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BANKFIELD MUSEUM NOTES.

SECOND SERIES.—No. 2.

Ancient Egyptian and Greek Looms.

BY

H. LING ROTH

(KEEPER).

WITH 38 LINE BLOCK AND ONE COLLOTYPE ILLUSTRATIONS.

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[TRANSLATION].

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TO

JOHN HOYLE, Esq.,

OF

Beech Grove, Halifax,

WHOSE CONTINUED KINDLY INTEREST IN THE MUSEUM

HAS CONTRIBUTED CONSIDERABLY

TO ITS SUCCESS.

Notes from Bankfield Museum.

H. Ling Roth, *Keeper.*

Second Series, No. 2.

Ancient Egyptian and Greek Looms.

Introduction.

Halifax, which is situated in the heart of the great textile trade of Lancashire and Yorkshire, has been a home of the woollen manufacture since the earliest times, and has held its own without that help from the Flemings to which so many writers, without adequate enquiry, persist in attributing its success. It is, therefore, only meet that its museum should possess specimens of the tools used in the early days of spinning, weaving, and cloth making generally, so that all those who wish to know can learn something about the manufacture of cloth almost from its very beginning amongst generations long since passed away. With that view in mind I have during my twelve years honorary curatorship endeavoured to make a representative collection of the more or less primitive tools by means of which the industry used to be carried on. Much evidence cannot be collected locally, but we are helped to a great extent in our studies by collecting and examining the instruments of the numerous more or less unrisen races still in existence, and by studying their methods. In spite of the considerable progress made towards that end, many typical specimens are still wanting, and, while we have plenty of material for the study of weaving in various parts of the world, we are lacking in everything relating to the industry in Ancient Egypt and Greece. Failing specimens I have had recourse to illustrations, but the Egyptian ones published by Cailliaud, Rosellini, Sir J. G. Wilkinson and Lepsius contradict each other in many important points, so that those who study them find them practically useless for an understanding of the art as carried on in the Nile lands. Fortunately, last year, Mr. N. de G. Davies, the well-known Egyptologist, hearing of my difficulty, very generously placed some of his copies of tomb drawings at my disposal, and with this invaluable help I have been enabled to complete the present paper, and to lay before Halifax students some new details of manufacture bearing upon their staple industry.

I. Egyptian Looms.

HORIZONTAL LOOMS.*

IN the tomb of Chnem-hotep, at Beni Hasan, there is a wall painting of a horizontal loom with two weavers, women, squatting on either side, and at the right in the background is drawn the figure of the taskmaster. There are also figures represented in the act of spinning, etc. For the present we are concerned with the weaving only.

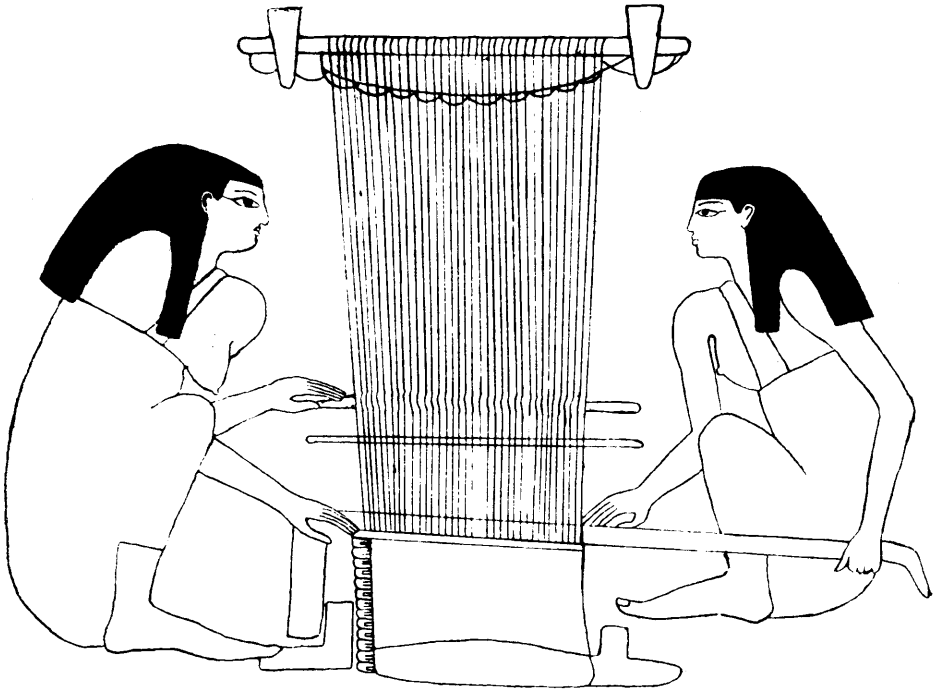
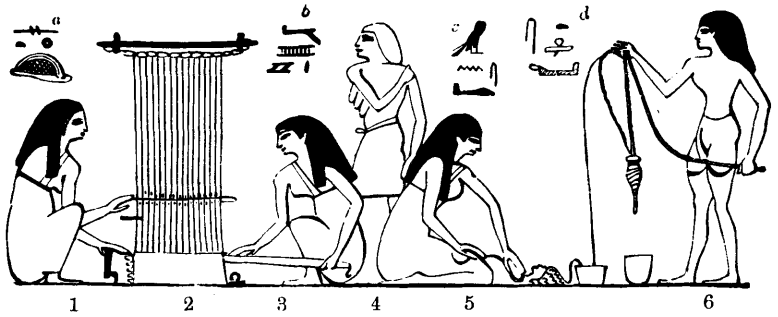


Fig. 1.—Horizontal Loom, Tomb of Chnem-hotep, from the illustration in Cailliaud's *Recherches*, etc. Same size as published.

Of this illustration, there appear to be six reproductions. We have first of all, Fig. 1, that of Fred. Cailliaud *(Recherches sur les Arts et Métiers*, etc., Paris 1831) with illustrations of drawings made by himself in the years 1819 to 1822. His publication was followed

* To the uninitiated I may explain that in a horizontal loom the plane of the warp is more or less parallel with that of the floor, while in an upright or vertical loom the plane of the warp is at right angles to that of the floor.



Figs. 1 & 3. Weaving.
Fig. 2. Loom.
,, 3. Putting in the woof, but not by a shuttle thrown with the hand.
Fig. 4. Male Overseer.
, 5. Hackling.
., 6. Twisting the double threads for the warp.
***a* Weaving.** ***b* Chief of Loom.** ***c* Facing.** ***d* Pulling out.**

Fig. 2.—Horizontal Loom, Tomb of Chnem-hotep, from Sir J. G. Wilkinson's *Manners and Customs*, London, John Murray, 1878, Vol. I, p. 317. Same size as published.

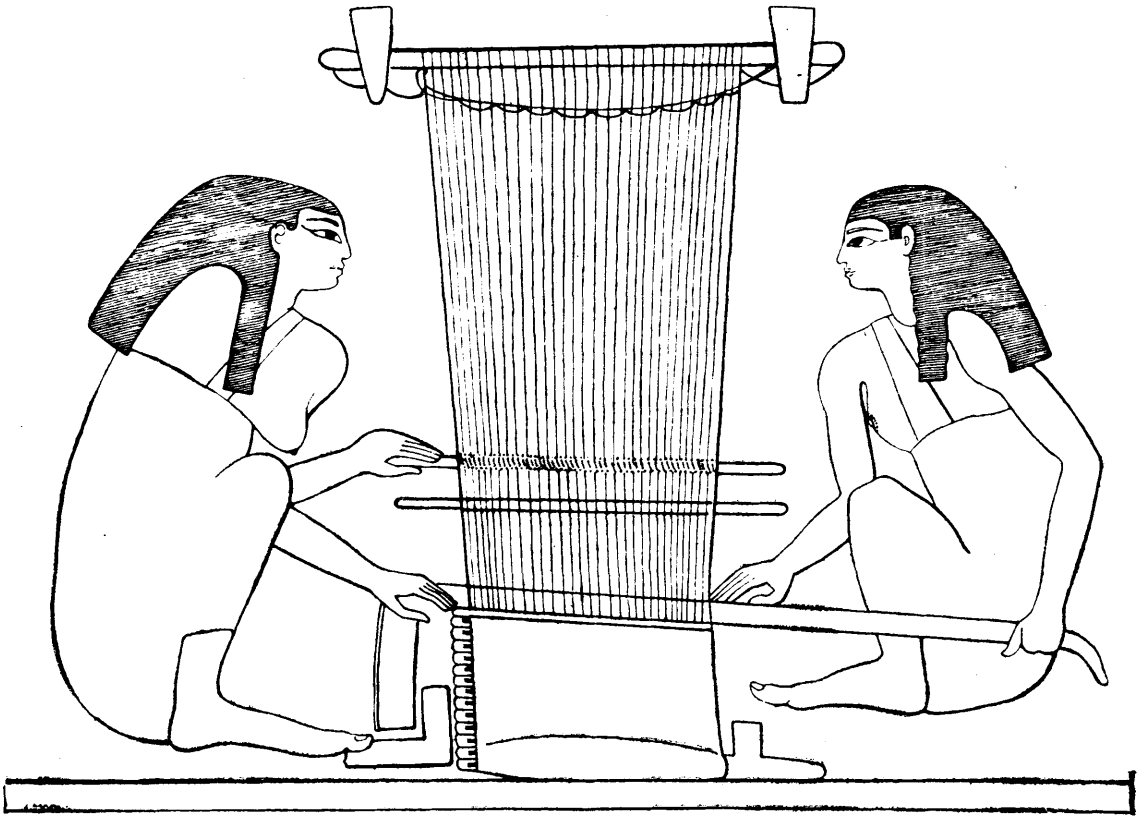


Fig. 3.—Horizontal Loom, Tomb of Chnem-hotep, from the illustration in Rosellini's *Monumenti* (Monumenti Civili), Plate XLI. Reduced one-fifth lineal of size published.

by Fig. 2, that of Sir J. G. Wilkinson (*Manners and Customs*, etc., London, 1837). Mr. John Murray, whose house has published Wilkinson's work from the first edition to the last, informs me that a few of the drawings were made by George Scharf, afterwards Sir George Scharf, Keeper of the National Portrait Gallery, but that most of them seem to have been made by Joseph Bonomi, the well known Egyptologist. Wilkinson's woodcut, although clearly and neatly done, is on a very small scale; nevertheless it admits of a fair comparison with those reproduced on a larger scale.

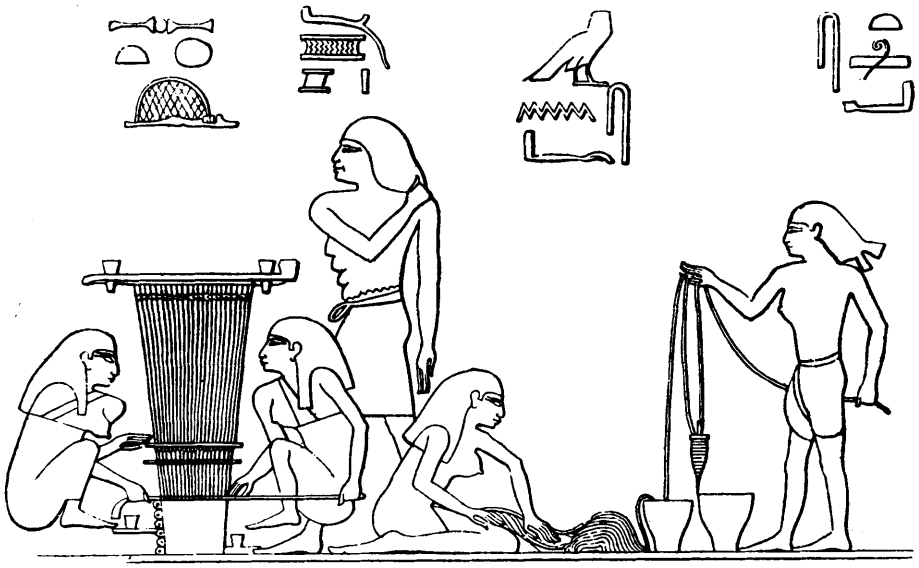


Fig. 4.—Horizontal Loom, Tomb of Chnem-hotep, from Lepsius' *Denkmäler*. Same size as published.

After him, Fig. 3, N. F. J. B. Rosellini began the publication of his great work (*I Monumenti dell' Egitto*, Pisa, 1832-1844). The similarity between the comparatively few drawings published by Cailliaud and the very large number published by Rosellini is very great. It is of course quite possible Rosellini may have made use of some of Cailliaud's drawings. Five years after Rosellini's publication came that of C. R. Lepsius (*Denkmäler*, Leipzig 1849), Fig. 4, his drawings having been made in the years 1842 to 1845. Since the time of Lepsius until quite recent years I can trace no further copying until we get the illustration, Fig. 5, in Prof. Percy Newberry's *Beni Hasan*, London 1910. In this work the reproduction is about one twentieth of the original, or

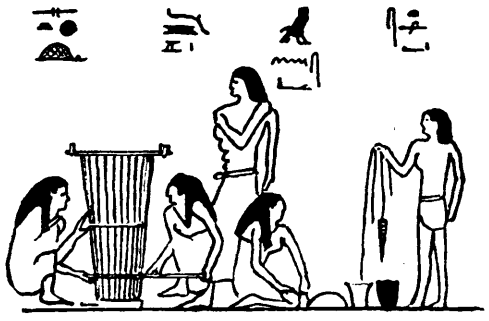


Fig. 5.—Horizontal Loom, Tomb of Chnem-hotep, from Prof. Percy Newberry's *Beni Hasan*, I. Plate 29. Same size as published.

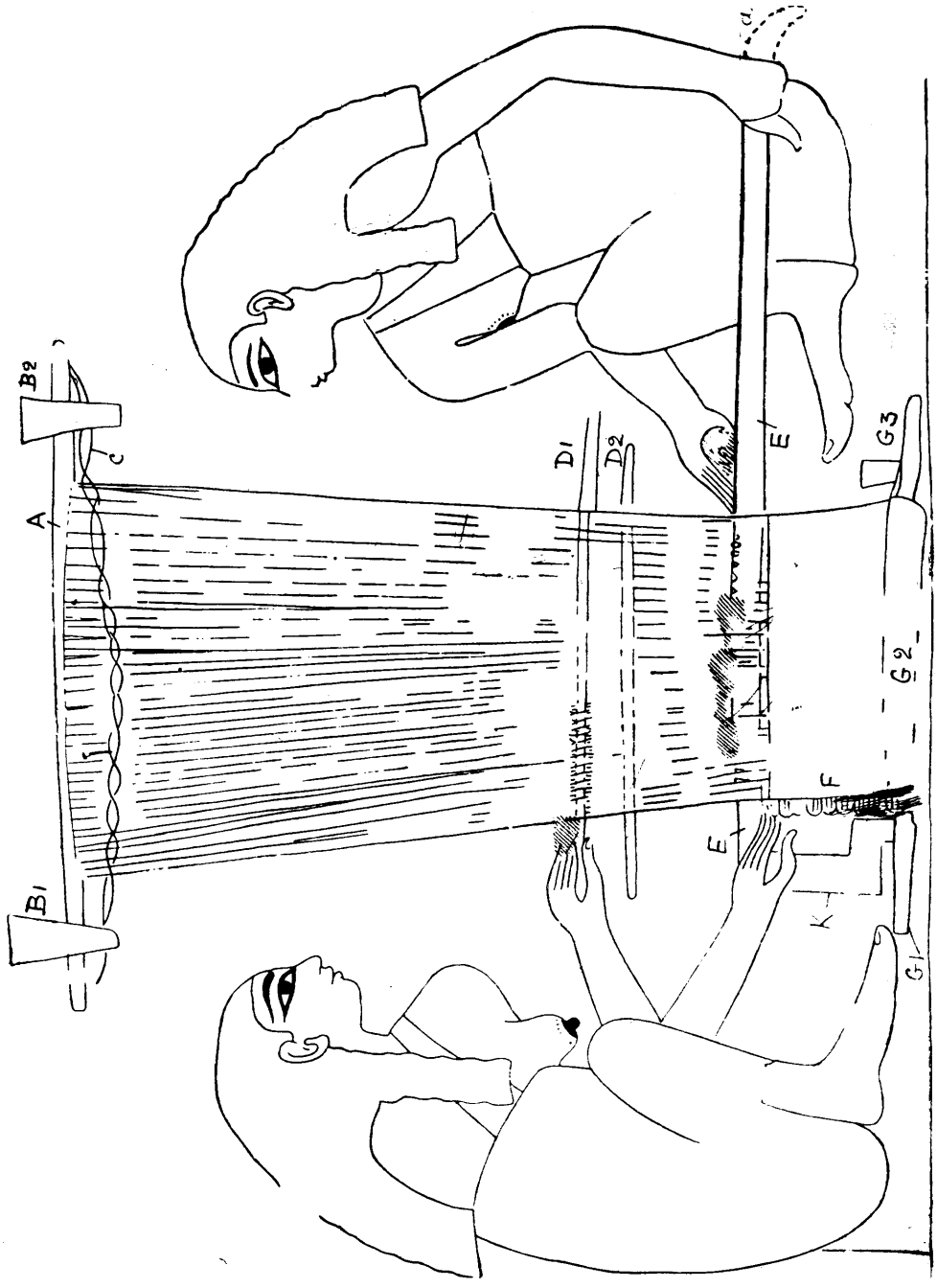


Fig. 6.—Horizontal Loom, Tomb of Chnem-hotep. Size of original: Height of the figures 9¼" = 24·4 cm. Drawn by Mr. N. de G. Davies, and now published for the first time by permission of Mr. F. Ll. Griffith.

about three fifths of the size of that of Wilkinson, and unfortunately so crude as not to be available for our present purpose.* Lastly we have the reproduction, Fig. 6, from Mr. N. de Garis Davies' drawing made in 1903, and now first published by kind permission of Mr. F. Ll. Griffith.

In the various reproductions by the above explorers, the only three which agree very closely are those of Cailliaud, Rosellini and Davies. The others vary considerably and in essentials do not agree with the above nor with one another. The differences may in the first instance be due to difficulties in copying the original in the tomb. Others may be due to ignorance of detail on the part of the secondary copyist—the man who prepared them for publication—so that he was unable to follow up the clues on the drawings laid before him. The differences may also be due to careless copying and to "touching up" of the copies when made; they may be slightly due to deterioration and obliteration of the original in the course of time.

The *Encyclopædia Biblica* gives a variant from all six illustrations, but approaching nearest to that of Cailliaud, Rosellini and Davies. It is misleading in so far that the drawing has been made to suit Professor Kennedy's idea as to what it should be.

Some of the differences are of minor importance, but a comparison will help materially to our understanding of the method of weaving adopted by the Egyptians from the XIIth to the XIXth Dynasties, or about B.C. 2000 to 1200. To go into details, and taking Mr. N. de G. Davies' illustration as our basis, we find slight differences in the shape of the pegs B, B1, which are immaterial. A more pronounced difference is seen in the way in which the threads are attached to the warp beam A. Neither Wilkinson nor Lepsius carry these threads over the beam, the former carrying them only as far as the laze threads C, while the latter carries them up to a line drawn parallel to and below the beam; Cailliaud and Rosellini carry them over the beam while Mr. Davies carries them half way only. The object of this half carrying over is not clear. The threads in chain-form at C are probably laze threads, apparently placed there so that in case of any disarrangement of the warp threads the weaver can from that point run her fingers along them and get them disentangled. It has been suggested to me that this chain-form might be a tension chain for taking up slack warp, but the former explanation seems the more likely.

All the drawings but Wilkinson's show the warp threads converging towards the breast beam; Wilkinson shows them parallel and in Lepsius their convergence is excessive. There should be a slight convergence shown, as in the course of weaving the threads get drawn in, and in later forms of looms in semi-civilised countries we find an

* To avoid indistinctness through over reduction, I have endeavoured to keep all reproductions in this paper as large as possible, and think I have succeeded in not losing any detail in the necessary reduction.

endeavour to counteract this tendency by the use of a tool known as a "temple."

The cross sticks D1, D2, look like laze rods. It may not be out of place here to point out that in primitive weaving laze rods serve two purposes, or one more than in the later somewhat more advanced looms. They serve throughout to keep the warp threads in place, and they serve to separate the odd threads from the even (1, 3, 5, 7 from 2, 4, 6, 8, &c.), and in so doing take the place of the fingers in making the "shed," *i.e.*, the opening through which the "weft (or woof)" is passed, a function which in turn is usurped by the "heald (or heddle)." The heddle therefore becomes a very important factor, and Dr. H. G. Harrison by no means overstates the case when he says that the development of the heddle is the most important step in the evolution of the loom (Horniman Museum Handbooks, No. 10, pp. 47-49). We may now return to the drawing. Wilkinson shows the rod D1 indistinctly and the left hand end only of D2. Lepsius' artist seems to have taken a liberty with D1 but in the right direction, by making it more definitely into an early form of heddle—the loop and rod—but he shows D2 the same as Cailliaud and Rosellini. Prof. Kennedy argues that these rods are in the wrong position and that D1 which is a heddle should be in the place of D2. Mr. Davies' drawing as well as those of Calliaud and Rosellini show that D1 is a heddle while D2 is shown to be a laze rod. Asiatic primitive looms, like those from Borneo and Bhutan, have two laze rods but no heddle; on the other hand many primitive African looms have one laze rod and one heddle as is the case with this Egyptian loom. More threads are shown on the left hand end of D2 than on the right hand end. Mr. Davies informs me that the same quantity should be shown from end to end across the warp, but on the right hand side they are so indistinct that he was just able to detect but not to trace them and so he omitted them.

We now come to the rod E. Cailliaud and Rosellini show an undulation at the one end *a*, but do not make the other end clear. Wilkinson shows a small hook at the end *a*, which appears to me to be a transcriber's development of the curved end of his two predecessors; in the text Wilkinson says there is a hook at each end of this stick, but he does not show any at the end opposite to *a*; he refers to these hooks more than once (1st ed., III., p. 126 footnote). Lepsius has altered the shape of the curve and transferred it from the end *a* to the opposite end. In Mr. de G. Davies' drawing, it has been inserted in dotted lines, as the original is in such a state that tracing is almost impossible. Wilkinson, Erman, v. Cohausen *(Das Spinnen u. Weben bei den Alten*, in *Ann. Ver. Nassau. Altherthumsk)*, Wiesbaden, 1879, p. 29), and others call it a shuttle, but I am more inclined to consider it a slashing stick ("sword" or "beater-in") for pushing the weft into position. A tool which appears to be a beater-in and of similar end shape is seen held in the hand of a woman on a wall

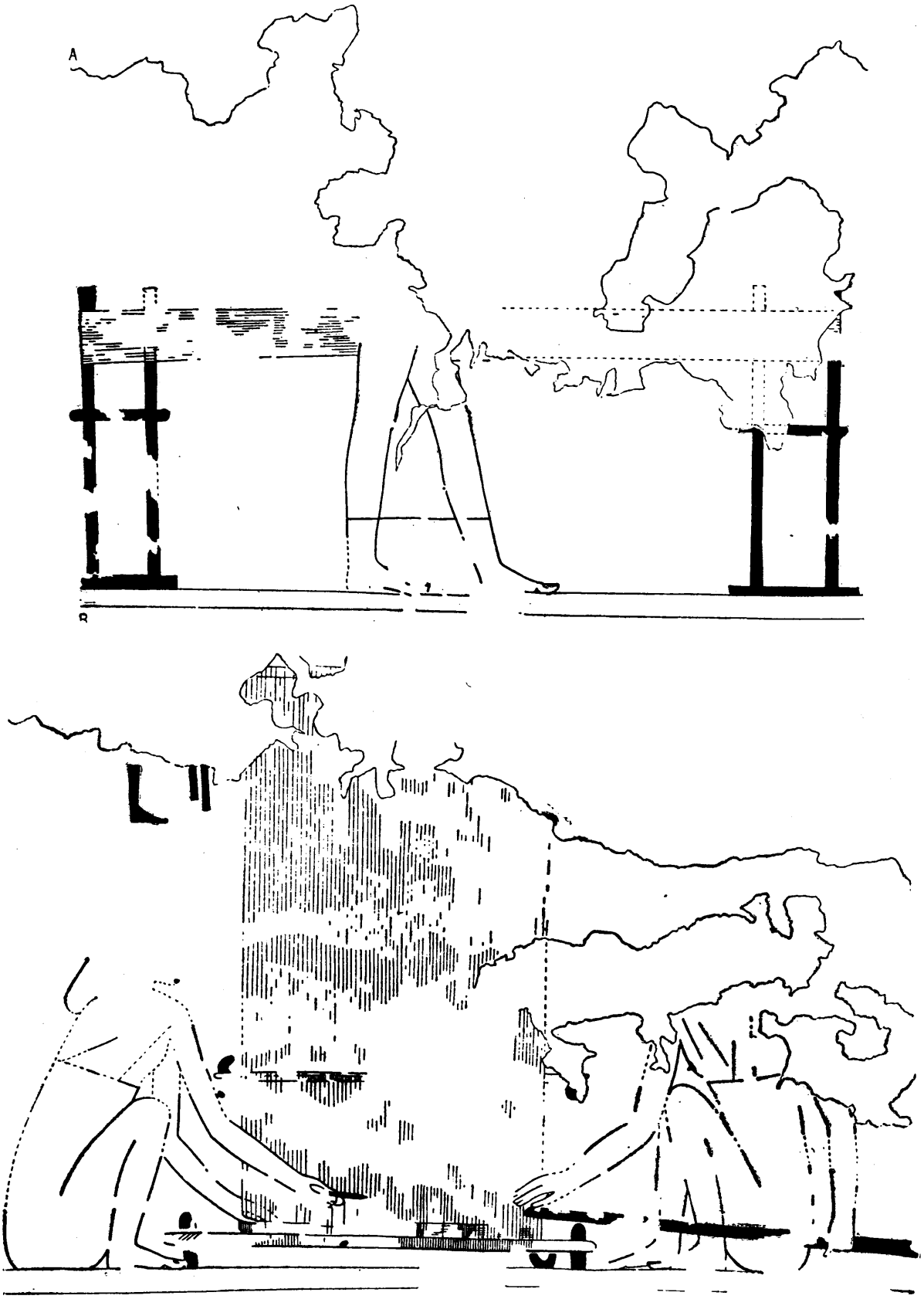


Fig. 7.—Tomb of the Vizier Daga. Date about end XI Dynasty, B.C. 2000. Mr. N. de G. Davies's *Five Theban Tombs*, Plate XXXVII.

The upper illustration indicates a woman warping or beaming, probably warping.

In the lower illustration note the left hand figure holding the spool in her hand. At first sight this small black line looks like a continuation of the "beater-in" in the hands of the other weaver, but Mr. Davies informs me that it is quite a distinct article, and that there can be no doubt about it. Just above the breast beam there are 8 or 9 threads of weft but they are too faint to be included.

painting at El Bersheh—see Fig. 11, top right-hand corner. We have in another illustration, Fig. 7, an article which appears to be a spool, which I think confirms the view that E is not the shuttle but the beater-in. In all the illustrations, too, the pose of the hands of the women bearing on this stick is indicative of a downward pressure and not of a grasp.

The selvedge F on the one side of the cloth and not on both sides is also interesting from the fact that selvedges do not appear on the Egyptian cloths until the XVIII Dynasty circa B.C. 1600.

The breast beam :—It appears to me that the three portions marked G1, G2 and G3 joined up are intended to represent the breast beam and its holding pegs, similar to the warp beam A and its pegs B1, B2, but the portion K is not clearly drawn in any of the reproductions. Wilkinson omits this altogether, but in its place has two black pieces which also are still less clear. Lepsius has omitted G2 altogether and appears to have made G1 and K and G3 into treadles, by raising G1 above the level of G3, and to support the view that these are treadles, he makes use of the overseer's foot by placing it on the supposed treadle, and the casual observer thinks it is the foot of the woman weaver. However, Mr. Davies' copy seems to offer a solution. He agrees with Cailliaud and Rosellini in so far as G1, G2 and G3 are concerned. With him K takes quite a different form, in fact it looks very similar to an article which an attendant woman in another panel has close by her, see Fig. 8. It might perhaps be a rest to prevent the beater-in being driven home too forcibly—this, however, is still only a surmise—as the length of the beater-in makes it heavy at the far end.

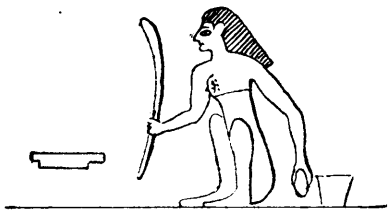


Fig. 8.—Weaver with the support K, Fig. 6; the woman appears to hold a beater-in in the right hand and a ball of thread in the left hand. Rosellini

In Cailliaud the warp threads are coloured in pale blue and red on top of the black lines of the drawing ; he has painted the selvedge and finished cloth a pale blue, as well as that portion of G2 which is covered by the cloth indicating that this is the breast beam, G3 and G1 are painted a dark red. Rosellini colours A, B1, B2, D1, D2, G3 orange ; G1 and K dark red, but E from end to end light ochre. This shows that K is distinct from E.

In consequence of this loom being represented as upright it is often spoken of as an upright or vertical loom. But it is drawn upright because the Egyptian artist did not understand perspective, and it was only by making the loom upright that he was enabled to show the details we have just been examining. For the same reason mat making is illustrated edgeways. If the loom were an upright one the two women weavers would have had their backs turned towards the

onlooker as can be seen in Fig. 9. Any doubt on the matter has however been set aside by Prof. John Garstang's extremely interesting discovery of a wooden model depicting a group of women spinning and weaving which he illustrates in his work, *The Burial Customs of Ancient Egypt*, London, 1907. After referring to the woman spinning, he continues: "The other seated figures apparently represent women at work upon a horizontal loom; the frame and the woof [*sic*, should be *warp*] threads are faintly represented upon the board. It is possible that they are making mats or, perhaps, weaving (p. 132)" He gives an illustration of the group taken from a photograph, but as it does not show the lines which indicate the loom lying horizontally on the ground nor the warp threads, I have asked him to let me have a drawing made of it and, with his kind permission, it is now reproduced here, Fig. 10. The threads of the warp and the finished piece of cloth at the breast beam end are clearly indicated. The whole model supports conclusively the well founded supposition that the loom we have been considering is a *horizontal* one. Curiously enough, Prof. Garstang does not appear to appreciate the important bearing of his discovery, for on a later page (p. 134) in speaking of Lepsius' illustration, discussed above, he says: "the weavers are seen at work at an upright loom."

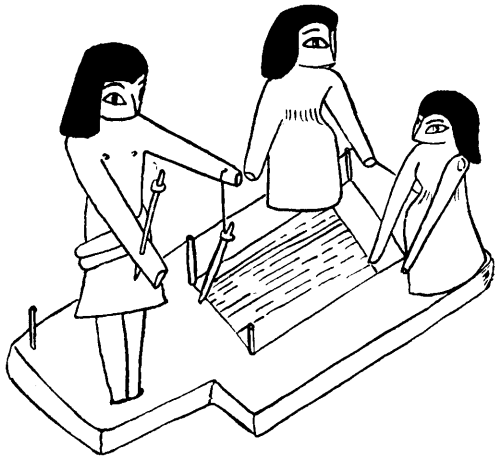


Fig. 10.—Horizontal Loom. Outline sketch by Miss Davey of the original model of a group of one woman spinning and two women weaving, found by Dr. John Garstang at Beni Hasan. The model is in the Museum of the Liverpool Institute of Archæology.

It must not be thought that the Beni Hasan representation is the only one which illustrates a horizontal loom. A second one is reproduced by Prof. Percy Newberry from the tomb of Tehuti-hotep circa 1938-1849 B.C., see Fig 11. In the upper portion the women are seen spinning and preparing the thread generally, while in the lower portion two women on the left are warping, and in the centre three apparently are "beaming," *i.e.* putting the warp on to the beams preparatory to commencing to weave, the warp threads being apparently drawn over pegs to ensure the proper tension. This illustration shows the warp flat against the wall like the mat making shown at Beni Hasan.

A third representation of a horizontal loom is reproduced from the forthcoming volume of the Egypt Exploration Fund by kind permission of Mr. N. de G. Davies, who made the copy. In this,

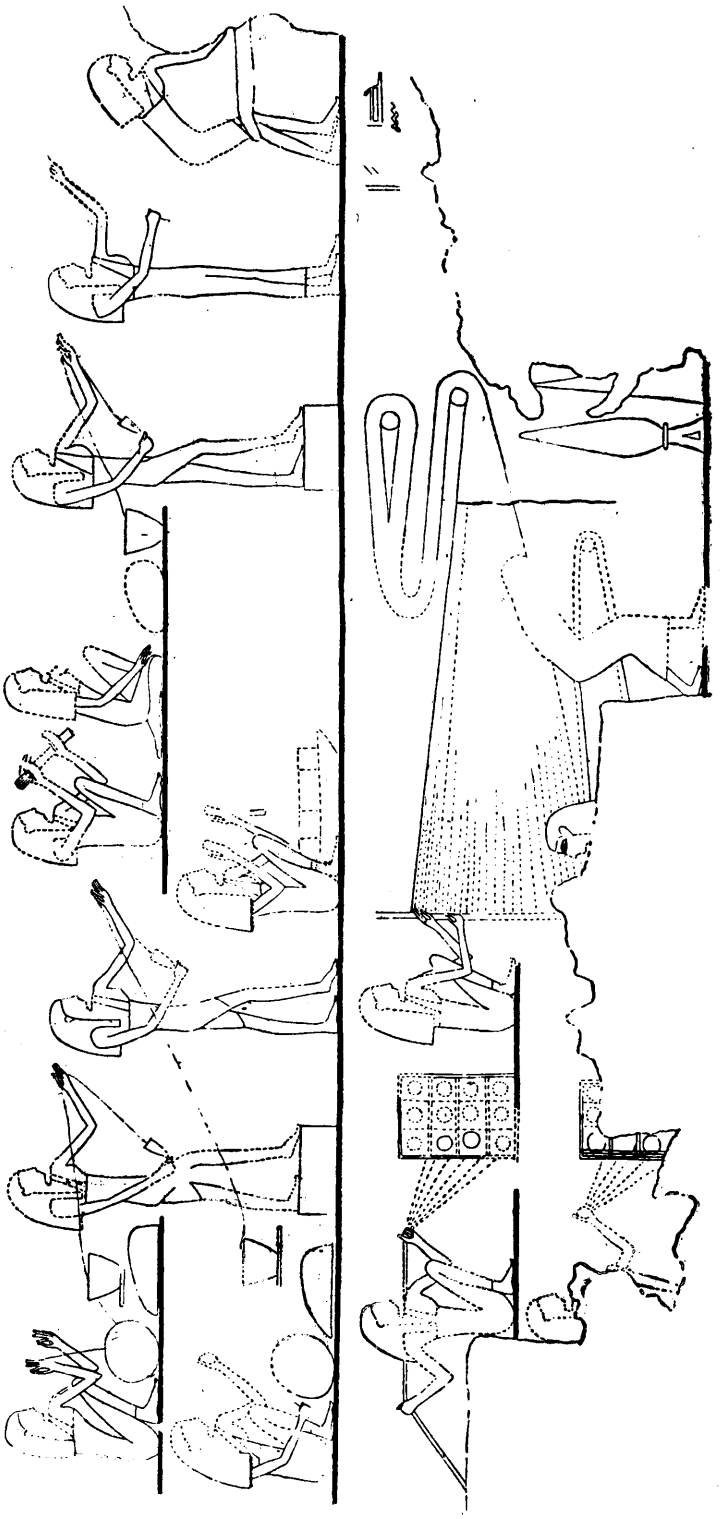


Fig. 11.—Tomb of Tehuti-hetep. Date about 1939—1849 B.C. From Professor Percy Newberry's *El Bersheh* I. Pl. 26.
Note the woman on the top right hand corner holding a "beater-in."

Fig. 7, already referred to, the lower portion is all that has come down to us. The cloth is not shown contracted as in the Beni Hasan representation, the two laze rods are drawn close to each other and here also an attempt appears to have been made to show the over and under lapping warp threads; the laze rods appear each with a hook, the hook on the upper rod turned upwards and the hook (if it be one) on the lower rod turned downwards. It is possible these hooks may be pegs to prevent the shifting of the laze rods. It may be that one of the two rods is a heddle rod the indication being the fine double lines, but this may not be compatible with the hook at the end of the rod. The weaver on the left holds a spool in her hand, evidently a piece of stick with the weft thread wound round it, which she is pushing through with her fingers. The weaver on the right holds a beater-in as shown in the Beni Hasan drawing. The breast beam is held in position by two pegs near the right one of which there is a curved article of indeterminate use.

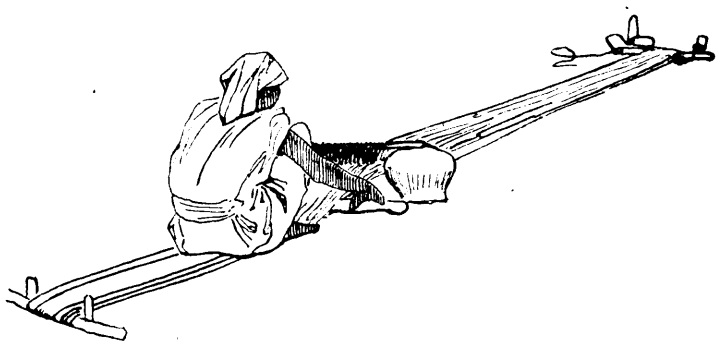


Fig. 12.—Study of a Bedawin Arab weaving, from a sketch taken in the Forties of last Century, by Frank Goodall, R.A. The original sketch is in Bankfield Museum. The weaver appears to be provided with one heddle and a beater-in.

There is no very clear evidence as to how the finished cloth was "taken up" unless we accept it that the bulging out of the part G. 2 means that it was wound round the breast beam as is done on hand and power looms of the present day. Some very long pieces of cloth have come down to us and unless they were "taken up" in this way a long stretch of ground would have been necessary. A modified form of this horizontal loom has been met with in recent years among the Bedawin Arabs, as shown in the illustration of a study sketch, Fig. 12, made by Frank Goodall, R.A., in the forties of last century. The loom was provided with pegs like the old Egyptian loom but it was supplied with a primitive heddle resting on a stone at each side of the warp and it would appear that the weaver, to a certain extent, did not take up the woven cloth by winding it round the breast beam and by that means retaining his position, but, as the weaving progressed and the line of finished cloth got beyond his reach, he crept up to it and so got farther and farther away from the breast beam until

in the end he arrived at the warp beam. Similar looms are still used for mat making by the Egyptian fellah.

VERTICAL LOOMS.

Apart from the horizontal loom Wilkinson and Robert Hay* also recorded the existence of an illustration of an upright loom, said in error to be at Eileithyias (ElKab). Wilkinson's copy, Fig 13, is more elaborate than that of Hay. Mr. Davies informs me that the original is not at Eileithyias, but in the tomb of Nefer-hotep at Thebes. Wilkinson in regard to this illustration quotes the oft-repeated statement of Herodotus (*circa* 460-455 B.C.) in reference to looms in general:—"Other nations make cloth by pushing the

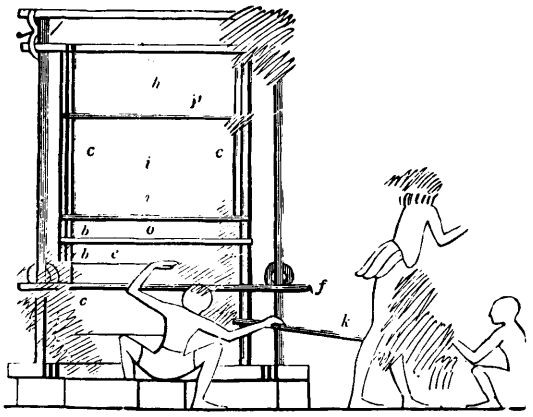


Fig. 13.—Upright or vertical loom. Wilkinson's *Ancient Egyptians*, London, John Murray. 1st ed., Vol. III., p. 135.

woof upwards, the Egyptians on the contrary, press it down." On this statement Wilkinson remarks: "This is confirmed by the paintings which represent the process of making cloth; but at Thebes, a man who is engaged in making a piece of cloth with a coloured border or selvedge, appears to push the woof upwards, the cloth being fixed above him, to the upper part of the frame" [Fig. 13]. But I am unable to follow Wilkinson in this, for I can find no indication in his illustration which shows how the beating-in of the weft is accomplished. From the illustration all one can say is that it might have been done either way. Wilkinson's illustration is lettered from *a* to *p* but this lettering is not explained by him at all, excepting in the case of the letter *k*, of which he says: "*k* is a shuttle, not thrown, but put in with the hand. It had a hook at the

* Hay's drawings are not published but can be seen in the Brit. Mus., Add. MSS. No. 29823, Fol. 32.

end....." and he proceeds to refer to the drawing elsewhere of the horizontal loom. He does not show the hooks in his illustration. In Fig. 14, I give the sketch made by Mr. N. de G. Davies of the remains of the original from which Wilkinson made his illustration.

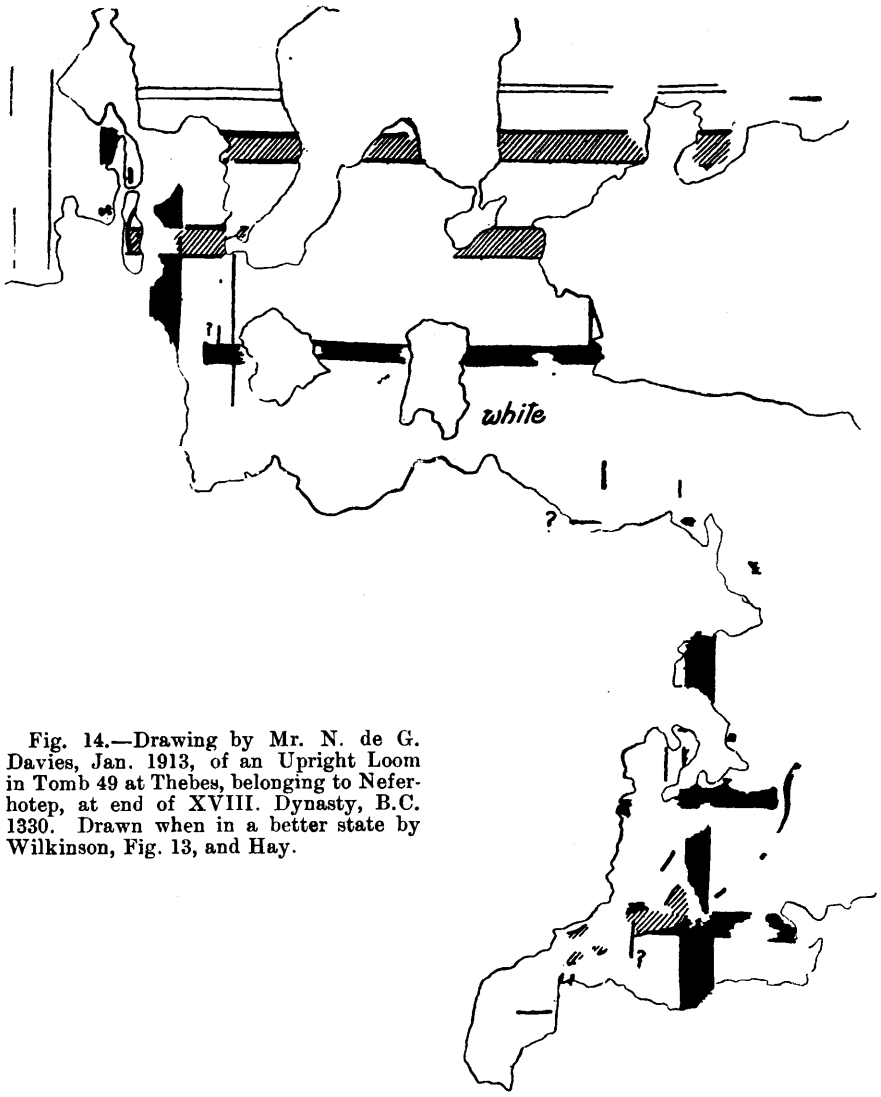


Fig. 14.—Drawing by Mr. N. de G. Davies, Jan. 1913, of an Upright Loom in Tomb 49 at Thebes, belonging to Neferhotep, at end of XVIII. Dynasty, B.C. 1330. Drawn when in a better state by Wilkinson, Fig. 13, and Hay.

A more satisfactory drawing of upright looms is that which Mr. N. de G. Davies has placed at my disposal for reproduction here. I append his description, Fig. 9. "The picture of men working at two looms is taken from the tomb of Thot-nefer at Thebes, who was a

royal scribe in the middle of the 18th Dynasty, *circa* 1425 B.C. In his tomb his house is shown. He himself sits in the hall, while inside some servants spin and weave, make bread, store the grain, etc. The roof of the chambers is supported on pillars, and between two of these the looms are set up which are here depicted. They are not attached however, either to the roof or the pillars. Faint sketching lines are mixed up with the darker reds in which the picture was re-drawn, and the whole very simply and carelessly executed. I have found it difficult to make it clear. In my sketch the first faint sketching outlines appear as lines. The more solid red lines which replaced these I have 'hatched,' and certain portions including the men's flesh colour, the stools, the discs I have put in solid black, partly because they are for the most part more solid and dark red in the original, and partly to distinguish the portions more clearly from one another. The horizontal lines which cross the web are very faintly drawn and almost as good as obliterated by the white paint which had been put on the web. I have put them in just to show that the bars were *conceived* of as passing behind or under the web and concealed by it.

"The larger loom is worked by two men, the smaller by one man only. The looms consist of an oblong frame A set up on two stones B. The warp is attached to the warp beam C on top and the breast beam D at the bottom. The threads of the warp are not shown, no difference being made between any woven part and the warp threads; to all is given one smear of white paint. Two discs E are seen hanging against the frame posts, one on each side, the earlier sketch showing a larger disc than the final drawing in dark red.

"Two slender laze rods F are shown on the large loom and heavy bars G, H, lower down; a somewhat similar laze rod and beams are also shown on the smaller loom.

"The weavers sit on benches with their backs to the spectator. The artist has not dared to draw a back view of their heads, but has turned each man's head to the right to show a profile. They are holding a heavy looking rod which looks like a 'beater-in.' One would expect to see a shuttle but perhaps this was too small an object for so rough a picture—perhaps the man at the smaller loom holds an exaggerated shuttle L in his right hand.

"The lines M seen alongside the framework are the faint red sketch lines *not* cords. The diagonal line N on the left I do not understand, it does not seem an accidental one.

"On the left hand of the two looms the original shows a man spinning coarse thread into finer (?) using two spindles at once; the threads pass through rings fixed in the ceiling as in a picture at Beni Hasan. Behind him two girls are breaking up the flax and two others are making coarse threads of the fibres, almost exactly like those in the tomb of Daga (No. 103) a couple of hundred yards away."

To this description of Mr. Davies I would like to add a word about the discs E. Wilkinson indicates these as rings apparently joining the horizontal beam to the post of the frame, the form of the ring being arrived at as explained by Mr. Davies by the original outline of the sketch having been made larger than the final drawing of the circle, or disc, and not obliterated. In Mr. Davies' drawing these discs hang on or are fixed on to the uprights only, and I am inclined to think they represent balls of weft thread hanging up in the same way as we see whole rows of coloured balls hanging on the looms of Persian rugmakers, and as can be seen on an Indian rug loom in Bankfield Museum.

It is also very clear that these Egyptian vertical looms are very different from the Greek looms in so far as we know anything about them. The Greek looms had an upper beam only and the warp threads were bunched at the lower end and weighted with metal or clay balls to keep them taut, Fig. 15. The *individual* warp threads were not weighted; they were bunched and then weighted. The pyramidal shaped clay warp weights found in Egypt are I understand considered by Egyptologists to belong to the Roman period, but in the Manchester University Museum there is a mud article which Miss M. A. Murray describes as a warp weight, Fig. 17, so that it is possible vertical looms with warp weights may yet be forthcoming as an Egyptian and not a foreign industrial tool. But Dr. H. R. Hall informs me this weight was probably found in the ruins of houses where Ægean pottery was found and hence it is probably a temporary warp weight of those people and not an Egyptian article.

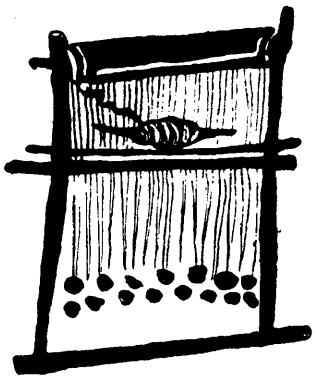


Fig. 15.—Greek loom with spool and warp weights. Illustration on a skyphos (van Branteghem vase in the Ashmolean Museum, Oxford). From H. B. Walter's paper on *Odysseus & Kirke* on a Boeotian vase, Jour. Hellenic Studies, 1892-3 XIII. p. 81.

Since writing the above Mr. N. de G. Davies has very kindly sent me on a new set of illustrations, Fig. 16, of which he says; "My attention was called to the scene by Dr. Alan Gardiner. The scenes which represent the preparation of the flax and the stretching of the warp are almost replicas of those in the tomb of Daga of the Middle Kingdom, so far as we can judge, while the pictures of the looms resemble closely those in the tombs of Thot-nefer and Nefer-hotep. The work is done by both men and women. Men prepare the flax while women stretch the warp. Men mostly work the loom, either singly or with a companion. But in one case a woman is seen at work at one of the upright looms. She is shewn sitting sideways on the low bench and is not pictured in a back view with widely spread legs like the men. Unfortunately the work is so slovenly and so much injured that few exact outlines

can be secured, and hence all detail is insecure. There are also superfluous lines in red colour which confuse the picture. The tomb is Ramesside in date (*circa* 1200 B.C.) The inscription over the seated man is too broken to be read."

The drawings appear to confirm generally what we have gathered from Mr. Davies' previous illustration, Fig. 9.

PORTIONS OF LOOMS WHICH HAVE COME DOWN TO US.

In so far as I know, not many loom parts have yet been discovered, and those which I have had an opportunity of studying do not assist us to much knowledge beyond that which we have gained by a study of the wall paintings. We have the article from Kahun already mentioned, which may possibly be a warp weight, as it somewhat resembles the later warp weights found elsewhere. It is of hardened mud with a perforation at the thin end through which a piece of string has been passed and knotted (Fig. 17), but so far no illustration of a loom with weights has been found, either for the period to which this article belongs or to any other period. On the other hand the material is not suitable for a netsinker, nor is it intended to be made to stand up. As mentioned above it is probably Ægean.

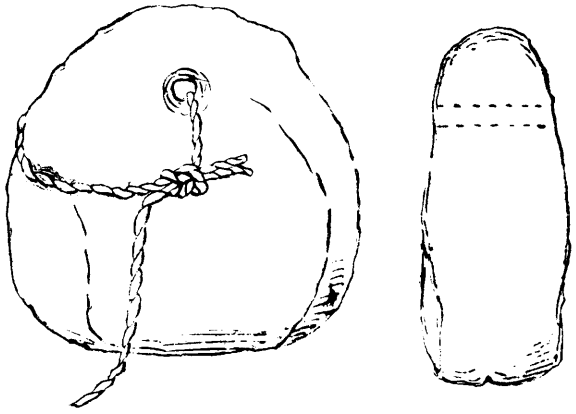


Fig. 17.—Piece of perforated hardened mud. Possibly a warp weight, 10cm × 8·7 × 4·2 (3$\frac{15}{16}$in. × 2$\frac{7}{16}$in × 1$\frac{5}{8}$in.) Weight 470 gramms (1lb. $\frac{1}{2}$oz.) Probably of Ægean origin. *Kahun.* Manchester Museum.

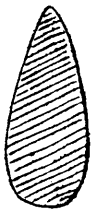
Fig. 18.—Burnt-clay warp weight. Height 11·4cm (4$\frac{1}{2}$in.) Weight 260 gramms (9$\frac{1}{4}$oz.) Probably Roman. Bankfield Museum. (Received from Prof. Flinders Petrie).

Another form of warp weight, of burnt clay, is somewhat frequently met with, Fig. 18, but it is described as appertaining to Roman times, and may therefore be either a Greek or Roman article. Similar weights from Cyprus and North Africa, &c., can be seen in the British Museum.

Wooden pegs have been found at Gurob, which may possibly have been used for holding the warp and breast beams in position, Fig. 19. These pegs may appear to be rather short for the purpose, but in very primitive looms the warp is not kept so taut as might and should be, and hence there is not the same heavy strain on the pegs as we should deem necessary. The way to settle their use would be to fix them in solid ground and test them.

Fig. 19.—Wooden Peg, possibly used for holding the warp and breast beams. Length 13·5 to 10·2cm (5⅓in. to 4in.) *Gurob* XVIII—XIX Dyn. (about 1580-1205 B.C.) Manchester Museum.

Fig. 20.—Long straight lath with notches at each end, probably a laze rod. Length 1 m 24 (4ft. 1⅜in.) Breadth 5·2cm (2in.) Thickness 2·2cm (⅞in.) *Kahun.* Manchester Museum.



½ size section of Fig. 20.

½ size section of Fig. 21.

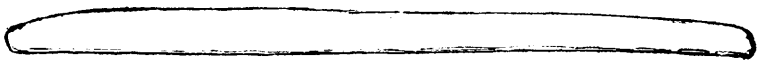


Fig. 21.—Long curved lath Probably a "beater-in." Length 1 m 20 (3ft. 11¼in.) Breadth 6·5cm (1$\frac{11}{32}$cm). Thickness 1cm (⅜in.) *Kahun.* XII Dynasty about 2000-1788 B.C. Manchester Museum.

At Kahun a long straight lath, Fig. 20, was found which is probably a laze rod, the notches being apparently for a nooze to slip into and so prevent the rod working towards the weaver which it has a tendency to do.

Another long but curved lath, Fig. 21, also found at Kahun is probably a beater-in.

Most large Egyptian collections contain one or more specimens of wooden combs, which are generally called weavers combs, and ascribed to Roman times. But one at least, Fig. 22, has been found with XVIIIth to XIXth Dynasty articles at Gurob, that is belonging to the period 1580-1150 B.C., which is long before Rome existed. None of these so-called combs, for they are really embryo reeds, are shown on the wall illustrations so that they no doubt belong to a later date than that of the XIIth Dynasty. If, as I take it, these "combs" are the forerunners of the reed and were used to drive the weft threads

home, and if also the Romans had upright looms provided with warp weights instead of the breast beam, then I think the "comb" may not be Roman but may be a late Egyptian invention. For, on trying to use such a comb on a *replica* of a Scandinavian upright loom provided with warp weights (instead of with the breast beam) I can get no good result, in fact rather the opposite, but tried on a primitive horizontal loom provided with a breast beam the comb is found to be of some

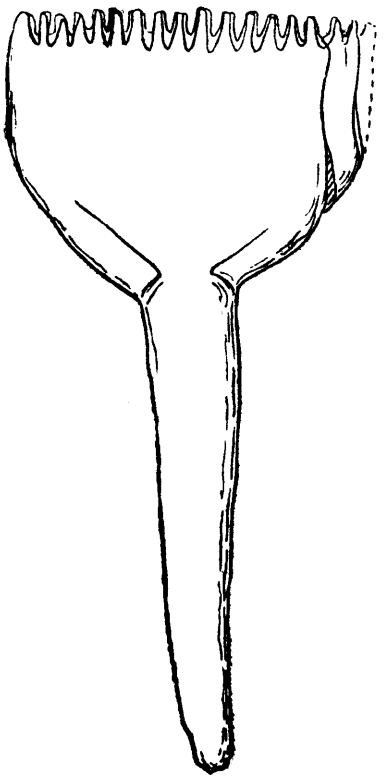


Fig. 22.—Weaver's Comb—a Beater-in. 19·5cm × 9·8 × 4·2 (7¾in. × 3⅞in. × 1⅝in.) *Gurob*. Manchester Museum.

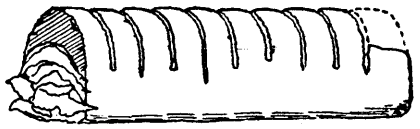


Fig. 23.—Possibly a warp spacer, somewhat similar in object to the raddle of modern hand loom weaving. Height 2.8cm. Width 2·5cm (1⅛in. × 1in.) The slots are 6mm. (¼in.) apart, 3mm. (1/16in.) wide, and about 10mm. (⅜in.) deep. From *Gurob* but probably Roman. Bankfield Museum, (Received from Prof Flinders Petrie).

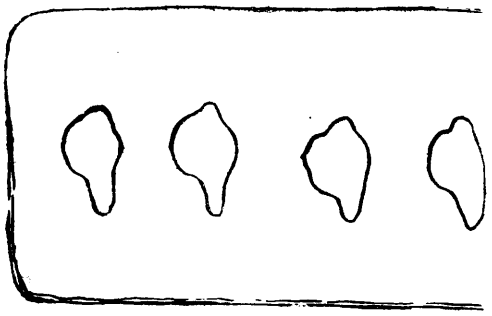
assistance, especially if the warp is not very taut as is generally the case with primitive looms. At Bankfield we have an Indian rug loom, already referred to, with warp and breast beam on which a somewhat similar instrument, but of iron, was used.*

An article which Prof. Flinders Petrie describes as a "warp spacer" is shown in Fig. 23. From fragments in the Egyptian Collection,

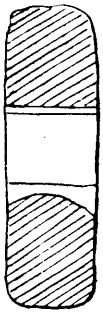
*Olafsson, to be referred to later on, remarks that while in Ovid's time the *spathe* was used for beating-in the weft, in Seneca's time the weft was beaten in by a toothed instrument. In other words a weaver's comb—the embryo reed—had been introduced.

University College, London, it would appear to have been originally more than a meter (three feet) long. It may have been used as a sort of a "raddle," a tool used for assisting to keep the warp threads in position when being beamed, *i.e.* put on to the loom. At Bankfield we have an old local hand loom the warp beam of which is provided with a series of holes in which pegs were once inserted to keep the coloured warp threads in position.

Fig. 24.



½ size of end of Fig. 24.



½ size section of Fig. 24.

A long piece of perforated wood described by Prof. Flinders Petrie, *Kahun*, p. 29, as a Weaver's Beam for making rush mats. Length 96·8 cm. × 8·0 × 3·0 (3ft. 1¼in. × 3¼in. × 1$\frac{3}{16}$in.) From Manchester Museum

A piece of frame, Fig. 24, has been described as a "weaver's beam" for making rush mats like the modern *hasira*. It is provided with 28 holes which are arranged about 27 to 40 mm. apart. The holes may have been more or less circular originally, and worn into present shape by threads, etc., and look more irregular inside than they really are, as the inside surface of the holes is fairly smooth; the holes are slightly larger, on an average about 4 mm., on the face shown than on the other face. Prof. Flinders Petrie seems to think it resembles the frame on which the modern Egyptian mat is made.

We now come to the two reeds in the Museum of the Liverpool Institute of Archæology, which Dr. John Garstang discovered near Abu Kirkas, tomb No. 693, of which he tells us: "They are 27 and 29 inches (68·6 and 73·7 cm.) in length respectively, and are precisely similar in general form. They are constructed on a system of nineteen or twenty reeds to the inch, and they may be seen to be exactly similar to the modern reed taken from a loom in the village of Abu Kirkas. It is not possible, unfortunately, to assign a precise date to these objects. They were found in a tomb which contained no other remains; this tomb was surrounded by others, all of them like-

wise very much disturbed, but equally characteristic of the general nature of the Middle Empire tombs, and containing nothing but Middle Empire objects. Since, in general, few tombs of this site show signs of intrusive burial of a later age, there is no reason to suppose that these objects are of any date later than the XII. Dynasty *(The Burial Customs of Ancient Egypt*, London, 1907, pp. 134-136)."

The horizontal looms we have been describing belong to this period, and the artists have not shown any reeds with them. My studies of primitive looms lead me to think that these Egyptian looms are of a date far anterior to the invention or the application of a reed. It has also, I believe, been remarked by those who have examined cloths of this date, that the irregular array of the warp threads is good proof that reeds could not have been in use. I have already pointed out that in the evolution of the loom the reed puts in a late appearance, but apart from this fact, I do not think the artist would have omitted such an important tool had it been in use in his time.

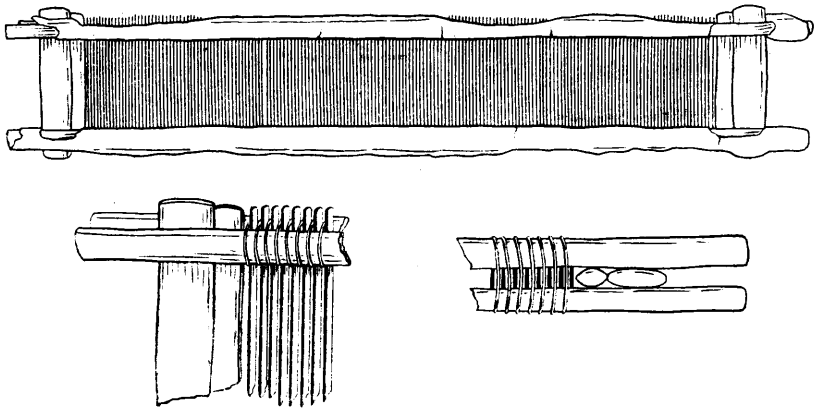


Fig. 25.—Reed in Cairo Museum. Length 66 cm. (26in.) It consists of two wooden frames fitted with flat iron wires. String is wound round the frames binding them together. Then a kind of canvas (?) cover is placed over the frames to cover up the projecting ends of the wires, but this has disappeared in places.

Dr. Garstang points out that although the surrounding tombs contained Middle Empire objects, the reeds were found in a tomb *without* any other remains. This can hardly be considered evidence tending to prove that they belonged to the period named, and it is certainly weakened by the accompanying statement that the reeds are *exactly* similar to the modern reed, for that is almost sufficient to prove that they are *not* 3900-3700 years old. To me they seem comparatively modern and very similar to one in the Cairo Museum which MM. Brugsch and Quibell are inclined to think is Coptic with this difference, that in Dr. Garstang's reeds the divisions appear to be of cane or wood, while in the Cairo reed they are of iron (? steel). The sketch of this Coptic reed, Fig. 25, has been drawn specially for me, and Miss

W. M. Crompton, Assistant Keeper in Egyptology in the Manchester University Museum, has kindly examined the sketch with the article and pronounced it correct. We may, I think, safely conclude that the reed found by Dr. Garstang is Coptic and not Ancient Egyptian.

As regards the actual work of weaving, balls of thread have been found and so have very flat bobbins and pieces of stick with thread wound round which may have been spools as indicated in the drawing, Fig. 7. There is no reason why balls of thread should not have been used as they are in uncivilised countries at the present day, as, for instance, in Tibet, as reported by W. W. Rockhill in *Diary of a Journey through Mongolia and Thibet*, Washington, 1894, p. 41.

"DIAGONAL WEAVING."

I am unable to agree with a recently made statement published in *The Labyrinth, Gerzeh and Marghuneh*, by Prof. Flinders Petrie, E. A. Wainwright and E. Mackey, p. 6, which runs: "The fact of the weft not being at right angles to the warp, if one may conclude by the fabrics, does not, I think, imply that such weaving is of inferior quality. When I noticed the pecularity first, I thought it might have arisen through distortion by stretching over the body, but repeated examples of the same fact have led me to consider other causes. We know how closely analagous to 'darning' was the early weaving; and in our days it is not unusual to find stockings not darned at right angles, and it may be the women weavers of old sometimes put in the weft more or less out of true right angle. In the childhood of weaving we should expect different methods, and it may be, seeing that we have no selvedged cloth until very long after this time, that they experimented with a diagonal weft to see if it would not reduce the tendency to fray out at the sides." The amount the warp and weft are out of the right angle is stated to be about 20°. The specimen shown me under the microscope indicated clearly that the warp and weft were not at right angles and that the interstices were not square but diamond shaped.

It is possible to arrange the warp threads diagonally from beam to beam, but with continuous weft (that is in weaving so as to get selvedges) the weft has the tendency to slip up on one side and down on the other, hence the weaving is made laborious. With a separate weft for each pick, *i.e.*, for every once the shed is opened, there is naturally not this tendency, but this alleged diagonally woven cloth frays just as easily as any other piece of cloth without selvedge, so in either case there is not only no advantage but distinct disadvantage taking the diagonal "beaming" into consideration. We must give the Egyptians credit for using the least laborious of two methods, that is *if* the second one were known to them.

Apparent diagonal weaving can be produced by anyone taking an ordinary piece of linen or cotton cloth, cutting off the selvedge and

stretching the cloth in a direction diagonally to the direction of the warp and weft, and a piece of diagonally woven cloth is the result!

The probability is that the specimen of cloth, without a selvedge, having been stretched over the body for a long period of time, has, in the course of that time lost its nature and when removed it has retained its altered form and gives us the impression of having been woven diagonally.

"THE LINEN GIRDLE OF RAMESES III."

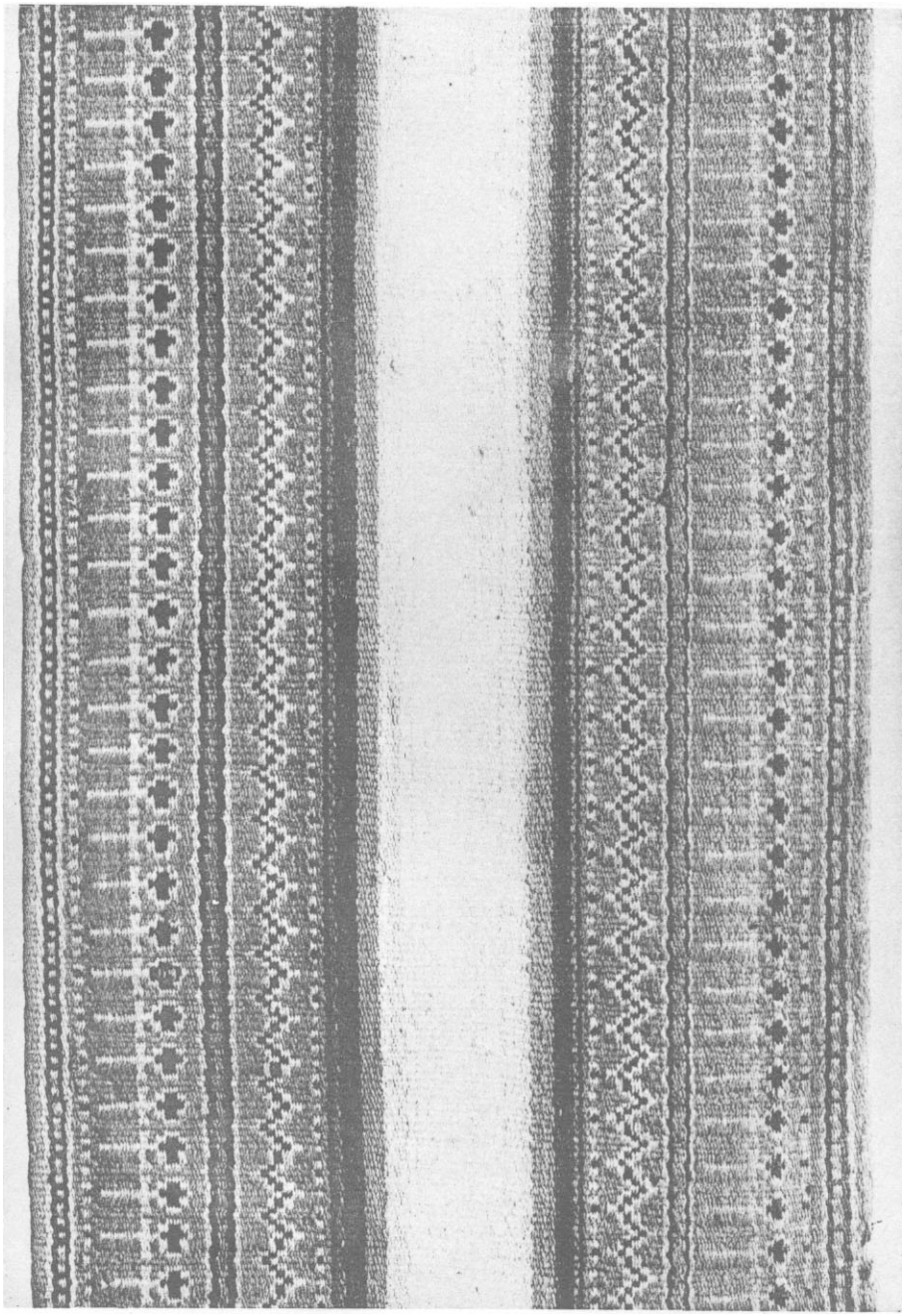
In the foregoing I have shown how extremely simple was the whole apparatus for weaving in use by the Ancient Egyptians, and one is rather surprised to be told that about B.C. 1200, in the time of Rameses III., the Egyptians "built and used looms very much more complicated than has hitherto been believed to be the case," or to be referred to "the really complicated form of loom used." Yet this is what Mr. Thorold D. Lee tells us (pp. 84 and 86) in his paper on *The Linen Girdle of Rameses III. (Ann. of Archæology and Anthropology of the Liverpool Institute of Archæology*, July, 1912, V.)

The characteristics of this girdle are its great length, 17 feet (5m. 2), its even taper diminishing from 5in. (12.7 cm.) in width to $1\frac{7}{8}$in. (4.8 cm.) in width, its elaborate design and excellent workmanship. Perhaps the chief of these characteristics is the taper. It is most probable, as Mr. Lee points out, that in the weaving the warp threads have been gradually dropped out to make the taper, rather than that additional warp threads have been added. As it is easy to drop a warp thread, and almost impossible to add one while weaving is in progress, Mr. Lee's view is confirmed by this. It would also be almost impossible to keep the warp taut if the number of warp threads were increased as the work went on. This means that the girdle was commenced at the wide end and finished at the narrow end.

It is common knowledge that when a warp thread drops out, its place is indicated by a thinness or fine opening for the whole length of the missing warp, and this is so because the reed, besides pushing the weft into position, also acts as a warp spacer, that is to say it keeps the warp threads properly apart, every one being properly aligned. When no reed is used the warp threads are not so evenly placed—they are not so parallel to one another for there is nothing but their tautness to keep them in position. Hence there is every reason to conclude that when, on a loom provided with a reed, warp threads have been removed their position must be indicated, and *vice versa* if no reed has been used the position of the removed threads will not be so clearly indicated, but there will be a more marked shrinkage in the width of the cloth as well as in the pattern, and this is what has taken place in the girdle giving us the diminishing taper.

If this diminishing taper were indicated by a decrease in the width of the pattern commencing at the selvedges, then it might be presumed

"THE LINEN GIRDLE OF RAMESES III."



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that a reed had been used for the central portion only—a very clumsy even if feasible arrangement, but the pattern begins to decrease along the middle and hence no reed could have been used.

It does not follow that because a loom was not provided with a reed it was without heddles. Anyone who will examine the large series of primitive looms at Bankfield Museum, will observe that heddles preceded reeds ; this must necessarily be so as the making of the shed is the first step in weaving, while the reed's work is more that of a finisher. But the heddles are all extremely primitive, and in my experience do not exceed four in number where there is no reed. Such a quantity of heddles with its complicated harness as Mr. Lee considers necessary is quite out of the question with a loom so undeveloped as not to be provided with a reed. Hence the indication is that the girdle was woven on a loom of a primitive character.

In carrying out the work the weaver has made many mistakes. On the left hand side of the right hand row of red crosses (they come out black in the photograph) there is an "end down" for a considerable distance—that is a thread has been missed.

On the same row of crosses three white threads show above and below, while on the left hand row of crosses there are five white threads above and below. The crosses are neither the same size nor shape in the two columns and curiously their white hafts in both columns point to the left instead of one row pointing to the left and the other to the right. Then again the white point at the right apex of the zigzag on the left corresponds to a red point at the left apex of the right hand zigzag, but if the girdle had been woven on an advanced loom with dobby and harness these points would have been red in both places.

As regards the large number of warp threads to the inch which Mr. Lee puts down as 272-340 (107-134 per cm.), this does not by any means indicate a complicated piece of machinery for the weaving of this belt or any other fabric. The greater the number of threads to the inch the finer must the threads be in order to get them into the allotted space, and in the weaving there will be so many more threads to raise and lower in order to make the shed opening. It means multiplying the work but does not necessarily mean that a more complicated loom must be used in the weaving.

It is not possible without opening the fabric to be quite positive on the many points which are raised, but there seems nothing about it which should prevent its having been made on a simple loom. Although superior to most, but not all, of the well known Coptic cloths in Bankfield and in many other museums, it very closely resembles some of them in many respects excepting in the taper.

I should add that in making my examination of this girdle I was kindly assisted by Mr. C. A. Trigg, a well known Halifax mill manager and designer. We made the examination independently and on comparing notes afterwards found that we agreed in all essential points.

AN EXAMINATION OF FIFTEEN SPECIMENS OF MUMMY WRAPPINGS.

By W. W. MIDGLEY, Curator, retired, The Museums, Bolton.

"So far back as 1834, Mummy cloths occupied the attention of James Thompson, F.R.S., who, after researches into their characteristics and structure wrote a paper on the subject, which appears in the London and Edinburgh Philosophical Magazine, Vol. V., page 355. From that time until quite recently, little additional knowledge on the subject has appeared. In the early part of 1910, Prof. W. M. Flinders Petrie, F.R.S., expressed a desire that the writer should undertake microscopic investigation of the body-wrappings of cloths of the III. and early IV. Dynasties (circa 2980-2750 B.C.) which he had brought home from excavations made at a cemetery near Meydum, Upper Egypt. The report upon them forms part of the "*Historical Studies*," Vol. II., of the *British School of Archæology in Egypt.*

When Mr. Ling Roth suggested that some of the examples of Egyptian Mummy cloths in Bankfield Museum should be examined on similar lines, describing the construction of the fabrics and yarns, together with the characteristics of the fibres used, I undertook to carry out the work and forward to him the results for permanent reference.

Each of the fifteen cloths submitted was first examined by mounting about $\frac{3}{4}$" x $\frac{5}{8}$" (20 mm. x 16 mm.) of the cloth on 3" x 1" (76 mm. x 25 mm.) glass slips, and covering with thin glass, so as to find out its plan of composition and the number of warp and weft threads per linear inch. Afterwards, a little of the warp threads as well as of the weft, was untwisted and the fibres separated, and these mounted apart on another 3" x 1" slip (76 x 25 mm.), so that the kind of textile fibre used and the diameter of the fibres could be measured. These microscopical preparations will be kept in Bankfield Museum, as they may be of interest to microscopists in the locality.

The cloths are from three sources :—Nos. 1 and 2 being from the private collection of Dr. Wallis-Budge, who has given the specimens to Bankfield Museum ; Nos. 3 to 8 are from the old Meyer collection in the Liverpool Museum (unfortunately the origin of them is unknown) ; and those marked 9 to 15 were taken from a mummy of the XXVI. Dynasty, brought to this country by Lord Denbigh, and now also in the Liverpool Museum.

A.—Specimens of Mummy cloths from Theban Tombs date about B.C. 1400, presented by Dr. Wallis-Budge.

1. A plain "one-up-and-one-down" linen cloth. The yarns in this example are more irregular in diameter than usual—the warp strands varying from $\frac{1}{25}$"th to $\frac{1}{71}$"st (1 mm. to $\cdot\frac{2}{8}$ mm.) The warp has about half its strands doubled (that is twined together), whereas the weft has only about one in twenty doubled. See Fig. 26.

2. This is a coarser fabric, has been dyed with safron, and is somewhat brittle to tease out the fibres. Both these cloths had evidently absorbed some of the gums or balsams used in the process of embalming, and hence the difficulty of separating the fibres for identification is increased. The structure of the fabric is peculiar, and, indeed, the only instance I have seen in Egyptian cloths. A portion, near the middle of the piece sent, has the warp strands in pairs parallel to each other, a few of them being double yarns, while all the remainder are doubled. Of the weft, nearly half are double yarns. See Fig. 27.

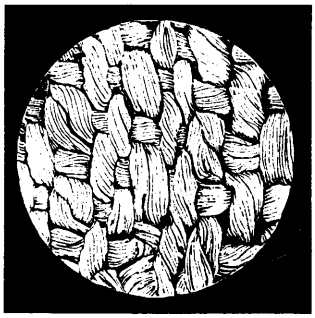

Fig. 26.—Magnified 10 diameters.

Fig. 27.—Magnified 10 diameters, showing the warp yarn in pairs.

B.—Specimens from the Meyer Collection, marked No. 11088. (Date of acquisition about 1856; date and place of origin unknown).

3. This is a beautifully soft, fine *Wool* fabric, containing no size or balsam. From the fineness of the yarn and of the individual fibres I have no doubt that the wool has been imported from India, or, more likely, that the cloth was made in Cashmere. The texture is a plain weave, has a selvedge edge, the warp yarns are doubled, while the weft is single yarn. It is much to be regretted that the particulars of locality, of burial, and the period of time to which this interesting fabric belongs has been lost. I assume from the general characteristics that it is of a late period—probably not earlier than the Ptolemaic.

4. This linen cloth has a plain selvedge, regular weave, and contains no size. About 25% of both warp and weft yarns are doubled, and all are very even in diameter.

5. A coarse linen cloth with plain selvedge. All the yarns are single and even in diameter.

6. This is a coarse, highly-sized linen cloth. The yarns are agglutinated, are brittle, and it is difficult to separate the fibres. The sample submitted has been cut from the end of the piece and shows the warp ends.

7. A coarse linen cloth, sized and brittle. No selvedge on the piece sent. Both warp and weft yarns are single, and even in diameter.

8. This is a very coarse linen fabric heavily sized and brittle. Both warp and weft yarns are single and very irregular in diameter.

C.—Lord Denbigh's: XXVI. Dynasty.

9. A soft-spun linen cloth containing no size. Specimen has been cut from the body of the fabric, showing no selvedge. About half of the warp is composed of doubled yarns of irregular diameter; the weft is of doubled yarns and more regular in diameter.

10. The selvedge of this linen fabric is peculiar and somewhat elaborate. The outer margin is composed of four sets of ten yarns parallel to each other, forming one strand of warp; then comes a space of $1\frac{9}{10}$" (48 mm.) where the warp yarns are dyed red; then occurs three more sets of ten parallel yarns (the object being to strengthen the selvedge), followed by the general body of the fabric. The entire selvedge is $2\frac{1}{4}$" (57 mm.) wide. About half the warp yarns are doubled, while all the weft are composed of doubled yarns, both being fairly even in diameter, and not sized.

11. A fine, soft, linen cloth, with selvedge $1\frac{1}{8}$" (29 mm.) wide; the three outer and the two inner strands of the warp are made up of many parallel yarns, as in No. 10, with an interspace of $\frac{3}{8}$" (10 mm.) All the warp yarns are dyed red, about 25% of them being doubled; the weft is peculiar in having five or six strands of single yarns alternating with six or seven double yarns, giving a faint stripe in the fabric.

12. A linen cloth, with no selvedge edge. It has been dyed red, probably *ferum*, a dye which I find uniformly associated with friable or decomposing fibres.

13. A peculiarly coloured fine linen cloth; the pattern is caused by some of the warp yarns being dyed, and occuring sometimes of four, two, or one red strands, with grey ones intermixed. A few of the warp yarns are doubled. The weft is composed of single yarns and are all in the grey.

14. A coarse soft-woven linen fabric, containing no size. Lines are indicated at irregular distances along the cloth, varying from $\frac{5}{16}$" to $\frac{9}{16}$" (8 to 14 mm.); these are caused by the introduction of three strands of doubled yarn in the warp while the remainder are single yarns. The weft is all of doubled yarns; both warp and weft are very regular in diameter.

15. This is a variegated linen fabric with warps coloured something like No. 13, but the red strands of warp are more irregular in distribution. Like it, a few of the warp yarns are doubled, both the red and the grey; while the weft is all of single yarns and in the grey."

[A considerable quantity of specimens of the cloths which were woven by the Ancient Egyptians has been examined both in this country and abroad. I may, however, call special attention to the results of examination published in Miss M. A. Murray's excellent little work *The Tomb of Two Brothers*, Manchester Museum Publications, No. 68, 1910.—H.L.R.]

DETAILS OF THE COMPOSITION OF THE BODY WRAPPINGS.

Specimen No.		Nature of Textile Fibre.	Warp Ends per inch.	Weft Picks per inch.	Micro Measurements of Ten Fibres.					
					Weft.		Warp.		Mean of.	
					Max.	Min.	Max.	Min	Weft.	Warp.
					in.	in.	in.	in.	in.	in.
I.	1	Linen	44	32	1/1400	1/3333	1/1424	1/3330	1/1768	1/1786
	2	,,	10	17	1/1786	1/3330	1/1780	1/2860	1/2020	1/1905
II.	3	Wool	224	40	1/833	1/2500	1/835	1/2000	1/1351	1/1429
	4	Linen	64	32	1/1429	1/2500	1/1250	1/5000	1/1818	1/1754
	5	,,	56	20	1/1250	1/3333	1/1250	1/2500	1/1754	1/1724
	6	,,	48	24	1/1250	1/2500	1/1000	1/2500	1/1640	1/1694
	7	,,	48	20	1/1111	1/2500	1/1000	1/2500	1/1408	1/1428
	8	,,	36	16	1/833	1/3333	1/1111	1/2500	1/1456	1/1613
III.	9	,,	48	24	1/1666	1/3333	1/1666	1/3333	1/2222	1/1960
	10	,,	32	60	1/833	1/3333	1/909	1/3333	1/1724	1/1613
	11	,,	80	36	1/1429	1/3333	1/1000	1/3333	1/1887	1/1784
	12	,,	96	40	1/1111	1/2500	1/1250	1/2500	1/1724	1/1695
	13	,,	80	36	1/1111	1/2500	1/1429	1/2500	1/1640	1/2040
	14	,,	56	24	1/909	1/3333	1/1250	1/2500	1/1594	1/1695
	15	,,	64	36	1/1250	1/2000	1/1429	1/2500	1/1724	1/1818

THE ABOVE CONVERTED INTO METRICAL MEASUREMENTS.

Specimen No.	Nature of Textile Fibre.	Warp Ends per Centim.	Weft Picks per Centim.	Micro Measurements of Ten Fibres in Millemetres.					
				Weft.		Warp.		Mean of	
				Max.	Min.	Max.	Min.	Weft.	Warp.
1	Linen	17	12·6	·0181	·0076	·0178	·0076	·0144	·0142
2	,,	4	6·7	·0142	·0076	·0143	·0089	·0126	·0133
3	Wool	88	15·6	·0305	·0101	·0305	·0127	·0188	·0178
4	Linen	25	12·6	·0178	·0101	·0203	·0050	·0140	·0145
5	,,	22	7·8	·0203	·0076	·0203	·0101	·0145	·0147
6	,,	19	9·5	·0203	·0101	·0254	·0101	·0155	·0159
7	,,	19	7·8	·0229	·0101	·0254	·0101	·0180	·0178
8	,,	14·1	6·3	·0305	·0076	·0229	·0101	·0174	·0157
9	,,	19	9·5	·0152	·0076	·0152	·0076	·0208	·0130
10	,,	12·6	23·6	·0305	·0076	·0278	·0076	·0147	·0157
11	,,	31·5	14·1	·0178	·0076	·0254	·0076	·0135	·0142
12	,,	37·4	15·6	·0229	·0101	·0203	·0101	·0147	·0149
13	,,	19	14·1	·0229	·0101	·0178	·0101	·0155	·0124
14	,,	22	9·5	·0278	·0076	·0203	·0101	·0159	·0149
15	,,	25	14·1	·0203	·0127	·0178	·0101	·0147	·0140

It is very obvious they had no scale to work to.

II. The Greek Loom.

We have now to say a few words about an upright loom which differs very materially from the Egyptian loom already described. Whether the horizontal loom is a later product than the vertical loom, or was evolved from it, or whether both were independent inventions cannot be discussed here, but I may point out that there is an intermediate form between the two. It is doubtful as to whether this is a transition form. It was first brought to my notice by Mr. T. A. Joyce, as in use amongst some negro peoples in Central Africa possessing an old, high

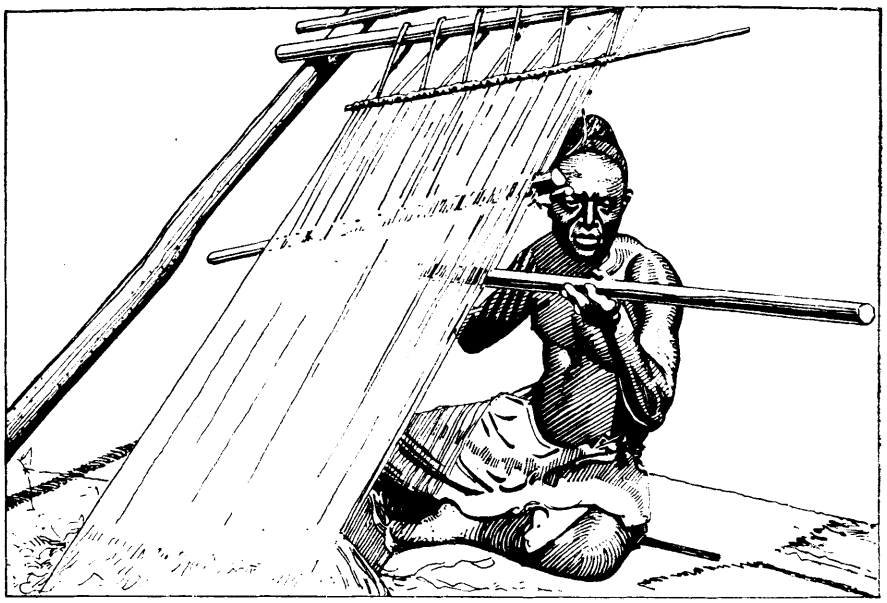

Fig. 28.—A Bushongo weaver at work. From Torday and Joyce, *Notes Ethnographiques, Ann. du Congo*, p. 182.

and possibly introduced civilisation, and is figured in Messrs. Torday and Joyce's *Notes Ethnographiques . . . . Bakuba . . . . et Bushongo (Annales du Congo)* pp. 24 and 182. In this loom the warp is stretched between an upper beam and a lower beam at an angle of about 90 degrees, and the weaver sits underneath at his work, Fig. 28. It is not at all uncommon to meet with illustrations showing the warp stretched at an incline, and apart from the fact that in many the weavers are posing for illustration, and therefore, are most probably not exactly in their natural positions, the tilted arrangement has this advantage, namely, that the work of beating-in is improved by the

fall given to the "sword" which, with less exertion by the weaver, drives the weft home more effectively. In all these cases, however, the weaver sits or stands in front of the loom, but in the case of the Bushongo the loom is tilted to such an extent that the weaver finds it more convenient to sit underneath the warp.

The discovery by Messrs. Alan Gardiner and N. de G. Davies of illustrations of Egyptian upright looms, confirms Wilkinson in his statement and illustration that the Egyptians had this class of loom as well as the horizontal one. The vertical loom is found in Europe, Asia, Africa and America, and is, probably, ethnically as old if not older than the horizontal loom. But this Egyptian upright loom differs from another, the Greek, or Central European, or Scandinavian form of the upright loom, in having an upper and a lower beam so that

Fig. 29a.—Illustration on a small lekythos of an Athenian girl at work on a tapestry loom, together with a full size tracing of the tapestry loom. British Museum. B.C. 500.

Fig. 29b.—Illustration of a Greek woman with a tapestry loom. From Stackelberg's *Graeber der Hellenen*, pl. xxxiii.

the warp is made taut between two beams, while in the Greek loom there is only *one* beam. The warp hangs from this beam, the warp threads being made taut by means of weights attached at the lower ends.

The Greeks were, however, acquainted with the tapestry loom, for there exists in the British Museum a small lecyphos with an

* I find frequent references, by various writers, to an upright loom mentioned by E. H. Palmer as used by a Bedawin woman near Jebel Musa, but on looking up his description (*The Desert of the Exodus*, I. p. 125), I find it to be so indifferent as to be quite useless for purposes of comparison.

illustration, Fig. 29a, of such an article resting on the knees of a lady weaver.*

It has been described by Mr. H. B. Walters in *Jour. Hellenic Studies*, XXXI., 1911, p. 15, who says : " In front of her, Fig. 29a, is a white wool basket *(Kalathos)* and on her lap is a frame somewhat in the form of a lyre, being formed by two upright pieces with knobs at the top, diverging slightly towards the top, across between which are stretched two threads at the top and two at the bottom, seven vertical threads being also visible. Her hands are placed on the threads, which she is engaged in manipulating. This object can only be intended for a hand loom, though there is apparently no evidence for

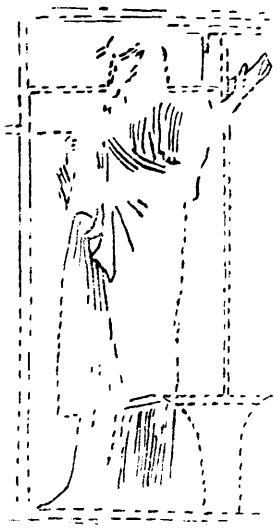

Fig. 30. — Greek woman at work on a loom. From C. Robert 'Εφ 'αρχ 1892, pl. xiii., p. 247. It is not possible to say from this illustration whether this is a warp weighted loom or not.

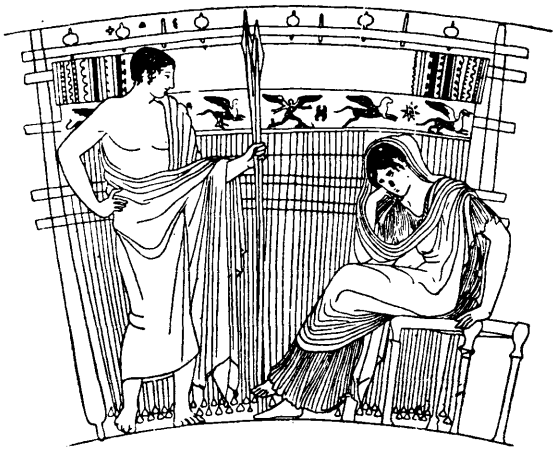

Fig. 31.—Penelope at her loom. Illustration on an Athenian skyphos found in an Etrusian tomb at Chiusi, and at present in the museum there. The illustration is taken from *Monumenti d. Inst. Archeologico*, IX., pl. xlii.

the use use of such objects in ancient times or among Oriental races either in the past or the present day. The only other parallel to the representation on this vase is one published by Stackelberg, Fig. 29b, where a woman holds a similar frame and is similarly occupied with her hands. The writers of the articles *Sticken* in Baumeister and *Phrygium Opus* in Daremberg and Saglio, misled by the likeness of the object to the modern crewel-frame, interpret the process as embroidery. But this kind of work implies cloth or other textile substance already woven, on which patterns are worked in, whereas in both vase paintings the textile is obviously in course of construction." He is right in so far as he goes, but both representations are those of

* My attention to this was kindly drawn by Mr. F. N. Pryce, Assistant in the Dept. of Greek and Roman Antiquities.

tapestry looms which fact is indicated by the warp threads in both cases, and by the design marked on the warp threads of Fig. 29b—a method of preparing their work in use to this day by tapestry weavers. Some authorities consider that tapestry weaving is more closely related to mat making than to true weaving. In other words, I take it tapestry is an early stage in the development of weaving. From this we get some idea as to how far the Greeks had progressed in the textile arts.

As pointed out by MM. Daremberg and Saglio, *Dic. des Antiquités Grecques et Romaines* pt. 46, p. 164, "illustrations of Greek or Roman methods of weaving are very rare, they are much reduced and in so far as the art is concerned purely diagrammatic." On the other hand if there are numerous references in the texts of classic authors, these references seem rather to obscure than elucidate the method of working. However, there are three illustrations—the Penelope loom, Fig. 31, and two Boeotian looms, one of which is illustrated in Fig. 15—quite sufficient to explain the principle of the upright loom as used with warp weights by the Greeks, and the discovery of numerous articles, considered to be the warp weights, confirm the illustration.

The principle is the same throughout, viz: the looms are vertical, there is a warp beam on top, there are two cross rods one of which is a laze rod and *possibly* the other is a heddle; and the warp threads are all kept taut by means of attached weights. On one of the Boeotian looms a bobbin or spool is shown. Along the top of Penelope's loom there are indications of nine pegs, on six of which balls of coloured thread have been placed, evidently for working out the designs, very much the same as shown on the rug loom in Bankfield Museum already referred to. The warp weights on this Athenian illustration are triangular in shape, and perhaps resemble the pyramidic weights found in Egypt and attributed to Roman times. Assuming these pyramids are Roman warp weights it would appear that both Greeks and Romans had vertical looms on which the warp threads were kept taut by means of weights. In one of the few clearly expressed technical classical references, Seneca speaks of the warp threads stretched by hanging weights.

In the above classical illustrations which are after all only rough diagrams, the warp weights appear to hang from a *single* thread only, but this can not have been correct. The warp threads must have been bunched, because a single suspended thread with a tension weight immediately begins to unravel, and so loses the advantage of its having been spun, as any one can ascertain for oneself. As regards the same point on the Lake Dwellers looms, Cohausen was the first to surmise that the warp threads were bunched to receive the weight, and Messikommer proved it by practical experiment.*

*The existence of warp weighted looms amongst the prehistoric Lake Dwellers of Switzerland was first surmised by Pauer (*Keller's Lake Dwellings*) from the discovery of the weights, and was made practically certain by Messikommer and Jentsch.

As can be surmised with this class of loom the weaving begins at the *top*, working *down*wards, and the beating-in of the weft is *up*wards—the exact opposite to the method adopted with other looms—for the pendant warp ends, although weighted to keep them taut, do not appear to have been further fixed in position, so that to commence weaving at the lower end made the operation so extremely difficult as to be almost impossible.

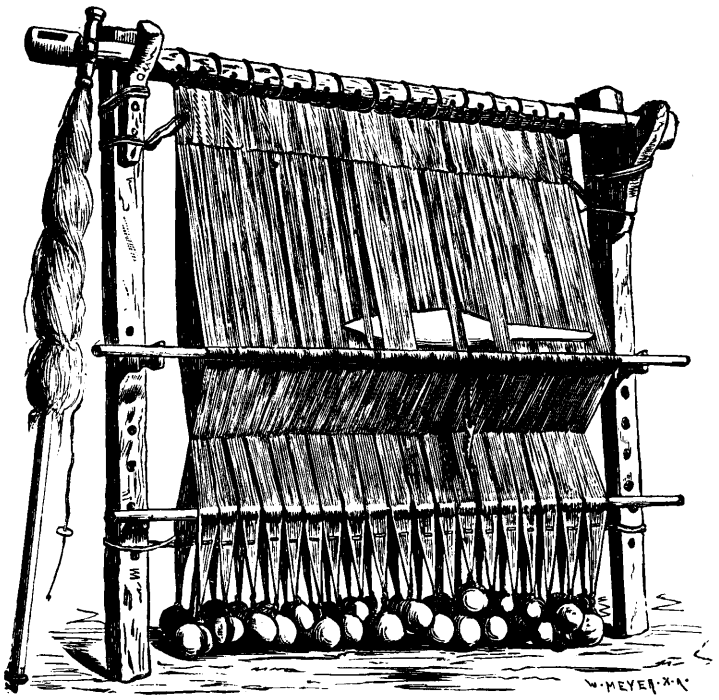

Fig. 32.—Illustration of a Scandinavian warp weighted loom in the Copenhagen Museum. The illustration is taken from Montelius' *Civilisation of Sweden in Heathen Times*, translated by the Rev. F. H. Woods, London, Macmillan & Co., 1888, p. 160,

[In the illustration of this loom published by the Trustees of the British Museum, in their *Guide to the Antiquities of the Early Iron Age*, London, 1905, p. 139, the shape of the warp weights has been altered to suit the shape of such weights in the British Museum collections.]

The Scandinavian form of the "Greek" loom from the Faroes Fig. 32, is made known to us through the article itself in the Copenhagen Museum, illustrated by Montelius, *Civilisation of Sweden in Heathen Times*, Lond. 1888, p. 160, and through the very clear illustration and description given us by Olafsson in his *Oeconomische Reise durch Island*, 1787, translated from the Danish edition of 1780. The loom figured by Olafsson, Fig. 33, shows an advance on that of Montelius, in being provided with heddles.* Upright looms with a lower beam instead of with warp weights and furnished

* Comparing the loom Olafsson saw with the description in the Nial Saga, he concludes this sort of loom was in use A.D. 1014, in the North of Scotland.

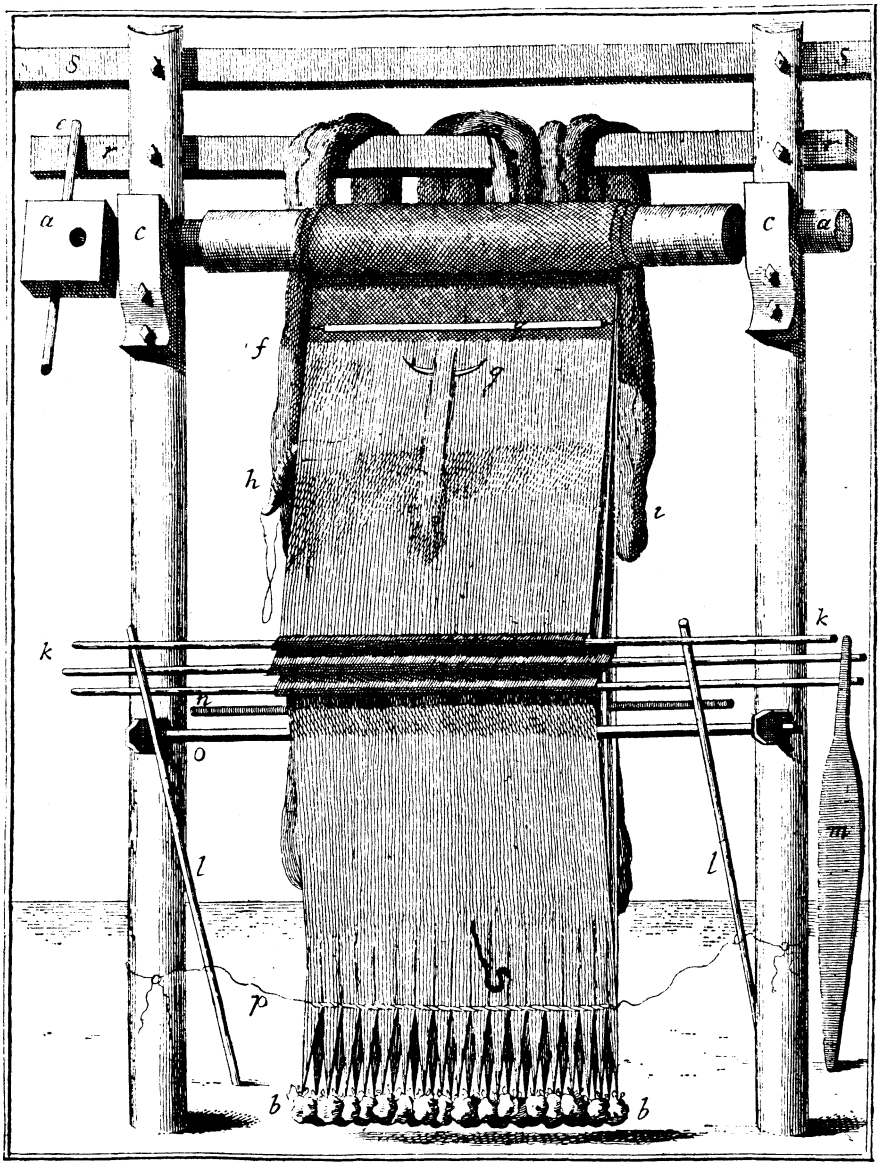

Fig. 33.—Icelandic Loom after Olafsson.

a a Beam on which the warp is fixed. *b b* Weights to make the warp taut. *c c* Brackets which support the beam and on which it can be revolved by means of the spoke *e* when the warp has to be lengthened, on account of the weft *f* working downwards and so shortening the finished portion of the woven cloth. *g* A sharp bone or tough piece of wood to beat the weft into proper position. *h* The wound up weft which is pushed through the warp with the fingers. *ii* The unbeamed warp. *k k* The heddles or shed openers. *l l* The supports on which the heddles rest when the "pick" is made [*i.e.*, the pushing the weft through]. *m* The beater-in. *n* and *o* Laze rods. *q* The templete for regulating the width of the cloth. *r r* and *s s* Beam on to which the loom is fixed.

Some of the descriptions are not as clear as could be wished. It is probable that *g* is a preliminary to *m*. N. Annandale mentions that he obtained in the Faroes a beater-in made of a whale's jaw or rib; while in Iceland he saw some of the perforated stones to which the warp threads were attached (*The Faroes and Iceland*, Oxford, 1905, pp. 195-6).

with heddles, are not uncommon. There are the well known Indian and Persian rug looms, and Du Chaillu figures one in his *Journey to Ashango Land*, London, 1867, plate facing p. 291. Randall-Maciver and Wilkin illustrate a vertical loom in use among the Kabyles, *Libyan Notes*, London, 1901, Pl. IX, and although the details of the illustration are not clear the text indicates the existence of one heddle : "The warp is decussated by means of a horizontal rod and leashes." Dr. Washington Mathews figures several Navajo looms with heddles, *Third Ann. Rep. Bureau of Ethnology*, p. 291 ; Ancient Peruvians also used them, as shown by Dr. Max Schmidt, *Baessler Archiv, I. pt. 1*, and so on practically *ad. lib.* But to work an upright warp-weighted loom with heddles is attended with great practical inconvenience, and this difficulty has, no doubt, been one of the chief causes of the complete discardance of this class of loom.

In spite of the evidence in favour of the existence of warp weighted looms, the Director of the Hermannstadt Museum, Dr. v. Kimakovicz-Winnicki, sees fit to deny their existence. He found that in some parts of Transylvania the peasants use wooden pyramids (see Fig. 18) similar to the Roman warp weights for winding the thread from the spindle on to the shuttle. For this purpose sockets are bored into the thin or top end of two pyramids, which are placed just so far apart that a spindle can rest horizontally with one end in the socket of one pyramid, and the other end of the spindle in the socket of the other pyramid, and the thread in being wound off on to the shuttle causes the spindle to revolve in the sockets. From this he argues that what we have hitherto taken to be warp weights are not warp weights at all (*Spinn- u. Webewerkzeuge*, Wuerzburg, 1911), and having denied these articles to be warp weights he gets over the difficulty presented by the illustration of Penelope at her loom, by attempting to prove that what we take to be a loom is no loom at all but a *flechtrahm*, *i.e.* plaiting frame ! He then attempts to pull to pieces the idea that the Scandinavian loom in the Copenhagen Museum is a loom and condemns it as unworkable. There can be no doubt about his meaning as he defines his terms. The principle of weaving (*Weben*) he describes "as the absorption of two groups of parallel material elements (warp and weft) at right angles to each other, and the principle of plaiting (*Flechten*) as the absorption by itself in one plane of one group only of material element,(warp)" and he gives diagrammatic illustrations showing clearly what he means (*op. cit* p. 31).* Judging from his remarks one must conclude he has not seen a primitive loom of any sort, and were it not for the official position he holds, his remarks would not need answering.

* He criticises the detail of the illustration of Penelope's loom. It must be remembered this illustration is not a technical drawing, but an artist's representation where correctness of detail cannot be expected. In his own drawing of the Egyptian horizontal loom many of the warp threads are shown over instead of under the laze rods, and yet this is supposed to be a correct technical drawing !

It has, I believe, been suggested more than once that some of the perforated stones, pieces of burnt clay, pieces of chalk and like objects may be and are net-sinkers, and there is some justification for Dr. Kimakovicz-Winnicki's statement that the pyramidic forms are not warp weights ; but it does not follow that all the perforated articles are either spindle-holders or net-sinkers, yet that is what his subsequent statements lead one to infer. It is, however, difficult to prove that these perforated articles are warp weights.

In 1875 several flat irregular oblong perforated pieces of soft chalk were found in enlarging the cattle market in Great Driffield, Yorkshire ; they were found in a hole about three feet deep with Anglo-Saxon potsherds, animal remains, and bits of iron. They can now be seen in the Mortimer Collection in the Hull Museum. They

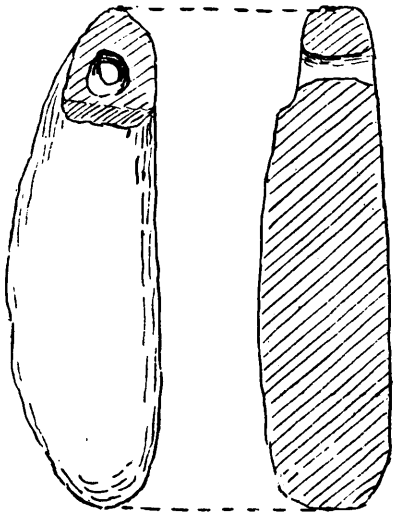

Fig. 34. —Side view and section of chalk warp weight found at Great Driffield. Of three of the weights the following dimensions were taken :

$7\frac{3}{4}$" (19·7 cm.) long, 2lbs. 3oz. (1·0 k)
6" (15·2 ,,) ,, 1lb. 8oz. (0 7 k)
$6\frac{3}{8}$" (16·2 ,,) ,, 1lb. 3oz. (0·6 k)
Hull Museum.

Fig. 35.—"Chalk weight, 6" × 4" × 2" (15·2 cm. × 10·2 × 5·1), similar to those found in pits, at Mount Caburn and Cissbury near Worthing, Sussex. Found with eighteen more in the *filling* of pit 7, Winkelbury Hill." *Excavations in Winkelbury Camp*, by Lieut.-Gen. Pitt-Rivers (*Excavations in Cranbourne Chase*, Vol. II., 1888). As Pitt-Rivers also found at Winkelbury the fragment of a comb and a chalk spindle whorle, which are textile tools, we may safely presume these fashioned pieces of chalk are warp weights.

consist of pieces of chalk, similar to those which drop annually in thousands upon thousands down the cliffs from the boulder clay between Bridlington and Flamborough. On some a shoulder has been cut, Fig, 34, most have one perforation, but in a few specimens, where the thin portion above the hole has been broken off, a second hole has been made. None of them can stand unsupported. Owing to the soluble nature of the chalk they could not have been used as net-sinkers in the sea (about nine miles off) for they would quickly dissolve in salt water, and the same holds good in regard to fresh water, although in a lesser degree. But I do not think they were used even in

fresh water as net-sinkers, for it was a characteristic of primitive peoples, with whom time was of no account, to do their work thoroughly—what they made was intended to last, and chalk net-sinkers would not have lasted. That these were found in a limited quantity, I believe about seventeen in number, tends to show that they are warp weights, for only a few are required for every loom, in spite of the considerable number shown in the non-technical illustration of Penelope's loom. Not being able to find any other use for these pieces of chalk, and judging that they are suitable for the purpose, I should say they are warp weights. In this case the weaver has made the most of what nature has given him; in other parts of England he has had to fashion the weight out of the rough chalk, Fig. 35.

In the Museum at Devizes there are several hard pieces of perforated and fashioned chalk which offer more conclusive evidence. Of these Mrs. M. E. Cunnington, the Curator, writes me: "All the weights here have holes bored right through. Two large ones stand easily on the floor. Others are more irregular in form and will not stand upright. This latter type is, as far as I am aware, the more usual in this part of the country. They are commonally cut out of the hard chalk, and weigh about 3 or 4lbs. (1·5—2 Kilos). We think these weights are loom weights because we find them with Romano-British remains, as at Westbury, and late Celtic remains on our chalk uplands, far from water where fishing could have been carried on. With the same remains we find weaving combs, numerons spindle whorls and other tools of bone that were also probably used in weaving operations." The Westbury, in Wiltshire, referred to, is some thirty miles in a straight line from the mouth of the Severn, and about forty miles from the English Channel. These pieces of chalk cannot therefore have been used as net-sinkers, leaving out of consideration their composition; they were found with weaving tools and they fit the position. So far the ingenuity of our ablest archaeologists at home and abroad has not succeeded in ascribing the use of these objects to anything else than net-sinking or warp tension. The adaptability of the articles for use as warp weights, the small groups in which they are found, the discovery of weaving implements in the closest proximity, our knowledge of the Greek representations of warp-weighted looms, the Olafsson illustration, and the loom in the Copenhagen Museum all tend to prove that these articles are really warp weights.

As regards the practical possibility or impossibilty of working a "Greek" loom, I had a simple frame made in the Museum and showed Mr. J. Smith, a mill "Overlooker" at Messrs. Wayman and Sons, Ld., Halifax, the illustration in Montelius' book already referred to, and asked him to weave me a small piece of cloth on it. In the course of a few hours he did the warping, beaming and weaving, making the pick with his fingers and using a ball of weft thread instead of a spool or shuttle. The result is shown in the accompanying illustration, Fig. 36, conclusively proving that weaving on such a frame is quite

feasible, and practically proving that Olafsson's and the Copenhagen warp weighted looms are properly constructed workable looms.

Finally, it may not be out of place here to point out that there are other looms, besides the Greek and Scandinavian, on which the warp is made taut by means of warp weights. The Rev. Dr. Henry Porter, of the American College, Beyrout, Syria, writing about the year 1901, thus describes the common loom of the country. He says :

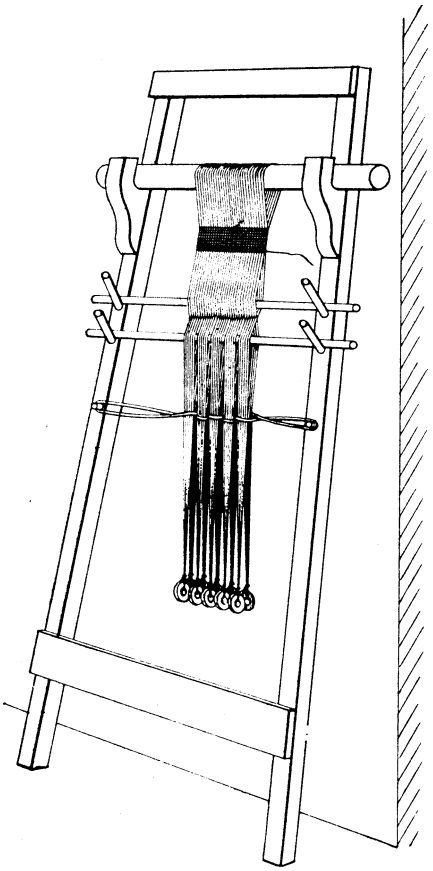

Fig. 36.—A warp weighted loom made at Bankfield Museum, to show the possibility of weaving by this method. There is no heddle nor shuttle used. The weaver made the "shed" and pushed the weft through with his fingers. He naturally worked *down*wards.

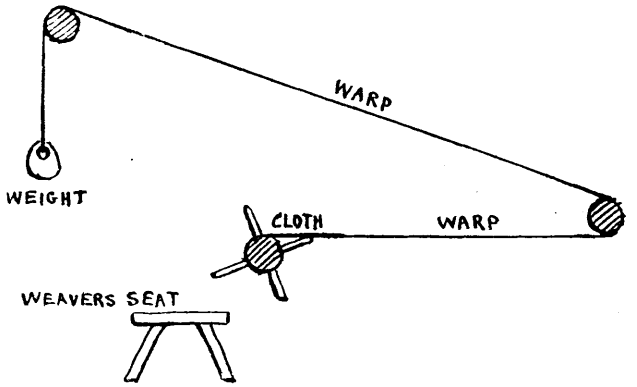

Fig. 37.—Diagram to show how the warp is kept taut on a Syrian loom.

"Two upright posts are fixed in the ground, which hold the roller to which the threads of the warp are fastened, and upon which the cloth is wound as it is woven. The threads of the warp are carried upward towards the ceiling at the other end of the room, and pass over rollers, and are gathered in hanks and weighted to keep them taut (*Dic. of the Bible*, Edinburgh, 1902, IV, p. 901)." He has kindly sent me an

ERRATUM :—Page 39, Line 5, for Dr. Henry Porter,
read Dr. Harvey Porter.

illustration of this loom, but unfortunately the weights are not clearly shown, and the same is the case with an illustration of a loom from Cyprus.* The diagram, Fig. 37, shows the principle. In a Shan loom illustrated by Mrs. Leslie Milne, in *The Shans at Home*, London, 1910, p. 120, the warp makes a somewhat similar detour over the head of the weaver, it is, however, not weighted but tied to a beam. The point to be observed is that these warp-weighted looms are horizontal

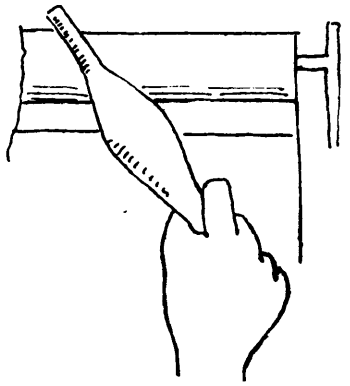

Fig. 38.—Hand of Penelope clutching her shuttle. From a corner of a piece of sculpture discovered by O. Kern and described by C. Robert, (*The Feet Washing of Odysseus*, fifth Century B.C., *Mitt. Kais. Deutsch. Arch. Inst.*, Athens, XXV., 1900, pp. 332-3). The author considers Penelope to be in the act of unravelling what she has woven: "We see her holding the spool with her right hand, while the left hand, half closed, is raised to about shoulder high, and the fingers, if I read the traces correctly, are posed as though she held a thread."

and not perpendicular, and also that the weaving is the reverse of that on the Greek loom but similar to that on our horizontal looms, so that the present Syrian and Cyprian looms have nothing in common with the old Greek loom.

The Greeks evidently used a spool in weaving, that is a piece of stick round which was wound the thread that became the weft, as is shown in the hand of Penelope, Fig. 38, and in Kirke's loom, Fig. 15.

III. CONCLUSION.

From the foregoing we gather that the Ancient Egyptians had two forms of looms. The earlier or horizontal form, date about B.C. 2000, has in a modified way survived to the present day in desert Egypt and is also found in Seistan. It required a large area of ground for working and probably in earlier times when there was plenty of space this did not much matter. But as the population in

* Since writing Dr. Porter has sent me photograph of another sort of loom in which weights are used as counter balances to keep the heddles raised. The subject requires further elucidation.

the towns increased and with the increase of civilisation and its concomitant increased demand for cloth, probably out of proportion to the increase of population, space would be begrudged and this may have caused the invention or the introduction of the ~~horizontal~~ form of / Vertical / loom which we find in use some 500 years later. In Egypt therefore the horizontal loom preceded the vertical loom but it does not necessarily follow that such was the case elsewhere. In so far as we can gather from the small amount of information at our disposal, in the earlier days the women were the weavers, and later on with the introduction of the upright loom the men were the weavers with an occasional female weaver. In the Egyptian Desert and in Seistan in the present day with horizontal looms the weavers appear to be males, but among the nomads of Persia who likewise use horizontal looms the weavers are females. In the use of either form of loom the Egyptian weavers beat the weft downwards or towards themselves and *not* upwards or away from themselves. They had the heddle in one of its earliest forms and had consequently made the first great step in the evolution of the loom as we now know it. In the beginning they made no selvedges so that for every pick a separate length of weft thread was used. The adoption of the selvedge was another improvement and until it was introduced the weft would no doubt have been put through with the fingers, later on a spool being used. It is possible also that in very late times the weavers' comb was introduced. It is safe to say that the Egyptians had no knowledge of the reed. Both forms of looms were simple, without harness or other complicated pieces of mechanism. The Egyptians accomplished fairly good work and judging these people from their looms alone we must conclude they were a progressive race.

The Greek form of loom was an upright one on which the warp threads were kept taut by means of weights and similar to the form which existed in Central and Northern Europe (in the latter until recent times) but of which so far there is no trace to the east, or south, or west. The Greek loom may have been furnished with a heddle but the drawings are not clear on this point. A spool was used. The weavers were women and the weft was beaten upwards or away from the weaver. It was not a form of loom so capable of improvement as the Egyptian forms and there appears to be no connection between the forms used on either side of the Mediteranean. The Greek tapestry loom could hardly have been more primitive. In respect to the forms of looms used by the two peoples the Egyptians were considerably in advance of the Greeks.

FINIS.

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