.g.*, V. & A. No. 585.[43] What renders it remarkable is the presence in the pattern-repeats of pairs of dancing girls, extraordinarily well rendered in view of the limitations of the technique, and vividly reminiscent of tapestries some hundreds of years older.[44] The resemblance between these pieces and those from Bankfield (Nos. 1 and 2; Plate II-A) needs no emphasis. In particular it should be noted that No. 2 employs a green wool for the rendering of the central plant-motif, just as does the Berlin piece, that the rendering of No. 1 is very like that of the Berlin piece, and that the roundel-frame of No. 1 is identical with that of the Karâra textile. All these patterns are woven at right angles to the warp.[45]

There is in the Victoria and Albert Museum a silk of an unique type [46] representing a pair of stags (?) grouped on either side of a plant-form springing from a vase, their heads turned back to nibble at the branches of foliage which project back past their shoulders. Beneath their feet appear two hare-like animals, the whole design being surrounded by a hoop of plant-forms. The resemblance with the wool-weaves is considerable, and it seems reasonable to think that here, too, the progenitors of the family are to be found in the silk-weaves.

The silks found in Egypt are variously ascribed. The diaper types described above were found mainly at Antinoë. Their manufacture has been ascribed by von Falke,[47] basing his argument on the similarity between these patterns and those shown on the Greek classical vase-paintings, to the place in which they were found, although he points out that other pieces in *e.g.*, Western Church Treasuries, may well have been woven in any Hellenistic center such as Alexandria. A. F. Kendrick,[48] following J. Strzygowski and basing his arguments on the Oriental qualities often found in the silk-designs, would attribute them to Syria and the western parts of the then Persian Empire.

Whichever view is correct (and their production would seem to have been possible in any large Hellenistic center which was in contact with Oriental influences), these silks were clearly articles of trade among the richer members of communities throughout Egypt, and undoubtedly the object of much admiration, as the sedulous imitation of them among the later tapestries indicates.[49] Nobody has attempted to deny these tapestries to Egypt, and there seems no reason in the present state of our knowledge not to allow an Egyptian origin for the wool weaves as well. They were probably cheaply made, and their wide distribution in Egypt indicates that they were within the means of many. They would scarcely, therefore, be the source of great profit to traders bringing them from Syria or Mesopotamia. Furthermore, the presence of the self-contained group from the Faiyûm mentioned above would tend to show that the type was manufactured there.[50] The considerations which apply to the Faiyûm presumably apply equally to other localities.

The woolen weaves must have been manufactured by professional weavers [51] and it is conceivable that they learned the principles of the draw-loom from Alexandria or some other large weaving center, and applied them to the making of cheaper wares to answer local demand, in the materials indigenous to the country—wool to take the dyes necessary to the traditional color scheme, and linen, the immemorial textile

fiber of Egypt, for the white pattern. It is as yet too early to attempt to narrow down the classification of these textiles by locality and time, but as scientific archæology in Egypt lays open more and more datable sites, we may approach some certainty in this matter.

The wool weaves, then, were probably the manufacture of Egyptian weavers in the 6th, 7th and possibly 8th centuries, and the evidence of their technique points to the use of a quite complex draw-loom in Egypt as early as the 6th century.*

* Since writing the above, I have been sent a copy of Metropolitan Museum Studies, Vol. II, Part 1, New York, 1930, in which M. S. Dimand, in the course of a general survey of Egyptian textiles, expresses the opinion that the patterns of these fabrics were mechanically produced.

DESCRIPTIVE LIST OF TEXTILE ILLUSTRATED

WOOL-WEAVE FROM THE AUTHOR'S COLLECTION

Plate I-A and B

Undyed linen on blue wool. Size approximately 8 in. x 2 in., 25 ends, 32 picks per inch. Warps: 2-ply blue wool, S-spun, Z-twist. Wefts: (1) Single-ply blue wool, S-spun; (2) Single-ply undyed linen, S-spun and woven double. Selvedge normal.

WOOL-WEAVES FROM THE BANKFIELD MUSEUM HALIFAX, YORKSHIRE, ENGLAND

No. 1, Plate II-A—Undyed linen on blue wool. Size 5¼ in. x 3⅜ in., 28 ends, 24 picks per inch. Warps: 2-ply blue wool, S-spun, Z-twist. Wefts: (1) Single-ply blue wool, S-spun; (2) Single-ply undyed linen, S-spun and woven double. Selvedge normal.

No. 2, Plate II-A—Undyed linen on red wool, but with green wool used for an edging and sparsely as a pattern-weft (see above, p. 75). Size 21 in. x 4⅜ in., 32 ends, 20 picks per inch. Warps: (1) 2-ply red wool, S-spun, Z-twist; (2) 2-ply green wool, S-spun, Z-twist. Wefts: (1) Single-ply red wool, S-spun; (2) 2-ply green wool, S-spun, Z-twist; (3) Single-ply undyed linen, S-spun and woven double. Selvedge normal.

No. 3, Plate II-A (Museum No. E. G. 328)—Undyed linen on blue wool. Size 8¼ in. x 1¾ in., 40 ends, 20 picks per inch. Warps: Single-ply tightly Z-spun blue wool. Wefts: (1) Single-ply blue wool, S-spun; (2) Single-ply undyed linen, S-spun and woven double. Selvedge normal on one side but piece hemmed on other.

No. 4, Plate II-A—Undyed linen on blue wool with a red border. Size 6¾ in. x 2⅜ in., 36 ends, 24 picks per inch. Warps: (1) Single-ply blue wool, Z-spun; (2) Single-ply red wool, Z-spun. Wefts: (1) Single-ply blue wool, S-spun and woven double; (2) Single-ply undyed linen, S-spun and woven double (or possibly trebled). Selvedge normal at one edge, hemmed at the other.

No. 5, Plate II-B (Museum No. E. G. 350)—Undyed linen on blue wool. Size 13½ in. x 3¾ in., 28 ends, 28 picks per inch. Warps: 2-ply blue wool, S-spun, Z-twist. Wefts: (1) Single-ply blue wool, S-spun and woven double; (2) Single-ply undyed linen, S-spun and woven double. Selvedge strengthened by five twists of weft around cord of two warps.

No. 6, Plate II-B—Undyed linen on red wool. Size 8½ in. x 4⅛, 42 ends, 30 picks per inch. Warps: 2-ply red wool, S-spun, Z-twist. Wefts: (1) Single-ply red wool, S-spun; (2) Single-ply undyed linen, S-spun and woven trebled. Selvedge strengthened by a group of five red warps, outside which a threefold *green* warp, the two forming a pair of warp-cords around which the weft could be twisted.

No. 7, Plate II-B—Undyed linen on blue (green?) wool. Size 11½ in. x 3⅛ in.,

34 ends, 28 picks per inch. Warps: 2-ply blue wool, S-spun, Z-twist. Wefts: (1) Single-ply blue wool, S-spun and woven double; (2) Single-ply undyed linen, S-spun and woven apparently trebled. Selvedge strengthened by a group of three warps bound by a treble turn of weft.

No. 8, Plate I-C—Undyed linen on red wool. Size 11½ in. x ⅞ in., 52 ends, 28 picks per inch. Warps: 2-ply red wool, S-spun, Z-twist. Wefts: (1) Single-ply red wool, Z-spun, (?); (2) Single-ply undyed linen, S-spun and woven double (treble?). Selvedge normal.

No. 9, Plate I-C (Museum No. E. G. 374)—Undyed linen on red wool. Size 6 in. x 1⅛ in., 48 ends, 28 picks per inch. Warps: 2-ply red wool, S-spun, Z-twist. Wefts: (1) Single-ply red wool, S-spun; (2) Single-ply undyed linen, S-spun and woven double. Selvedge normal. Two strips apparently cut from one band and then joined in such a way that the pattern does not fit together.

No. 10, Plate I-C—Undyed linen on red wool. Size 7 in. x 3 in., 30 ends, 24 picks per inch. Warps: 2-ply red wool, S-spun, Z-twist. Wefts: (1) Single-ply red wool, S-spun; (2) Single-ply undyed linen, S-spun. Selvedge normal.

No. 11, Plate I-C (Museum No. E. G. 349)—Undyed linen on blue wool. Size 20 in. x ⅞ in., 20 ends, 70-90 picks per inch. Warps: 2-ply red wool, S-spun, Z-twist. Wefts: (1) Single-ply red wool, S-spun; (2) Single-ply undyed linen, S-spun and woven double (treble?). Selvedge normal.

No. 12, Plate I-C—Undyed and green wools on red wool. Width 1¼ in., 34 ends, 30 picks per inch. Warps: 2-ply red wool, S-spun, Z-twist. Wefts: (1) Single-ply red wool, S-spun and woven double; (2) Single-ply undyed wool (?), S-spun; (3) Single-ply green wool, S-spun and woven double. Selvedge apparently strengthened.

NOTES

1. It is a thousand pities that the sites of Akhmîm (the Greek Panopolis) and Antinoë, which have yielded by far the most important and numerous of our fabrics, should have been opened up before the era of scientific archæology, and surrendered their priceless plunder shorn of its evidential value. It is tragic, for instance, to read Guimet's "Portraits d'Antinoë" and need to piece together the infinitesimal fragments of evidence scattered by a writer absorbed in the study of comparative religions. The situation has improved. In 1926 appeared an account of the German excavations at Karâra in 1913-14 ("Koptische Friedhöfe bei Karâra," ed. H. Ranke, Berlin, 1926), and in 1933 there was published a survey of the textiles found by the University of Michigan expedition to Karanis in the Faiyûm in 1924-6 (Lillian M. Wilson, *Ancient Textiles from Egypt in the University of Michigan Collection*, Ann Arbor, 1933). An evil genius broods over this study. Both books contain valuable archæological evidence, yet the former, whose material is so rich, is marred by the fact that a part of the expedition's field records was lost in transit for Germany at the beginning of the last war: the latter, which suffered no such misfortune, describes a site relatively poor in textiles.
2. See, *e.g.*, A. F. Kendrick, *Catalogue of Textiles from Burying-Grounds in Egypt*, London, 1921, Vol. III, Chap. VII; O. von Falke, "Decorative Silks," Berlin and London, 1922, pp. 2-9; O. Wulff and W. F. Volbach, *Spätantike und Koptische Stoffe aus Agyptischen Grabfunden*, Berlin, 1926, pp. 145-152; J. F. Flanagan, "The Origin of the Draw-loom Used in the Making of Early Byzantine Silks," *Burlington Magazine*, Vol. XXXV, 1919.
3. See, *e.g.*, A. F. Kendrick, *op. cit.*, Vol. II, Chap. VII, Nos. 535-548; O. Wulff and W. F. Volbach, *op. cit.*, No. I 6682, Plate 36, No. 9017, Plate 57; Grace M. Crowfoot and Joyce Griffiths, "Coptic Textiles in Two-faced Weave with Pattern in Reverse," *Journal of Egyptian Archæology*, Vol. XXV, Part 7, 1939.
4. See, *e.g.*, Lillian M. Wilson, *op. cit.*, Nos. 11-15 and 116, Plates II and IV.
5. I have been most fortunate in being able to examine the fabrics of this type preserved in the Bankfield Museum, Halifax. For his courtesy in extending me this facility, and for permission to publish Plates I-C, II-A and II-B, I am indebted to the curator, Dr. M. B. Hodge. It is a pleasure to record here my grateful thanks to Sydney Harry, Esq., for every kind of practical help, in particular with the photographing of the Bankfield Museum pieces, and for his unfailing sympathy and interest in the work. Without him this paper could not have been written.
6. See below, p. 71.
7. O. Wulff and W. F. Volbach, *op. cit.*, Nos. 9103, p. 116, Plate 113, dated 6/7th century; 6831a, p. 70, Plate 93, dated 5/6th century; 14253, p. 69,

Plate 89, dated 4/5th century; 6884, p. 118, Plate 91, dated 6/7th century: A. F. Kendrick, *op. cit.*, Vol. II, Nos. 440, dated 5/6th century; 442, dated 5/6th century. This wide fling of dates can perhaps be restricted by the elimination of Volbach's 14253, the dating of the tapestry being possibly a little too early. The terminus *post quem* would then be 5/6th century. Compare also Bankfield Museum No. 4, Plate II-A, the tapestry of which may be dated 6/7th century (*cf.* O. Wulff and W. F. Volbach, Nos. 4596 and 9306).

8. The frequent appearance of these bands on woolen, rather than linen, tunics is an indication of late date, *e.g.*, A. F. Kendrick, *op. cit.*, Vol. II, Nos. 337, Plate XVI; 584, Plate XXIX; 587, Plate XXVIII; E. Errera, *Collection d'Anciennes Étoffes Égyptiennes*, Brussels, 1916, No. 210; Bankfield Museum Nos. 2, 7, 9, 11 (Plates I-C and II). Although all the bands cited here are not strictly of the type dealt with in this paper, they present a sufficiently close analogy to warrant their contribution to this argument. A. F. Kendrick, *op. cit.*, Vol. II, Nos. 337, 582, 583 and 584 (Plates XVI and XXIX), although it has not been my fortune to examine them, almost certainly form a distinct branch of the family, all four pieces deriving from the Faiyûm and being of a distinctive style, though woven in wools of different colors (red, blue and purple).

9. See A. F. Kendrick, *op. cit.*, Vol. II, pp. 2-3. Particular examples are: A. F. Kendrick, *op. cit.*, Nos. 337, Plate XVI (cuff-band, neck-piece and tunic-hem); 440 and 442 (cuff-bands); 570 and 578, Plate XXVIII (roundels): E. Errera, *op. cit.*, Nos. 210 (roundel), 211 (shoulder- and clavus-band): O. Wulff and W. F. Volbach, *op. cit.*, Nos. 9103, Plate 113; 6831a, Plate 93, and 14253, Plate 89 (neck-pieces); No. 6884, Plate 91 (shoulder-square): Bankfield Museum, No. 11, Plate I-C (neck-and shoulder-piece of a child's tunic).

10. In this example alone of the specimens examined, the undyed weft appears to be of wool and not linen—a possible indication of lateness, see *e.g.*, A. F. Kendrick, *op. cit.*, Nos. 575, 579, 581, 587, etc., the first-named being clearly related to No. 196 in Lillian M. Wilson, *op. cit.*, Part II, Plate XXIII, a piece probably deriving from Ashmunein, the ancient Hermupolis.

11. A number of threads from the piece shown on Pl. I-A, were tested by the Bradford Corporation Conditioning House, and the presence of indigo confirmed. The red piece, Bankfield Museum No. 11, Pl. I-C, was tested by the Sandoz Chemical Co. Ltd., Bradford, who, whilst able to state that madder was not used, could give no definite diagnosis beyond the opinion that the dye used was probably of the soluble redwood class, iron and copper being present as a mordant. Owing to overseas service I have been unable to follow this clue up. I am very much indebted to the Sandoz Co. for their courteous assistance.

12. The twists of spun yarns have been used by R. Pfister (in *e.g.*, *Textiles de Palmyre, Paris*, 1934, p. 38, n.) as an argument for attribution. The S-spun yarn, with a Z-twist if doubled, seems to be the general rule in Coptic Egypt, yet the appearance in, *e.g.*, Bankfield Museum Nos. 4 and 8, Plates II-A and I-C, of Z-spun yarns alongside S-spun, without any apparent discrepancy of dye or any other singularity of the textiles themselves, renders the argument dangerous if pressed too far. See also Grace M. Crowfoot and Joyce Griffiths, *loc. cit.*, p. 47. For technical details of the pieces published here, see below, p. 87.

13. Bankfield Museum No. 4, Plate II-A has single-ply red and blue warps.

14. *e.g.*, Bankfield Museum Nos. 5, 6 and 7. No. 6 has an additional group of three *green* warp threads outside a group of five red warps: the green is not visible, being completely covered by the whipped weft. It is noteworthy that these three pieces are further united by the style and fineness of their weaving, and by the use in Nos. 5 and 7 of a double pick in each shed of the ground weave. The linen pattern-weft appears to be woven trebled instead of doubled as in the coarser fabrics.

15. How this might be done may easily be seen by a glance at A. F. Kendrick, *op. cit.*, Nos. 574, 575 and 579 (Plates XXVIII and XXIX), or Lillian M. Wilson, *op. cit.*, Part II, No. 196, Plate XXIII. This practice also occurs in the case of the diaper-patterned silks, *e.g.*, O. von Falke, *op. cit.*, Fig. 10.

16. *e.g.*, Bankfield Museum No. 2, Plate II-A; A. F. Kendrick, *op. cit.*, No. 585; Lillian M. Wilson, *op. cit.*, Part II, No. 193, Plate XXIII.

17. In the figure the pattern-weft threads are marked where they pass over the warp-threads. A square marked in solid ink indicates an intersection observed with certainty from the fabric: diagonal hatching indicates an intersection reconstructed from a corresponding part of the design, and vertical hatching one probable from the general nature of the cloth. Half the pattern repeat has been hatched in this way, the remaining intersections being marked only as observed. The ground weave is not shown in the figure: if it were, the design would be obscured.

18. This feature of the back of the fabric has caused some doubt whether the pattern weft does not in fact occasionally cross a background weft. If this were so, the pattern could only be embroidered. It is true that the pattern wefts at the back of the fabric, floating free as they do, are liable to considerable distortion and do give an impression of disorder. But from my dissection of the fabric, as shown in Fig. 1, the fact emerges that in the preserved portions of the pattern, the pattern weft does infallibly lie in one shed between two background wefts, and never crosses from one shed into the next. Unfortunately, it is not now possible to publish a photograph of the back of this textile. Were it possible, it would actually create even more strongly the

impression that pattern wefts occasionally do jump from one shed to the next, but the fact remains nevertheless that they do not, and the impression would be all the falser for its strength. Such a photograph would, however, give a useful idea of the material extravagance with which these fabrics were made.

19. All the pieces observed in the Bankfield Museum bear out this observation except No. 2, which does not seem to adhere to the even-number principle. The nature of the warp in this case, however, made accurate observation difficult.

20. It has been necessary to make this description in the terms appropriate to pattern-weaving. The possibility of these fabrics having been embroidered is discussed below.

21. *loc. cit.*, p. 90. For the view that draw-cords were used in the making of these textiles, see J. F. Flanagan, "The Origin of the Draw-loom Used in the Making of Early Byzantine Silks," in *Burlington Magazine*, Vol. XXXV, 1919, pp. 167 ff., also V. Sylwan in *Rig* (Stockholm), VI, 1923, pp. 62 ff., Figs. 3 & 4 (in Swedish).

22. The horizontal ground loom was known and used early in Egyptian history. See H. Ling Roth, "Ancient Egyptian and Greek Looms," *Bankfield Museum Notes, Second Series, No. 2*, Halifax, 1913, pp. 3-14. A model of such a loom from the XIth dynasty is reproduced in *The Legacy of Egypt*, ed. S. R. K. Glanville, Oxford, 1942, Plate 19. The date of the introduction of the treadle loom is not known.

23. From the weaver's point of view, of course, if a horizontal loom was used, the figure would need to be turned upside down and the errors regarded as spreading *up* the warp. The other orientation is more convenient for description.

24. Fifteen for the pattern-wefts, two for the ground-weave, in order, *e.g.*, (1), 3, (2), 4, (1), 5, (2), 6, (1), etc., the heddles of the ground weave being shown in brackets.

25. The modern equivalent in hand-loom weaving is a draw-loom with a series of draw-cords which run on a frame over the head of the weaver and are fixed behind him. For each pattern-lift the appropriate draw-cords are controlled by a number of loops which are knotted together; thus when the knot is pulled down and fixed, the appropriate draw-cords are also pulled down and the corresponding warps raised.

26. It seems, however, quite likely that these bands were woven face down, as this would permit the lifting of the warps over which the pattern-weft was actually spread, rather than those more numerous threads not required to be covered, which would have to be lifted if the pattern was woven on the face of the cloth. The proper management of the pattern-weft where it was secured

by the ground-weft at the turn-back (see Fig. 2, B) would also be greatly facilitated by this.

27. *Op. cit.*, Vol. II, p. 82.
28. *Burlington Magazine*, Vol. XXXI, July 1917, p. 19.
29. No. 9 from Antinoë, No. 48 from Aix-la-Chapelle. See also O. Wulff and W. F. Volbach, *op. cit.*, No. 9269, p. 147, Plate 135.
30. *Cf.* also A. F. Kendrick, *Catalogue . . . , Vol. II*, Nos. 575, 581, although these are not strictly in the class under consideration. Also Lillian M. Wilson, *op. cit.*, Part II, No. 196, Plate XXIII; O. von Falke, *op. cit.*, Figs. 11 and 13; Bankfield Museum No. 9, Plate I-C.
31. Lillian M. Wilson, *op. cit.*, Part II, No. 193, Plate XXIII.
32. A. F. Kendrick, *Catalogue . . . , Vol. II*, Plate XXIX (white on red).
33. O. von Falke, *op. cit.*, Fig. 14.
34. A. F. Kendrick, *Catalogue . . . , Vol. II*, Plate XXVIII.
35. O. von Falke, *op. cit.*, Fig. 11. It is worth noting that the palmettes springing from the angles of the lozenges are strongly reminiscent of the Faiyûm group mentioned above—A. F. Kendrick, *Catalogue . . . ,* Nos. 337, 582, 583, 584.
36. A. F. Kendrick, *Catalogue . . . , Vol. II*, Plate XXIX.
37. Lillian M. Wilson, *op. cit.*, Plate XXIII: *cf.* E. Errera, *op. cit.*, No. 376, and A. F. Kendrick, *Catalogue . . . , Vol. III*, No. 849, Plate XXXII. *Cf.* also O. Wulff and W. F. Volbach, *op. cit.*, No. 9103, p. 116, Plate 113, and E. Errera, *op. cit.*, No. 223.
38. Compare, *e.g.*, V. & A. Nos. 579, 588 (A. F. Kendrick, *Catalogue . . . , Vol. II*, Plates XXVIII and XXIX) with O. von Falke, *op. cit.*, Fig. 11.
39. Compare, *e.g.*, V. & A. No. 835 (A. F. Kendrick, *Catalogue . . . , Vol. III*, Plate XXXI) and O. von Falke, *op. cit.*, Fig. 38 with the Michigan pieces 193 and 195 (Lillian M. Wilson, *op. cit.*, Plate XXIII); V. & A. No. 845 (A. F. Kendrick, *Catalogue . . . , Vol. III*, Plate XXXII) with the Bankfield piece No. 5, Plate II-B.
40. O. Wulff and W. F. Volbach, *op. cit.*, No. 6695, p. 137, Plate 117.
41. Possibly a discoloration of the linen thread. This may vary in color from pure white to a quite deep buff according to its state of preservation.
42. H. Ranke (ed.), *Koptische Friedhöfe bei Karâra*, Plate 8, 1. No details of the archæological context of this piece is given in the text, but the terminus *ante quem* is considered by the author to be the beginning of the 8th century.
43. A. F. Kendrick, *Catalogue . . . , Vol. II*, Plate XXVIII. *Cf.* also Bankfield Museum, Nos. 8 & 9, Plate I-C.
44. *e.g.*, O. Wulff and W. F. Volbach, *op. cit.*, No. 9230, p. 9, Plate 44, dated 4/5th century.

45. There is no indication of the use of these bands. The Karâra piece appears to be used as an edging to a cloth of apparently late type (resembling an Arab striped linen) and indeterminate use. If used as *clavus* bands the patterns would lie on their sides.

46. A. F. Kendrick, *Catalogue . . . , Vol. III,* No. 808, Plate XXV. It is woven in "orange and buff silk" and is attached to portions of a linen tunic. It was found at Lâhûn by Sir W. M. Flinders Petrie.

47. *Op. cit.,* pp. 3-5.

48. A. F. Kendrick, *Catalogue . . . , Vol. III,* Chap. VII, pp. 71-2, citing J. Strzygowski, "Altai-Iran und Völkerwanderung," Leipzig, 1917, and "Seidenstoffe aus Aegypten," from Königlich Preussische Kunstsammlungen, Jahrbuch, XXIV, 147, Berlin, 1903. I have not been able to refer to these works.

49. See A. F. Kendrick, *Catalogue . . . , Vol. III,* Chap. II: O. Wulff and W. F. Volbach, Nos. 9635, p. 106, Plate 109; 6882, p. 106, Plate 113; 9081, p. 127, Plate 115; 9082 and 9083, p. 121, Plate 115; these are imitations of the diaper-pattern type silks: Nos. 6902, p. 109, Plate 98 (*cf.* O. von Falke, *op. cit.,* Fig. 38); 6903, p. 127, Plate 98 (*cf.* O. von Falke, *op. cit.,* Fig. 14); 17529, p. 88, Plate 101 (imitations of silk showing Oriental influences).

50. See above, p. 1, n. 8. Bankfield Museum No. 5 (Plate II-B) displays a marked similarity to V. & A. No. 583.

51. In many excavations in Egypt, great quantities of spindles and weaving-combs have been found (see, *e.g.,* H. Ranke, *op. cit.,* p. 21 for spindles, p. 25 for combs; J. Strzygowski, "Koptische Kunst," *Catalogue Général des Antiquités Égyptiennes du Musée du Caire,* Vienna, 1904, pp. 153 ff.). It would appear from the wide diffusion of these objects that weaving was carried on as a home industry, but it seems probable that the weaves done were of the simplest (plain weaves and tapestries?), possibly on an upright loom against the wall. The weavings under consideration would require more elaborate equipment. Three reeds of a type resembling the modern reed have been found (see H. Ling Roth, *op. cit.,* pp. 21-22) and it seems probable that some such equipment was available to the weavers of these woolen fabrics.