

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

A PRIMITIVE FRAME FOR WEAVING
NARROW FABRICS.

BY

OTIS TUFTON MASON,
Curator, Division of Ethnology, U. S. National Museum.

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“Tela jugo vineta est; stamen secernit arundo;
Insertitur medium radiis subtemen acutis;
Quod digiti expediunt, atque inter flamina ductum
Percusso feriunt infecti pectine dentes.”
(OVID—*Pallas and Arachne*, lines 55-58.)

INTRODUCTION.

The textile art among savage and barbarous peoples, as well as in the hands of country folk in civilization, consists in the joining of flexible materials in filaments—straw, splints, threads, etc. The simplest of these activities is twisting or twining. The making of sennit or braid comes next. After that will follow basketry, matting, netting, lace work, and even fabrics, all made, out and out, with the fingers.

The second step in the textile art, as in all others, will be taken with the aid of some kind of device which hastens or perfects the operation of the hand. There will be knives to split the material, gauges to replace the finger nail, spindles, bobbins, frames, and shuttles, of very humble structure, forsooth, but all of them containing the working principles of the most advanced apparatus having the same functions. Omitting all other textile processes, attention will be directed here to weaving proper, or the use of mechanical appliances to this end among primitive peoples.

In any style of mechanical weaving, however simple or complex, even in darning, the following operations are performed: First, raising and lowering alternately different sets of warp filaments to form the “sheds;” second, throwing the shuttle, or performing some operation that amounts to the same thing; third, after inserting the weft thread, driving it home and adjusting it by means of the batten, be it the needle, the finger, the shuttle, or a separate device.

In the modern power loom the parts by which these operations are performed are very intricate and rapid in their composition and action; but in the simplest form of apparatus, from which the power loom was originally derived, a few sticks and strings and the cunning hand of the operator take the place of machinery, and time is no object. A careful examination of any power loom will demonstrate the oft-repeated fact that most of the machinery, after all, is a substitute for the human fingers.

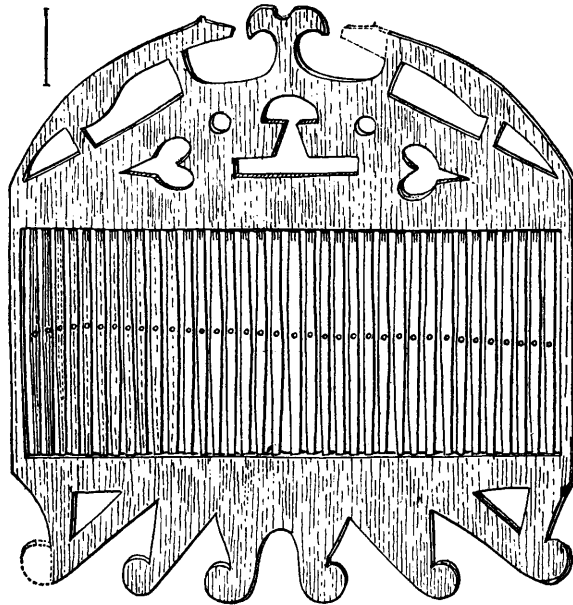


Fig. 1.

CHIPPEWA HEDDLE FRAME, CARVED FROM A SINGLE PIECE OF WOOD.

Cat. No. 3648, U.S.N.M. Collected by Henry R. Schoolcraft.

DEFINITION OF HEDDLE FRAMES.

There are in the U. S. National Museum a collection of heddle frames, and photographs of others from different parts of Europe and America, each one of which was designed to form the "sheds" in weaving belts and garters—that is, to raise or lower different sets of warp filaments in the manner to be now described. A series of healds are attached to or form parts of a heddle frame, which sometimes hangs free on the warp threads, as in the frontispiece, and sometimes is attached solidly to a frame or box, or to the body of the operator. (Compare fig. 16 with Plate 3.) In the former of these classes the "sheds" are opened by the weaver, who lifts or lowers the heddle with the hand. In the second class, the "sheds" are formed by raising or lowering the inner ends of the warp itself, half of its filaments being

entangled in the stirrups of the healds, the other half passing up and down between the healds.

A still simpler style of making "sheds" may be seen in a Chinese device employed in weaving rush matting. A block of wood like a piece of studding, as long as the matting is to be wide and 4 inches square in section, has a series of triangular saw cuts through it. Each cut has an upright opening on one side and terminates with a small hole on the opposite side. The next saw cut alternates with the preceding, its long opening being on the side of the small perforation in the other cut. In rocking the heddle block by means of two handles on top, backward and forward, "sheds" are formed in the twine which constitutes the warp of the matting.

The specimens to be herein described came to the Museum from the Zuñi and other pueblos of the Southwest; from the Masquakee or Sauks of Iowa; from the Chippewa Indians; from Finland, Germany, and Italy in Europe; and, finally, from the English settlements in the New England States and New York, and the Dutch settlements in Lancaster County, Pennsylvania. To complete the round this ingenious mechanism, having traveled through many lands and some centuries, emerges from the U. S. Patent Office as patent No. 334320 (Plate 4), and adapted forms are used for illustrating technical instruction in the Teachers' College, New York.

HEDDLE FRAME OF THE ALGONQUIN TRIBES.

The first of these objects brought to the notice of the ethnologist, belonging to the first class above described, in which the operator raises and lowers the heddle frame, was a Chippewa specimen figured in Schoolcraft, but no description of it is there given (fig. 1).

The Chippewa Indians (belonging to the Algonquin family) about Lakes Michigan, Huron, and Superior were in an excellent area of food supply, contiguous to Iroquoian and Siouan tribes, and were also brought into close industrial relationship with the French explorers and priests; later the English settlers became their teachers.¹

The very object described by Mr. Schoolcraft was in the possession of the United States Government before the U. S. National Museum was founded, and is here figured; but there is on the specimen and in the catalogues no allusion to the distinguished ethnologist and none to the function of the apparatus. It is carved from a single block of beech wood one-eighth of an inch thick. The upper margin is rounded and cut into patterns as with a jig saw, representing two animals, two hearts, and a symmetrical pattern in the middle. The lower margin is treated in the same way, only the designs are such as might be seen on old-fashioned furniture. The working part of this apparatus is

¹ Information respecting the Condition and Prospects of the Indian Tribes of the United States, Philadelphia, 1852, II, pl. 77.

the rectangular space constituting the middle portion. There are thirty-seven upright healds or "heddle dents" and thirty-eight spaces. The healds are not inserted into the wooden frame, but are a part of it, and are about the twenty-fourth of an inch in thickness, the material having been cut away on both sides so as to leave these as thin as safety would allow. Each heald or upright piece is wider in the center than at the ends and is there perforated with a small hole. The whole frame is just $7\frac{1}{2}$ inches wide and the healds about 3 inches in length. The points to be especially noticed in this example are, first, that the apparatus is made from a single piece of wood; second, that the Indians of the upper Great Lakes were taught by the early settlers from Europe to be weavers; and third, that the method of ornamentation, shown at the top and bottom of this specimen, is common enough in Germany (figs. 8 and 9), but it is not common elsewhere among American aborigines on such heddle frames. The healds and spaces, together seventy-five in number, make provision for seventy-five warp threads in all.

Mr. W J McGee, of the Bureau of American Ethnology, calls attention to similar heddle frames in use among the Masquaquee, or Sauks and Foxes, an Algonquin tribe in Iowa, and presents to the U. S. National Museum an excellent example of a weaving frame from that tribe (fig. 2).

Mr. W. H. Jackson says that the Sacs, Sauks, Saukies, or Osaukees, as it has been variously written—a word meaning yellow clay—and the Foxes, or Outagamies, or more properly the Musquakkink (red clay) are now as one tribe. They were first discovered settled about Green Bay, Wisconsin (after residence on the north shore of Lake Ontario), but their possessions extended westward, so that the larger part was beyond the Mississippi. They partly subdued and admitted into their alliance the Iowa, a Dakota tribe. By 1804 they had ceded all their lands east of the Mississippi and settled on the Des Moines River, moving subsequently to the Osage (in Kansas) and, after 1842 [in 1845], the most of these finally to the Indian Territory. In 1822 the united bands numbered 8,000, but are now [1875] reduced to a little more than 1,000, of whom 341 are still in Iowa, 430 in the Indian Territory, 98 in Nebraska, and about 200 in Kansas. The Sauks and Foxes of the Mississippi in the Indian Territory have a reservation of 483,840 acres.¹

The frame is made of walnut and is in its general structure similar to the foregoing, but is much heavier and more elaborately finished. It has forty-two healds, making provision for eighty-three warp threads in all. The ornamentation, at the top especially, has been evidently under the influence of whites in quite recent times. In this

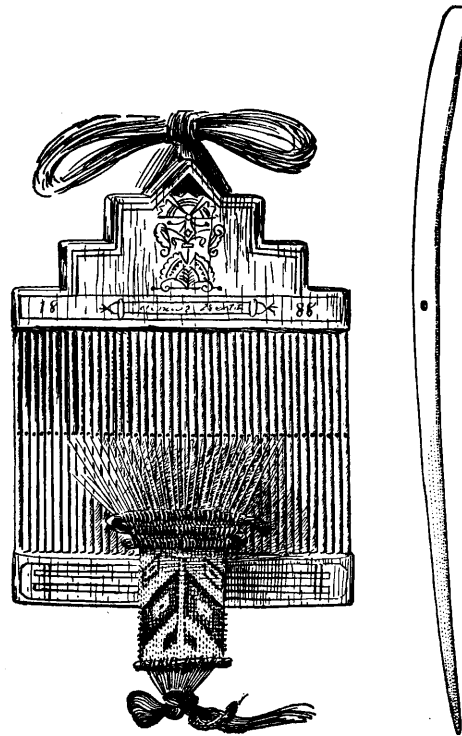
¹ Report U. S. National Museum, 1885, p. 37.

specimen, as it is set up, the healds are not all used, only a sufficient number to enable the weaver to form a texture having fifty-five warp threads. Especial interest attaches to this piece of work, which is an example of transparent weaving and beadwork. The warp consists of fifty-five white threads. The shuttle is a steel needle threaded with fine cotton on which beads of different colors are strung. The figures are produced by counting off the beads and arranging them so that one will fall in each of the interstices of the weaving.

Accompanying this frame (fig. 3) is a shuttle for mat weaving, having an eye near the center of its body. In forming the beadwork a steel needle was employed; but in ordinary garter weaving on the same loom the shuttle was employed both for placing the weft and beating it home.

The general method of operation in both heddles just described and in all others of this type was as follows: Warp threads of the healds and spaces, or a smaller number, were cut into the length of the intended garter, or belt, or band to be woven. If they were all of the same color one filament was drawn through the stirrup in each heald and one passed between each pair

of healds. If there were to be various colors in the warp, filaments of different shades were passed through the stirrups and between the healds according to the taste of the weaver. At one end, which will be called the outer or farther end, the filaments were gathered together into a knot and made fast to some fixed object answering to the yarn beam of a loom. The other end, which will be called the inner or proximal end, answering to the cloth beam of a loom, contained that portion of the fabric which, when finished, was rolled on a stick that lay against the breast of the weaver and was secured by a strap passing around the body and buttoned to the ends of the cloth beam. Sometimes the inner ends of the warp were merely held in the left



Figs. 2 and 3.

MASQUAKIE HEDDLE FRAME AND SHUTTLE.

Cat. Nos. 205262 and 176680, U.S.N.M. Collected by W J McGee.

hand of the weaver. In any case, they were secured to some movable object which allowed the weaver to increase or decrease the tension at will.

THE PUEBLO HEDDLE.

There is among the Zuñi Indians a style of setting up the warp of a belt or garter for heddles of this class, which relates the frame to the Indian blanket loom. The warp is one continuous yarn wound round and round two cylinders, one resting against the soles of the weaver's feet, the other attached to her body by a strap which passes behind her back, its ends buttoning over the ends of the inner cylinder. In the use of this device the warp is loosened or tightened by moving the feet or inclining the body, the most pliant, delicate, and responsive tension device.¹ (Plate 1.)

When the woman and her loom apparatus were set up for work, she raised or lowered the heddle with one hand. The warp filaments which passed through the stirrups in the healds, being fixed in their places, were by this movement raised or lowered with the frame, but the alternate threads which passed between the healds remained steadfast and straight. Whether the frame was raised or lowered, a "shed" was formed in the warp; the weaver then passed through this "shed" a simple bobbin or shuttle, often a rod with the weft woven on it, after the manner of a kite string, containing the weft or wool filaments, usually of white thread and quite fine. When the weft had been passed through this "shed" between the heddle frame and the body of the weaver it was beaten home by means of the shuttle or with a separate tool, as among the Zuñi, or by the weaver's finger. This completed one weft.

The alternate warp series were then brought to the top or depressed, and a second "shed" formed. The shuttle was passed back through this "shed" and the weft again beaten home. If a pattern was to be wrought, the shuttle was not passed through the "shed" as described, but worked, as in darning, through a certain number of the upper warp threads each time before a new "shed" was made.

THE FINLAND HEDDLE.

In 1893, Consul-General John M. Crawford sent to the U. S. National Museum, from Helsingfors, in Finland, two specimens of this type of heddle, one of which resembles in general features those described, while the other (fig. 4) is very suggestive of the type found in the pueblos of southwestern United States, to be later studied (fig. 5).

¹ Washington Matthews, *Navajo Weavers*. Third Annual Report of Bureau of Ethnology (1884), pp. 371-378.

Each of these specimens is carved out of a single piece of wood, and in each one the framework above and below is much thicker than the healds. Fig. 4 has eighteen healds in all and seventeen long slits between them. The specimen is 8 inches long and $5\frac{1}{2}$ wide. The upright bars are whittled into a roundish shape, so as to present no sharp corners to the work. The top of the framework is carved out into the form of a ring used both in handling the apparatus and for suspending it when out of use. In fig. 5 the upper and lower margins are cylindrical in form, like the back of a comb, the middle parts corresponding to the teeth. In outline this example is nearly square, being about $5\frac{1}{2}$ inches broad and high. Accompanying this specimen of Consul-General Crawford's was a shuttle for carrying the weft. It is a thin piece of wood, parallel-sided, except a slight constriction at the middle, with a wide notch at either end for holding the weft filament; the edges are sharpened for driving home the lay. It also has a perforation through one end for the purpose of suspension.

With these frames were a number of belts and garters woven in such apparatus, which exhibit in their patterns the manner of producing diaper effects on the surface. In plain weaving, it will be recalled, the shuttle is passed backward and forward on the "shed" produced by the vertical motion of the heddle, and as soon as the weft is passed the shuttle becomes a batten for driving it home. But whenever the weaver desires to produce other effects than plain weaving, it is necessary to count off from the upper threads at each excursion of the shuttle such numbers of warps as are necessary, and to use a batten stick or her fingers in forming the secondary "shed" and in driving home the weft. This custom also appears in other places, to be mentioned farther on. In each instance, the patterns on Plate 2 are in pairs, showing the two sides of the fabric and the effects of the special secondary treatment of the warp by counting. There is thus to be seen in these patterns a good example of primitive arithmetic (Plate 2). Attention is especially called to the fact that along with this type of heddle in the Crawford collection there came a loom for weaving

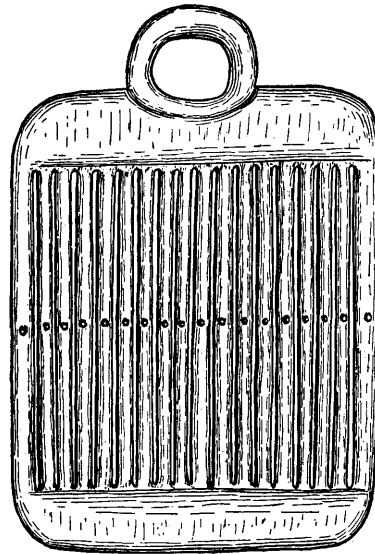


Fig. 4.

HEDDLE FROM HELSINGFORS, FINLAND.
Cat. No. 167839, U.S.N.M. Collected by Consul-General John M. Crawford.

coarse hemp cloth. This apparatus coincides precisely with the common hand loom seen over Europe and the United States. Just as in New England and in New York the country folk were making cloth and tape with primitive apparatus only a generation back, so in Finland the same practices yet survive. Helsingfors lies at the northern end of the Baltic Sea, and it is only a short journey thence to northern Germany, where the little heddle frame will next be found. It doubt-

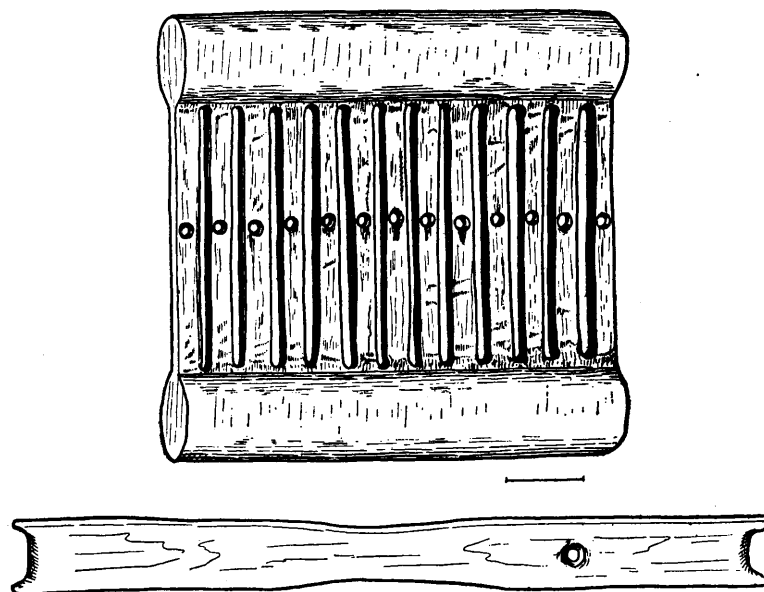


Fig. 5.

HEDDLE FROM HELSINGFORS, FINLAND, WITH SHUTTLE.

Cat. No. 167837, U.S.N.M. Collected by Consul-General John M. Crawford.

less traveled northward, acquiring a new name at every landing, but its structure and function have undergone little change. The patterns at Helsingfors are more primitive.

GERMAN HEDDLE FRAMES.

The next example takes the student to the town of Saalfeld, Königsberg, in east Prussia. It was presented to the U. S. National Museum by Mrs. Elizabeth Lemke, who says that it is a common apparatus among the people. There are twenty bars or healds in this example, and nineteen slits between. The frame is $14\frac{5}{8}$ inches long, and $8\frac{1}{4}$ inches wide. The healds are $8\frac{3}{4}$ inches long, giving to the warp thread a wider excursion up and down. This specimen is made from a thin pine board finished in a planing mill, and is three-eighths of an inch

thick, without ornaments. The upper part is rounded and has a projecting handle, as in old-fashioned school slates.

The shuttle is of hard wood and resembles the form of a netting needle which has a deep, rectangular notch at one end and a slitted point at the other end opening into an eye, in the middle of which stands a pointed spindle. This specimen, like all those before mentioned, hangs free on the warp, and the "sheds" are made by moving the heddle up and down while the warp is stationary at both ends (fig. 6).

Example No. 176321, in the U. S. National Museum, is also from Saalfeld. It is made of a thin piece of plain board, and there are sixteen healds and fifteen slits or spaces between the healds. The apparatus is $19\frac{1}{4}$ inches long, 8 inches wide, and nearly one-half an inch thick, rounded at the upper end, and cut out to form a hand hold or grip. The saw cuts are roughly made, and the holes have been burned through with hot wire.

The shuttle is a small seine needle, not slitted at the point, but having a projecting spindle in the eye at the pointed end and a deep notch in the other, as in the common seine needle. In this example the shuttle contains white weft thread or twine; the warp filaments are alternating brown, blue, white, and red threads. The shuttle serves also for a batten to beat the weft in place.

Accompanying this apparatus is a device used in winding off the warp and giving to its filaments the correct length (fig. 7). It is a piece of hard wood, heart-shaped, with a pointed base to fit in a socket and a pointed spool above to hold the yarn.

In the Museum of the Society for Pomeranian History and Antiquities, in Stettin, are three heddles or weaving boards of the type now being considered. Each was collected in Further Pomerania, where the apparatus is called the "deska," as it is also known in Cassubisch dialect. It is in use up to the present day, but among the surrounding German population throughout the whole of Pomerania, so far as information goes, it is unknown. The oldest one (fig. 8) measures 4 inches in width and 7 inches in length, is carved out of a single piece of wood, and has nine long openings between the healds which, through many years of use, have become worn away. These openings or slits are 3 inches long and 0.2 inch broad. There are ten perforations for warp

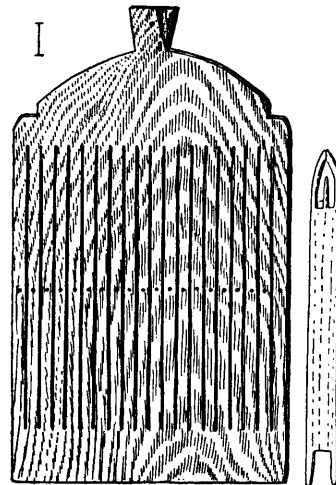


Fig. 6.

HEDDLE AND SHUTTLE, FROM SAALFELD,
EAST PRUSSIA.

Cat. No. 17642 a, U.S.N.M. Collected by
Elizabeth Lemke.

threads, the outer two being through the sides of the frame itself. The upper margin of the board is cut out in figures or patterns quite similar to those on the Schoolcraft specimen. In addition to these openings, the surface is covered with carvings.

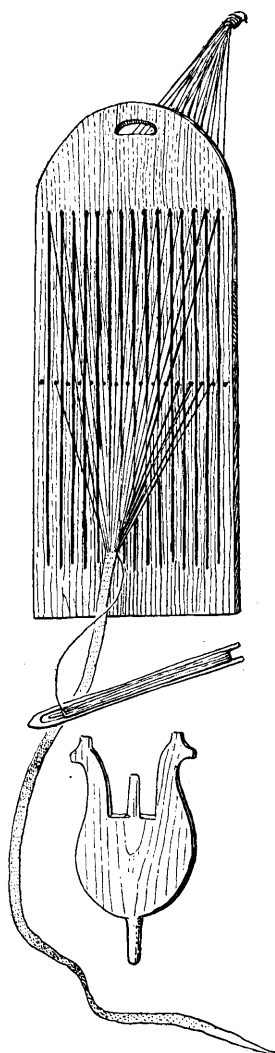


Fig. 7.

HEDDLE AND SHUTTLE, SET UP FOR WEAVING, ALSO WARP HOLDER.

Sraalfeld, East Prussia.

Cat. No. 176321, U.S.N.M. Collected by Elizabeth Lemke.

The second example (fig. 9) is rather rudely made of board. It is 5 inches broad and 8 inches long. Counting the sides of the apparatus, there are fourteen healds, perforated in the middle, through which warp threads pass, and thirteen slits or openings between these, all $4\frac{1}{2}$ inches long and 0.2 inch broad. The upper part of the board has three heart-shaped perforations, a serrated border, and a loop, used for moving the heddle up and down or for hanging it up when not in use.

A third example, having no ornamentation, is $5\frac{1}{2}$ inches long and 8 inches broad. It has eighteen openings, 4 inches long.¹

The lack of definite information concerning the precise origin of the Schoolcraft specimen (fig. 1) and that of the Sauk or Masquakie Indians of central Iowa, collected by Mr. W. J. McGee, makes it difficult to inquire into the German origin of the Algonquin specimens. It must be noted, however, that the ornamental carvings at the top are alike in the two types. Furthermore, it must not be assumed that the specimens in the U. S. National Museum exhaust the geographic distribution of this type of apparatus. Quite the contrary. It would be surprising to find that it had no use in England and France in the Colonial period.

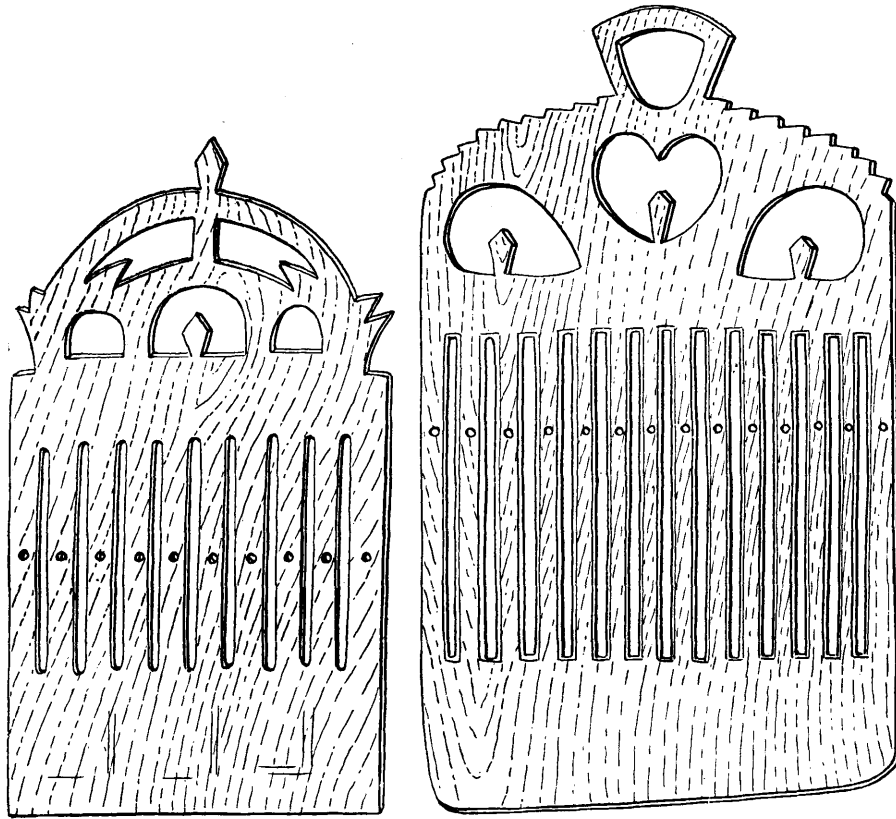
ITALIAN HEDDLE FRAMES.

In the U. S. National Museum is a heddle frame from the town of Siena, south of Tuscany, Italy, collected by Dr. G. Brown Goode. Unfortunately, material is lacking in all the area between east Prussia and Tuscany.

Furthermore, it will be seen that the inventor has been at work more than once to transform the Cassubisch into the Tuscan specimen

¹Upon the Cassubic population of Farther Pomerania see *Baltische Studien*, by Dr. C. A. Hass, pp. 33-368, and *Blätter für Volkskunde*, IV, pp. 51-81.

(fig. 10). It consists of eleven strips or healds of walnut wood $5\frac{1}{4}$ inches long, one-fourth inch wide, and one-twelfth inch thick, each perforated in the middle for a warp filament. These slats are set into grooves in a rectangular frame $6\frac{1}{2}$ inches long and $5\frac{5}{16}$ inches wide; the frame itself is three-fourths inch wide and five-sixteenths inch thick. It accommodates twenty-three warp filaments and belongs to the second class of heddles before mentioned, in which the heddle



Figs. 8 and 9.

HEDDLES FROM STETTIN, NORTH GERMANY.

In Museum of the Society for Pomeranian Antiquities.

is stationary and the weaver raises and lowers the inner end of the warp. This specimen is set up, with considerable mechanical accompaniment, on one end of a box that is $7\frac{3}{4}$ inches long and $5\frac{1}{4}$ inches wide. On the other end is an upright frame in which works a revolving yarn beam, a feature copied from the ordinary hand loom.

There is also in the U. S. National Museum a facsimile of this example, from Lancaster, Pennsylvania, the center of the Teutonic

population called the Pennsylvania Dutch. The framework, or heddle frame, has thirty-one healds or upright bars, perforated, and thirty-two slits, in all accommodating sixty-three warp threads of various colors. The ordinary yarn beam is replaced in this example by a reel, on which the warp is distributed. This reel is held fast by a stick pushed through between the spokes of the reel and resting against the upright posts which support the shaft. By removing the stick additional warp may be unwound (fig. 11). Still more rude is another example in the U. S. National Museum, probably from Pennsylvania, consisting of a heddle frame cut out of a thin piece of board one-eighth inch thick. Provision is made for twenty warp threads, by means of ten healds and ten slits. On one margin of the frame the outer portion is perforated and on the other side it is not. This upright is nailed in the end of a very rude box, having a bottom and two sides but no ends. The box is 2 feet long. At the rear portion, on either side, a post is fastened, and in this a reel, on which the yarn is wound. The structure is similar to that of the Italian specimen and to others from Pennsylvania, but this is the rudest example of the kind in the Museum.

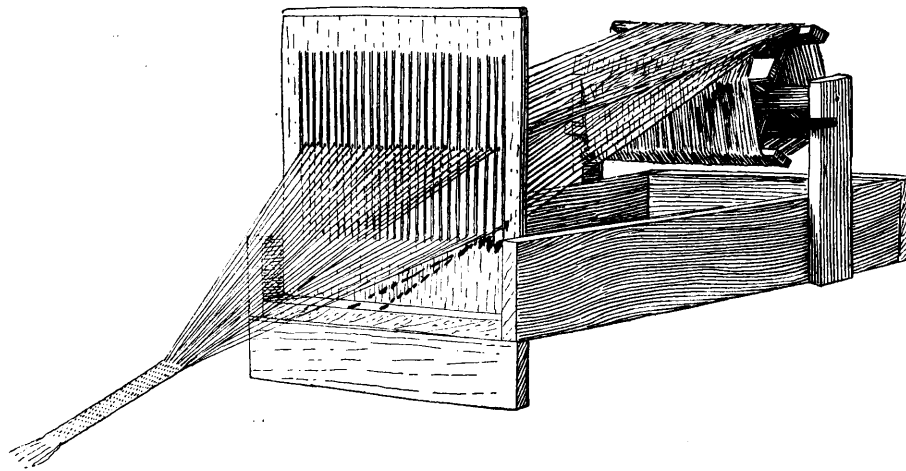
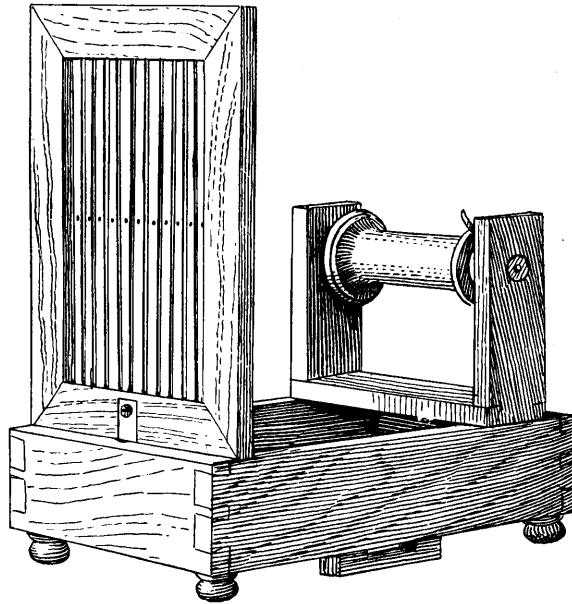
NEW ENGLAND HEDDLE FRAMES.

The writer is greatly indebted to Mrs. Alice Morse Earle, author of the charming work on *Life in Colonial Days*, for a photograph of a loom belonging to this stationary type for making silk braid, from Long Island, set up and in operation. The furniture of the room and the costume of the weaver are all in harmony with the instrument itself, and reproduce, as nearly as possible, the time in which these heddle frames were in common use throughout New England and the Eastern States. There is room for thirty-three warp threads, though it is possible to weave with a smaller number. Mrs. Earle, after speaking of the large, home-made looms seen in all thrifty New England houses, makes the following observation on the heddle frames:

Smaller looms, called tape looms, braid looms, belt looms, garter looms, or "gallus frames," were seen in many American homes, and useful they were in days when linen, cotton, woollen, or silk tapes, bobbins, and webbings or ribbons were not common and cheap, as to-day. Narrow bands, such as tapes, none-so-pretty's, ribbons, caddises, ferretings, inkles, were woven on these looms for use for garters, points, glove ties, hair laces, shoe strings, belts, hatbands, stay laces, breeches suspenders, etc.¹

In 1894 the author visited the town museum in Bristol, Connecticut, and saw two specimens of the second type of heddle apparatus, one of which was given to the U. S. National Museum, and is here figured (fig. 12). It will be recalled that in this type the heddle is fixed and the weaver moves the inner or cloth end of the warp up and

¹ Alice Morse Earle, *Home Life in Colonial Days*. New York, 1898, p. 225.



Figs. 10 and 11.

HEDDLES FROM SIENA, ITALY, AND LANCASTER, PENNSYLVANIA.

Set up in a box, with yarn beam and other loom attachments.

Cat. Nos. 164841 and 175639, U.S.N.M. Collected by G. Brown Goode.

down to form the sheds. A note with reference to these specimens was inserted the next day in the Hartford Courant, and as a result replies were received from various quarters, calling attention not only to the existence of other examples, but mentioning the names of women who in their early days had practiced weaving tape, fanciful hatbands, garters, and other narrow ornamental fabrics on them. It

became evident that a device which at first seemed to have been invented by American Indians was not known to them prior to Columbus, but had crept into savage hands from the folk craft of early white settlers.

Specimen No. 169078, in the U. S. National Museum, is a heddle frame presented by Roswell Atkins, of Bristol, Connecticut, of the seventh generation of this family in the United States. It is made of a piece of pine board three-fourths of an inch thick. The upper end is sawed into fourteen healds, and each of them is pierced for a warp thread, making room for twenty-seven warp threads. At the top, the healds are held in place by two battens which clamp the upper ends. The bottom is chamfered to be held between the knees by a person sitting in a chair (fig. 12). This is a very primitive specimen of this class of heddles, and serves to illustrate their popularity in folk industry. There is nothing about this piece that is above the skill of the untutored farm boy with a common saw and awl and hammer; the lower portion is not even rounded out to fit the limbs of the operator as seen in other figures.

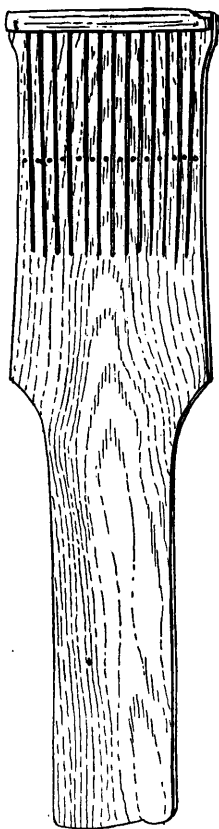


Fig. 12.

HEDDLE FRAME FROM BRISTOL, CONNECTICUT.

Cat. No. 169078, U.S.N.M. Presented to the National Museum by Roswell Atkins.

Specimen 175641 in the U. S. National Museum is a heddle frame from Bristol, Connecticut, made from a thin board of maple wood. The upper portion consists of twenty-two healds $8\frac{3}{4}$ inches long, sawed out from the top as in fig. 14 (fig. 13). These, together with twenty-one spaces, provide for forty-three warp filaments, and this portion of the apparatus is 9 inches wide. The tops of the healds fit in a groove of a rectangular block of oak which furnishes a framework to the upper border. On opposite sides, at the bottom of the healds, are riveted semicylindrical strips of the same material, strengthening the apparatus at that point. The continuation downward of this upper or working part forms a base 17 inches long, cut out in a pattern resembling a vase or lamp stand. This stand is inserted in a groove

at the end of a piece of oak wood and held fast by wooden pegs. Finally, the oak piece is firmly set in and mortised into a heavy block of wood which acts as a foot to the apparatus.

This specimen belongs to the class of stationary heddle frames as in the example from Siena, Italy, and from Lancaster, Pennsylvania. The specimens from Maine and Connecticut, held between the knees of the operator, really belong to the same type.

Mrs. F. R. Post, of Hebron, Connecticut, has one of these heddle frames cut out of a single piece of wood, on which her grandmother when young used to weave garters, etc., for her mother and her sisters, and her mother has also used it.

The warp was laid off in proper lengths by being wound around chairs, run through the holes in the healds and between slats; the outer ends were tied together and fastened to some object and the inner ends were held in the hand of the weaver. The weaver held the heddle between her knees by means of the projecting lower part or handle, and taking the inner ends of the warp in one hand, she raised and lowered it alternately. The slats allowed the warp to spring the same as the harness in a loom. The filling was put in with her other hand by means of a simple shuttle, and beat up with one finger. (Compare fig. 14.)

Mrs. Louise G. Strong, of Colchester, Connecticut, also sent to the U. S. National Museum models, in cardboard, of these primitive hand looms, and with them two specimens of work done thereon. The first specimen is tough white linen tape one-fourth of an inch wide, used in old country houses for making loops on towels and other fabrics to hang them up. The other example is in worsted; the warp is a series of black, green, red, olive, and blue worsted thread; the woof is a salmon-colored worsted thread, but it is invisible on the surface of the fabric, the warp having been driven hard home, so as to give a twilled effect.

Mrs. Strong says that the loom on which these were woven was used in her family eighty years ago for making substantial fabrics, but more especially as a pastime for young women.

Mrs. O. D. Nott, of New York, writes that her grandmother, living in the little village of Milton, Litchfield County, over sixty years ago, used a loom to make tape for apron strings. It was a very simple affair, operated as follows: One end of the warp threads was fastened to some stable object to hold them firm; the other ends were held in the left hand, and by raising and lowering them the "shed" was formed, through which the filling or weft was inserted. In a cardboard model given to the U. S. National Museum are five healds and six spaces. The woof in this example is not even wound on a shuttle. The fabric being very narrow, a small reel or bobbin was sufficient for the work, the lay being beaten home with the forefinger.

Specimen 175640 in the U. S. National Museum is a heddle frame

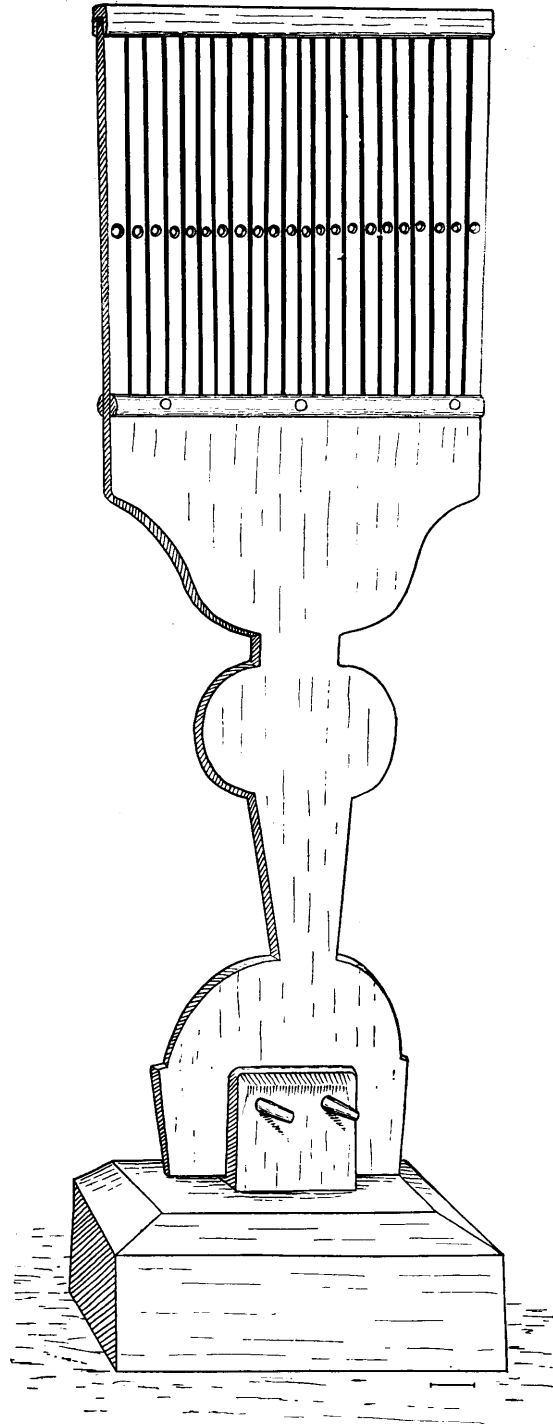


Fig. 13.

HEDDLE FRAME FROM BRISTOL, CONNECTICUT.

On solid base connected by an ornamental leg.

Cat. No. 175641, U.S.N.M. Collected by A. W. Williams and G. F. Richards.

from Auburn, Maine, collected by Mr. H. C. Merrill. It is formed from a piece of white pine board one-half inch thick, and has eighteen heddle dents. There is no crosspiece at the top, the working portion being formed by seventeen saw cuts 10 inches long, dividing the upper portion into parts like the teeth of a comb, each part one-half inch wide. On both sides the angular edges of the upright parts have been whittled away so as to facilitate the passing of the threads. The holes for the warp threads have been rudely perforated and their outer extremities whittled. The lower part of the apparatus, $8\frac{1}{2}$ inches long, has concave sides to facilitate holding it between the knees of the operator (fig. 14).

It is quite possible that examples might be found in northern New England States. The form in which the heddle made of a single piece of board is prolonged to be held between the weaver's knees or to be set in a block of wood on the floor is peculiar to New England, so far as the U. S. National Museum collection testifies.

PATENTED HEDDLE FRAMES.

As the climax of this type of the stationary heddle frame, attention is now called to the United States patent No. 334320, granted in 1886 to Eugenia Wernicke, a subject of the King of Prussia, residing at 7 Besselesstrasse, Berlin.

In the Wernicke patent the heddle frame, in the drawing, shows twenty-seven healds made of wire or cord, with stirrups in the middle. The shuttle for holding the thread is a seine needle lenticular in cross section, tapering at its extremities, and provided at each end with an eye. Other attachments to this device form part of the patent, namely, for holding the warp in good shape, so as to secure uniformity of width in the textile; clamp for holding the apparatus to the table, etc., all unimportant in this place, the principle of operation being the same as in those previously described from Germany and other parts of Europe.

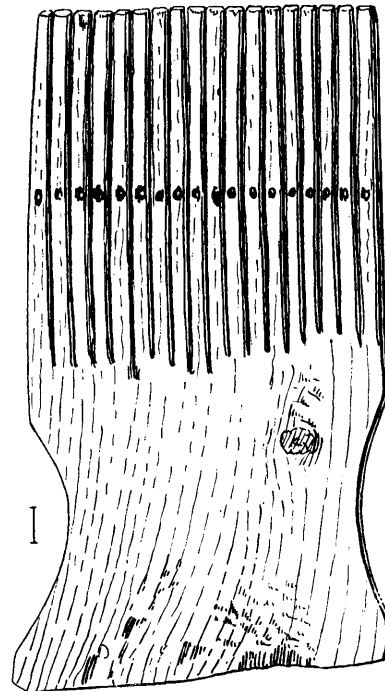


Fig. 14.

HEDDLE FROM MAINE, WITH HEALDS DISCONNECTED AT THE TOP.

At the bottom a footing is cut in to fit the knees of the operator.

Cat. No. 175640, U.S.N.M. Collected by H. C. Merrill.

The language of the claim is as follows (Plate 4):

I claim as new:

(1) The combination, with a holder for one end of the warp threads, a clamping device for securing said holder to a fixed support, and a holder for the other end of the warp threads, of one or more bars adapted to be inserted in the warp, to serve as a guide against which the weft is beaten up, a heddle frame constructed to be held in and operated by hand, and a shuttle, also constructed to be operated by hand, said devices constituting a hand-weaving apparatus, substantially as described.

(2) The combination, with a fixed support for one end of the warp threads and a free support for the other end of said warp threads, of one or more bars adapted to be inserted in the warp, to serve as a guide against which the weft is beaten up, a heddle frame constructed to be held in and operated by the hand, substantially as and for the purpose specified.

(3) The combination, with a fixed support for one end of the warp threads and a free support for the other end of said threads, of one or more bars adapted to be inserted into the warp and to serve as a guide against which the weft is beaten up, a heddle frame constructed to be held and operated by hand, and a shuttle of lenticular form in cross section, operated by hand to pass the weft thread through the warp and for beating up the lay, substantially as described.

(4) The holder or clamping device for one end of the warp thread, consisting of the clamping bars 1, 2, 3, the latter being provided with a screw clamp or clamping bracket (B), and the screws (s), said parts being constructed for operation substantially as and for the purpose specified.

(5) The heddle frame consisting of a rectangular frame (H), the upper crossbar (h¹) of which is provided with a groove in its under side, and the lower crossbar (h²) with an offset in combination with the rack bars (h), rectangular in cross section, the healds (H¹), the stirrups (e), the locking bar (L), and locking latches (l) substantially as and for the purpose specified.

(6) The herein described shuttle (S), the body of which is of lenticular form in cross section, having slitted points (s⁴), the slit of which terminates in an eye (s²), substantially as and for the purpose specified.

HEDDLE FRAMES FROM THE PUEBLO REGION.

This interesting region occupies the valley of the upper Rio Grande, the Territories of New Mexico and Arizona, and also portions of southern Utah, southern Colorado, southern California, and northern Mexico. It was first invaded by Spaniards when Cabeza de Vaca crossed it in 1536, and visited by Francisco Vasquez de Coronado in his expedition to search for the Seven Cities of Cibola in 1540. After this the region was occupied by Spanish settlers, sheep were introduced, and weaving in machines began. Some of the rude mechanical appliances of this class existed there doubtless before of Mexican type, since in the ancient ruins and cave dwellings textile fabrics of excellent quality are found. But no relic has, up to this time, been exhumed which connects the heddle frame here described with anything earlier than the Spanish occupation, nearly 400 years ago.

The most interesting part of this study, however, is a large collection of heddle frames from the pueblo region of the United States for weaving garters, belts, and other narrow ceremonial fabrics, sometimes in plain color, more commonly in stripes and diaper effects in

different colored warps, quite similar to those of the Finlanders (Plate 5). A number of sections of reed or split mesquite sticks are laid parallel, as in the batten of the ordinary loom. These are fastened at their ends on two parallel sticks, which constitute the framework, whose length depends upon the number of warp threads to be inserted in the garter or belt.

An interesting feature in the structure of many of these pueblo heddles is the occurrence of the wooden cross piece at the upper part, on the opposite side from the cross piece at the bottom. When one of these heddles is held perpendicularly in the hand, if the upper cross stick is on the side next to the eye, the lower one will be on the outside away from the eye (fig. 15).

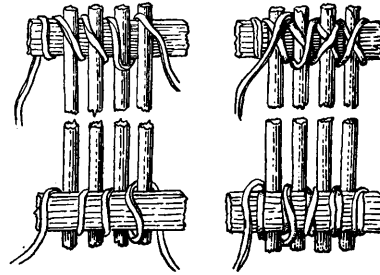


Fig. 15.

SKETCHES SHOWING METHOD OF ATTACHING THE HEALDS TO THE CROSSBARS IN PUEBLO HEDDLES.

The Algonquin Indians sit upon the ground at their work; so do the pueblo tribes. Hence the free-swinging heddle is more convenient for them. The same may be true of the east German types. Fig. 16

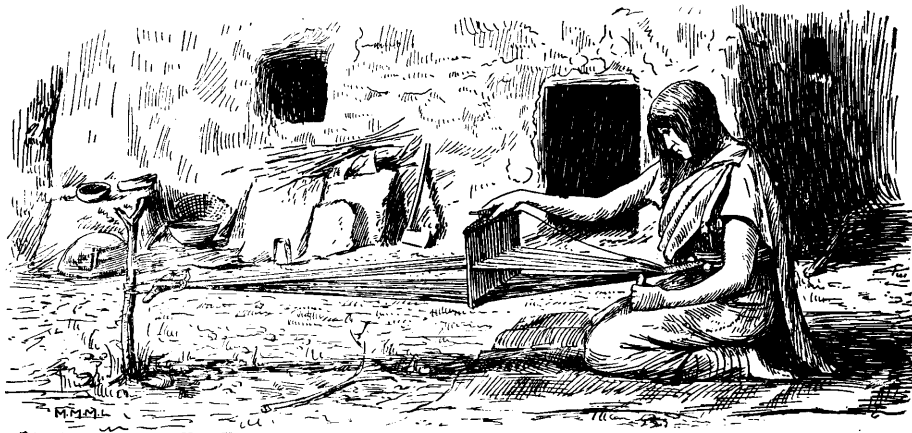


Fig. 16.

PUEBLO WOMAN SITTING ON THE GROUND AND WORKING HEDDLE IN WEAVING A BELT.

shows the attachment of the warp to the cylindrical stick in front of the weaver, which by courtesy may be called the primitive "cloth beam." It is held in place by a strap around the back, buttoned on the end of the roller, serving also as a roller for the finished work. The method of administering the heddle and the batten is clearly exhibited (fig. 16).

This pueblo series is of such importance that the typical forms will be more minutely described, and a table given of all the specimens so as to bring out the characteristics which they have in common and those which serve to differentiate them.

Specimen No. 176704 in the U. S. National Museum is a rude heddle frame from Zuñi, New Mexico, collected by Frank Hamilton Cushing (fig. 17). The crossbars of twig are $6\frac{3}{4}$ inches long, and there are sixteen healds, $4\frac{1}{2}$ inches long, laid parallel, with their ends on the same side of the crossbars; these are made of little sticks rudely whittled out, notched at their ends and fastened to the crossbars by

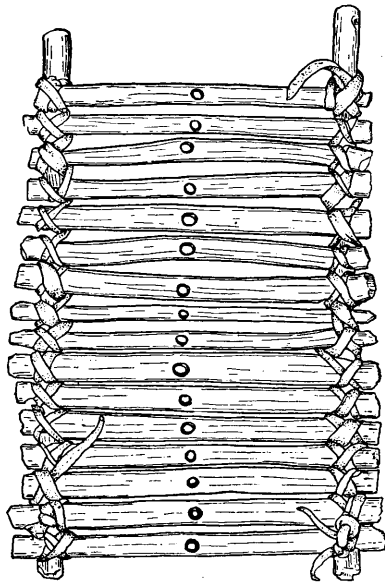


Fig. 17.

RUDE ZUÑI HEDDLE FRAME FOR NARROW GARTER.

Cat. No. 176704. U.S.N.M. Collected by F. H. Cushing.

means of a rawhide lashing. The holes, or dents, or stirrups in the healds are rudely gouged out and punched through. The whole apparatus is so clumsily put together that it gives the impression of a child's heddle for practicing. It is inconceivable that good work could be done with such a utensil, and yet the Zuñi have no better. Only thirty-one warp threads could be used in this heddle. One can not always be sure that the objects obtained from modern Indian tribes have seen actual service. As soon as things are known to be desirable, they are forthcoming. In the best made Zuñi heddles the crossbars are on alternate sides.

Specimen No. 41666 in the U. S. National Museum is a heddle frame from Zuñi, New Mexico, collected by Maj. J. W. Powell. The crossbars, of wood, are 28 inches long.

There are ninety-four healds of small reed, $5\frac{3}{4}$ inches long, and these are attached to the crossbars by the usual lashing of rawhide thong, supplemented by wrappings of yellow yarn. The excursion of the loose warp filaments is $4\frac{1}{4}$ inches up and down. The holes or stirrups through the healds have been bored with hot wire; indeed, in all of the old specimens this seems to have been the method of piercing the healds or of finishing off the stirrups (fig. 18).

It is noteworthy that in the examples presented from the different States of the Union, from Finland, Germany, and Italy, the heddle frame, with its healds, is carved or sawed out of a single piece of wood, or the healds are set in a groove which corresponds with the crossbar

of the Zuñi loom, but in all the looms of the Southwest the healds are lashed to crossbars.

Specimen No. 165534 is a small batten frame or reed from Guadalajara, Mexico, collected by P. L. Jouy. It consists of sixty-four "reeds" made of bits of flat iron, somewhat like those of a small clock spring. These are set at the top and bottom between two semicylindrical bits of wood and held in place by half-hitches of twine, which not only hold fast the reeds, but also give uniform spacing for the warp. The collector says that "it is used for separating the threads of the warp in weaving the 'rebozos' or ornamental head shawls," universal throughout Latin America (fig. 19).

At the side of this frame upright pieces are set in between the ends of the crosspiece and held in place by lashing. There are no dents or stirrups in this piece, so that it could not in any way have been used as a heddle or harness, but simply as a reed in beating home the weft. The noticeable feature is the method of attaching the upright iron portions to the crossbars, which is very similar to that used by the Zuñi in attaching the healds to their heddle frames.

Example No. 166694 in the U. S. National Museum is a heddle frame labeled Moki or Tusayan, collected by Mr. James Mooney. The frame sticks are $22\frac{1}{4}$ inches long. There are eighty-two healds of reed and eighty-one spaces, so that there is in all provision for one hundred and sixty-three warp threads. The healds are $8\frac{3}{4}$ inches long, giving an excursion to the warp threads of 7 inches; at their upper and lower ends they are laid on different sides of the crossbars, so that in looking at the apparatus the crossbar will be on the side of the eye, and the other will appear behind the ends of the healds.

As before remarked, there are a great many specimens made in this way, although there are others in which the crossbars are both on the same side of the healds as in a gate. The ends of the healds are attached to the crossbars by a peculiar kind of lashing, in which the twine or filament crosses itself over the healds and lies in somewhat parallel lines on the sides of the crossbars (Plate 6).

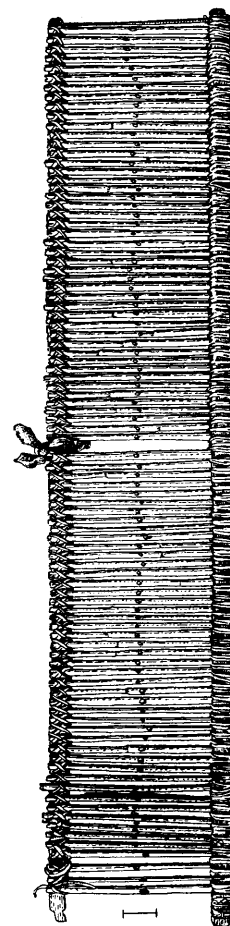


Fig. 18.

HEDDLE FROM ZUÑI.

Showing the healds on alternate sides of crossbars.

Cat. No. 41666, U.S.N.M. Collected by J. W. Powell.

PUEBLO HEDDLES OF VARIOUS SIZES.

Collection of heddles from pueblos, marked Zuñi in the catalogue, but the location is not definitely known. The apparatus is more common at Moki.

Plate 7, fig. 1. Crossbars, rectangular strips of wood with notches cut on the flat side to receive the ends of the healds. This characteristic should be noted in this specimen, since it is very rare; in most examples it will be seen that the healds are laid against the

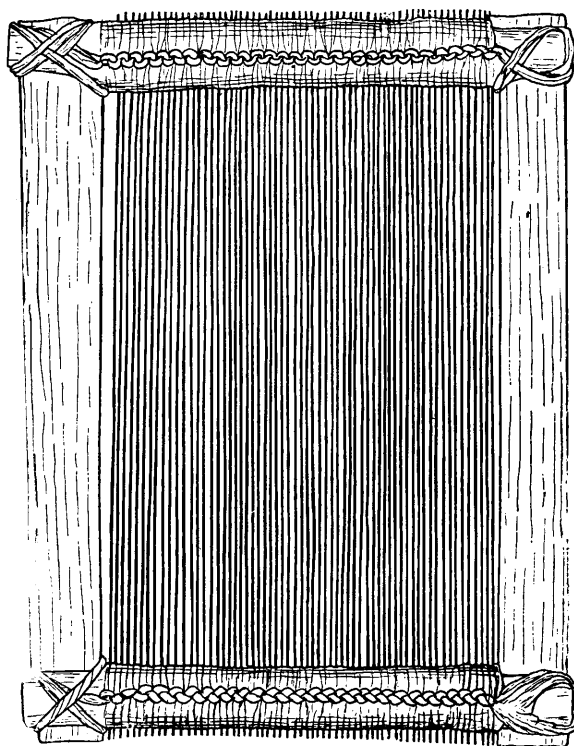


Fig. 19.

BATTEN FROM GUADALAJARA, MEXICO, ON THE PLAN OF THE PUEBLO HEDDLES.

Cat. No. 165534, U.S.N.M.

frame. In this specimen there are sixteen healds made of bits of split cane or splints of wood one-fourth of an inch wide and very thin. The ends are notched to fit into the notches cut into the crossbars and are held in place by a continuous winding or wrapping of sinew filament. The holes or stirrups, in the healds, are coarse and rudely excavated.

The healds are 4 inches long between the crossbars; the whole length of healds is 5 inches, and of crossbars $9\frac{1}{2}$ inches.

Cat. No. 127688, U.S.N.M. Collected by Bureau of Ethnology.

PLATE 7.—Collection of Pueblo heddles, marked Zuñi, but they are quite as likely to be Moki. U.S.N.M.

FIG. 2.—Crossbars of willow twigs; sixteen healds, $5\frac{1}{2}$ inches long, made of splints of wood, rudely whittled and fastened to the crossbars by wrapping of rawhide and rags. This is a very rude specimen. Length of crossbars, $7\frac{1}{2}$ inches. Zuñi, New Mexico. Cat. No. 75732, U.S.N.M. Collected by James Stevenson.

FIG. 3.—Crossbars of twig; forty healds of cane splints, $5\frac{1}{2}$ inches long, notched at either end to be fastened against the crossbars on alternate sides by rawhide string and rags. It is specially noteworthy that the ends of the bars are not opposite to each other. Zuñi, New Mexico. Cat. No. 75731, U.S.N.M. Collected by James Stevenson.

FIG. 4.—Crossbars of splints of wood, rectangular in cross section and regularly notched in on the broad side for securing the thirty-five healds which are made of thin splints of wood, $6\frac{1}{4}$ inches long, and notched at the ends and fastened to the crossbars by a lashing of leather. This specimen has the appearance of having been much used. Moki pueblo. Cat. No. 127688, U.S.N.M. Collected by James Stevenson.

FIG. 5.—Crossbars of sticks of wood rectangular in cross section; forty-four healds, the shorter ones $6\frac{1}{4}$ inches long, are fastened to the crossbars by wrapping of leather string. On either side of the middle are three groups of healds rising above the upper crossbars by a series of steps. Moki pueblo, New Mexico. Cat. No. 127688 (a), U.S.N.M. Collected by James Stevenson.

PLATE 8.—Figures of two heddles from Moki Indians, New Mexico. Collected by Mrs. Stevenson.

FIG. 1.—Crossbars of sticks, perforated for the fastening of the forty-eight healds, of split cane, 6 inches long, which are attached to the crosspieces by means of a leather string rove through the holes in the ends of the healds and through the crossbars. Both ends of each heald are on the same side of the crossbars.

This specimen is unique in the manner of attachment, since most of the healds are fastened to the crossbars by wrapping, but in this case they are sewed together by means of leather thong. Moki Indians, New Mexico. Cat. No. 127688 (b), U.S.N.M. Collected by James Stevenson.

FIG. 2.—Crossbars, one of stick, the other a flat piece of wood resembling a bow. There are eighty-nine healds, consisting of small reeds not split, $7\frac{1}{2}$ inches long, neatly wrapped at their ends with fine thread attaching them to the crossbars. The two ends of these healds, as in other best examples, are on different sides of the crossbars. The great number of healds, their neat lashing, and the position of the crossbars on different sides of the healds, mark this as a well-used and genuine example. Two reeds are broken out, and their places have been filled by woollen yarn with knotted stirrups in the middle to take the place of the holes in the healds. Moki Indians. Cat. No. 166695, U.S.N.M. Collected by James Mooney.

It has been seen already, from the plates and descriptions, that among the Zuñi and other Pueblo Indians a special batten is used for beating home the weft. In the simple tape-weaving devices in Connecticut the forefinger of the weaver is used as a batten, the shuttle serving merely to carry the warp thread back and forth through the "sheds." In the Finland examples, in those of Germany, and perhaps elsewhere, a wooden bobbin with open ends carries the warp filament, while in other examples either one or both ends of the bobbin are carved into the shape of the shuttle used in net making, and the edges of this wooden bobbin in all cases are made in the form of a knife

blade, so as to be utilized also as a batten in pushing the weft thread into place. Now, in the Pueblo examples the bobbin is a little stick on which the weft thread is wound, very much as a boy winds his kite string, into a spindle-shaped package, the ends of which pass easily into and through the "sheds." This bobbin is not used at all in beating the weft thread home, but a separate sword or batten is employed, which performs several functions. First, it takes the place of fingers in separating different series of warp threads when figure weaving is in view. After running the batten underneath those warp threads that are to appear in the figure it is revolved 90° on its axis and in this way becomes a special harness for making "sheds." Second, as a batten for beating home the weft. Third, as a help to the heddle, which does not always separate the two series of warp threads. The longer specimens are used for precisely the same purposes by blanket weavers in their looms, and in the U. S. National Museum there is, in the Ainu collection, a weaving in bark in which a very broad batten of this kind with a handle similar to some of those found in the Pueblo region is exhibited.

The specimens shown in Plate 9, are of mesquite wood (*Prosopis juliflora*) or of oak (*Quercus gambelii*). The upper example is made from a branch split and smoothed and shaped as little as possible. In the others it will be seen that there is an increasing effort on the part of the maker to secure a handle and a wider, thinner, and smoother blade.

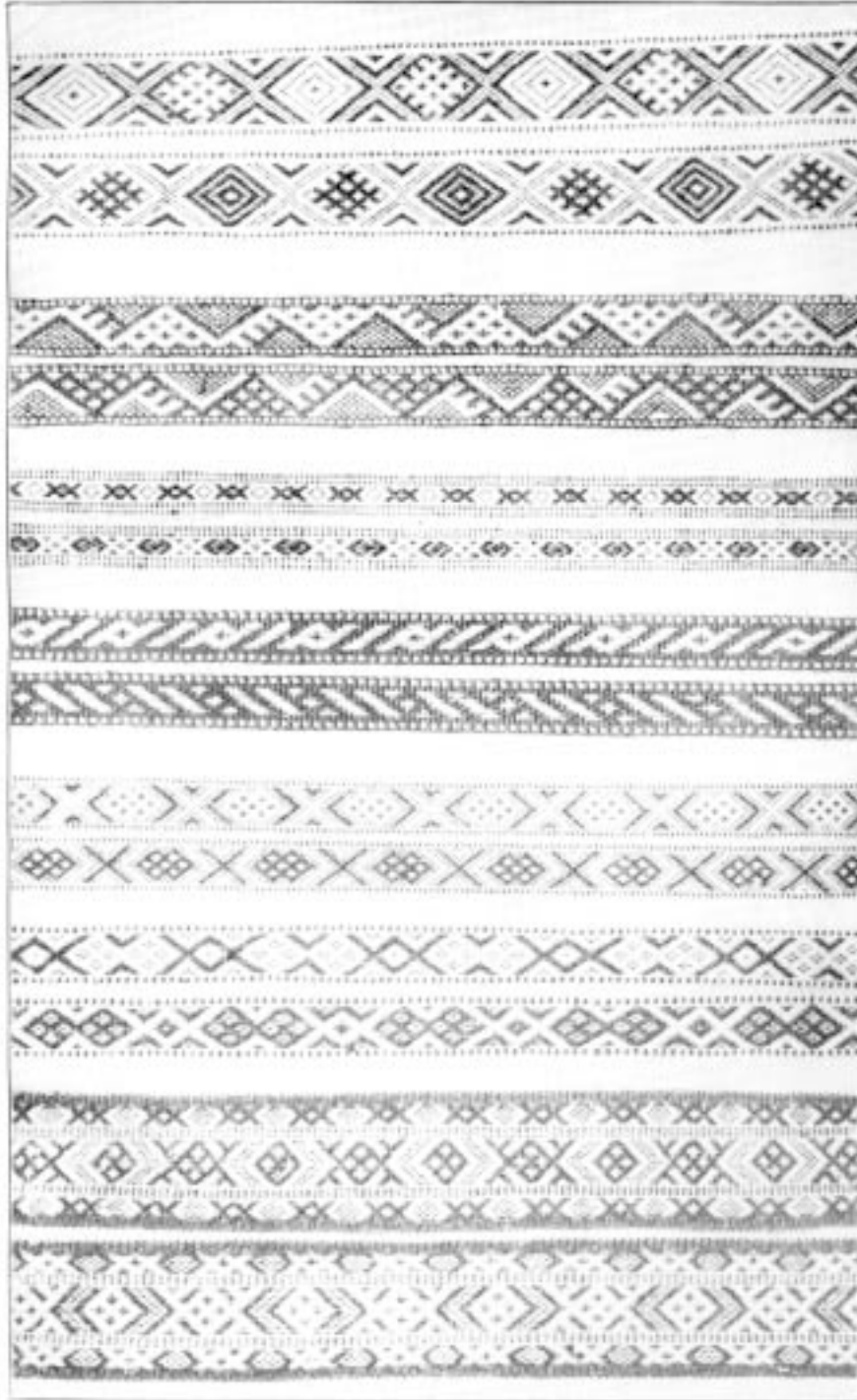
It is regrettable that the author has not been able to extend his inquiries into France and Spain. Hypothetically, the heddle frame came from Europe or southwestern Asia. The Finns, the Germans, the Sauks, and the Pueblo tribes have the free-swinging heddle frame. The New England women, who sit in chairs at their work, the Pennsylvania Dutch, and the Italians used the stationary frame, making the "sheds" by raising and lowering the inner or cloth ends of the warp.

Those weavers that sat on the ground and employed the free-swinging heddle could use a sword or paddle batten, serving to make the "sheds," to separate certain warp filaments for figure working, and for beating home the weft. Only rich patterns occur where the free-swinging heddle frame is employed. Not enough is known of the spread of this last apparatus in Europe to show the definite manner of its introduction into Iowa and the Pueblo region. On weaving with little boards in Bagdad and Mesopotamia, see C. F. Lehmann.¹

¹Verhandl. d. Berliner Gesellsch. f. Anthrop., etc., May 19, 1900, p. 299.



ZUNI WOMAN WEAVING CEREMONIAL BELT.



PATTERNS OF GARTERS AND BELTS MADE IN HEDDLE FRAMES IN HELSINGFORS.



LOOM WITH HEDDLE FRAME FOR WEAVING SILK BRAID.

(No Model.)

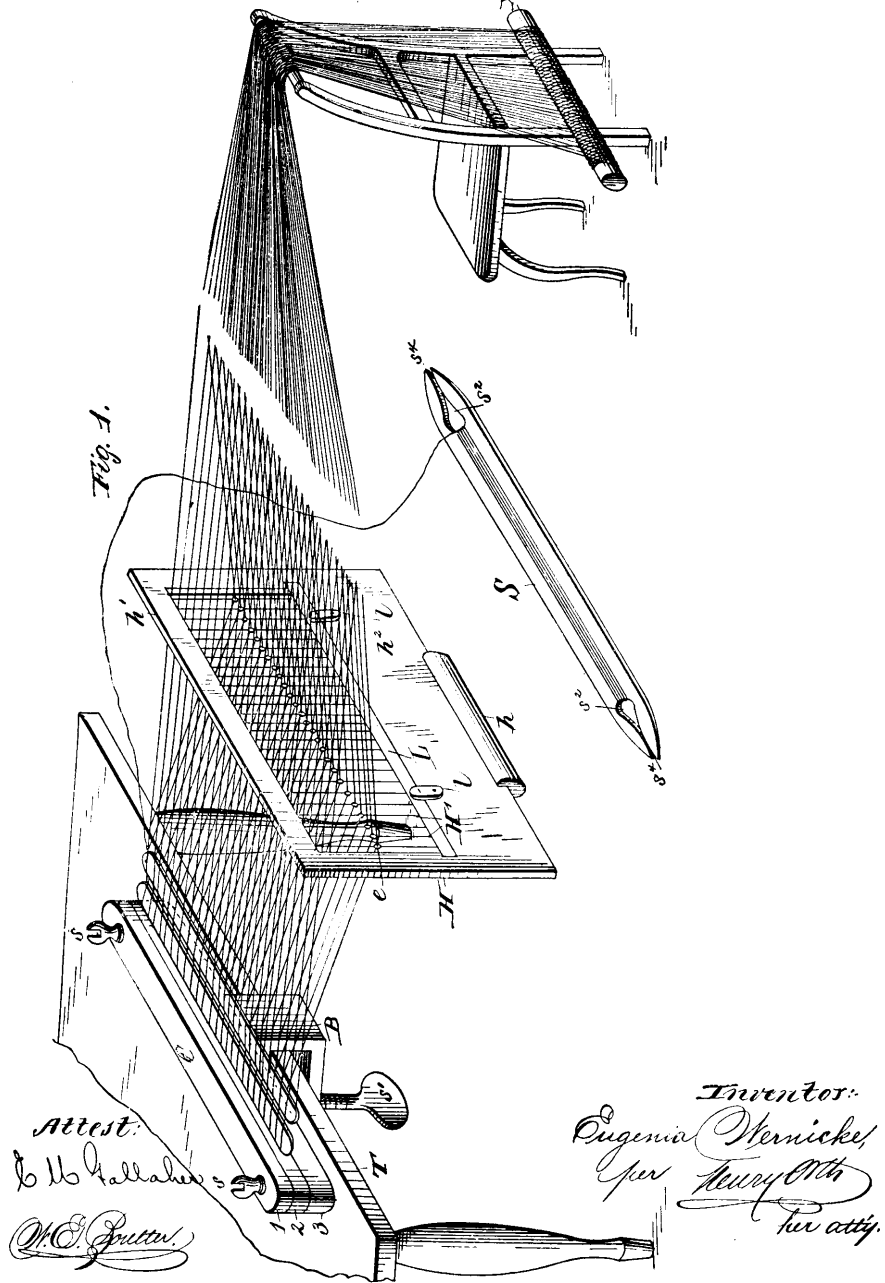
2 Sheets—Sheet 1.

E. WERNICKE.

HAND WEAVING APPARATUS.

No. 334,320.

Patented Jan. 12, 1886.

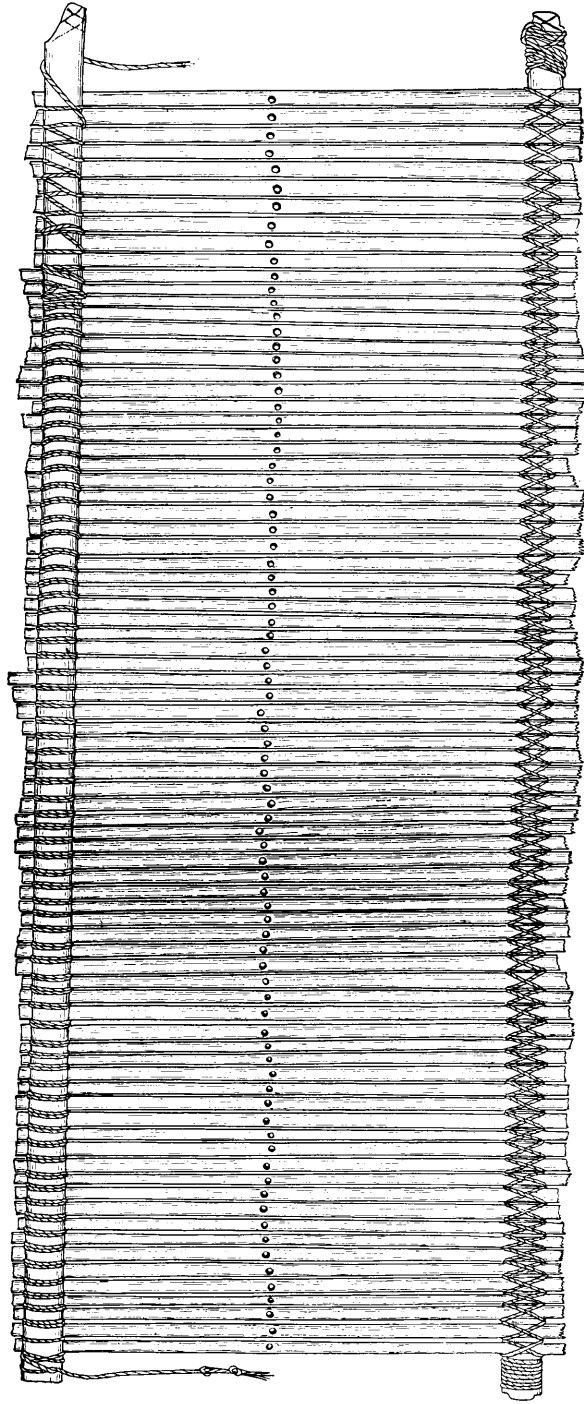


Attest:
 D. M. Hallahan
 M. C. Gutter

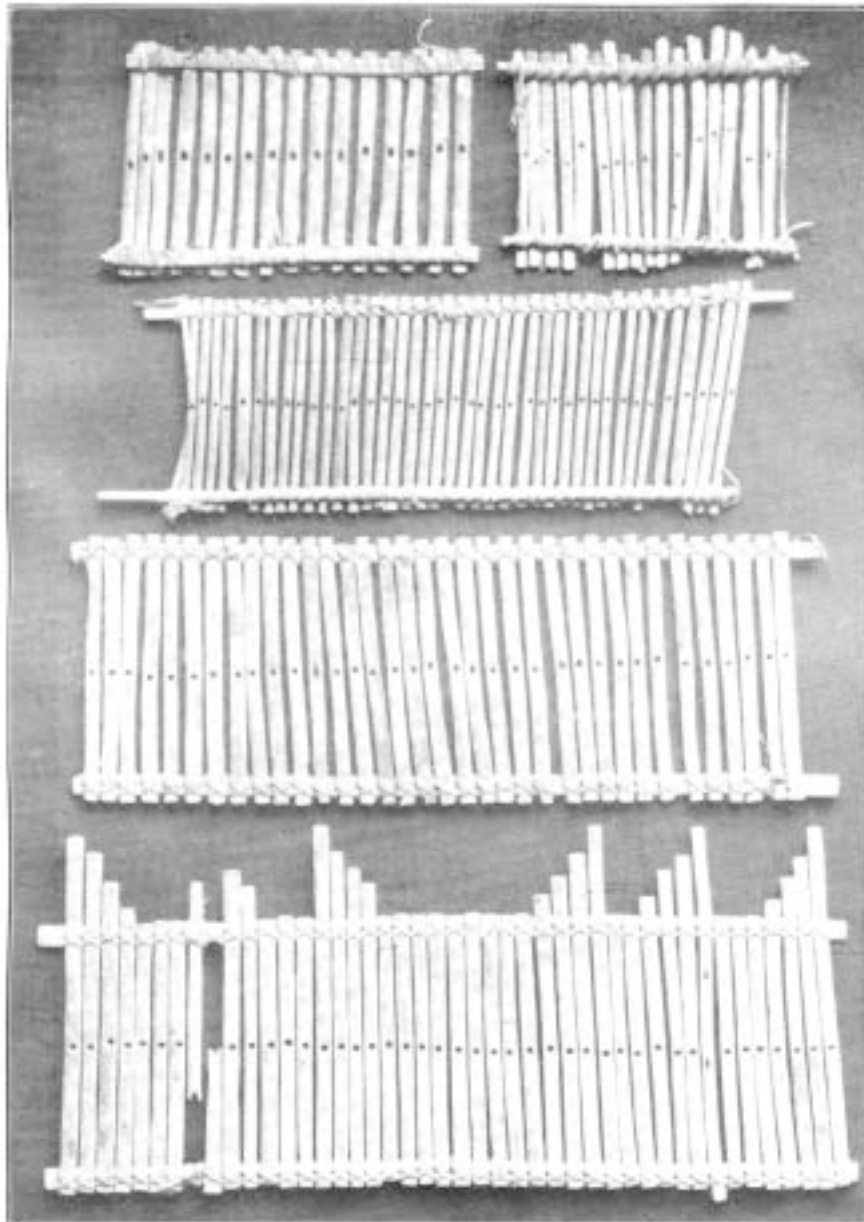
Inventor:
 Eugenia Wernicke,
 per Henry Otho
 her atty.



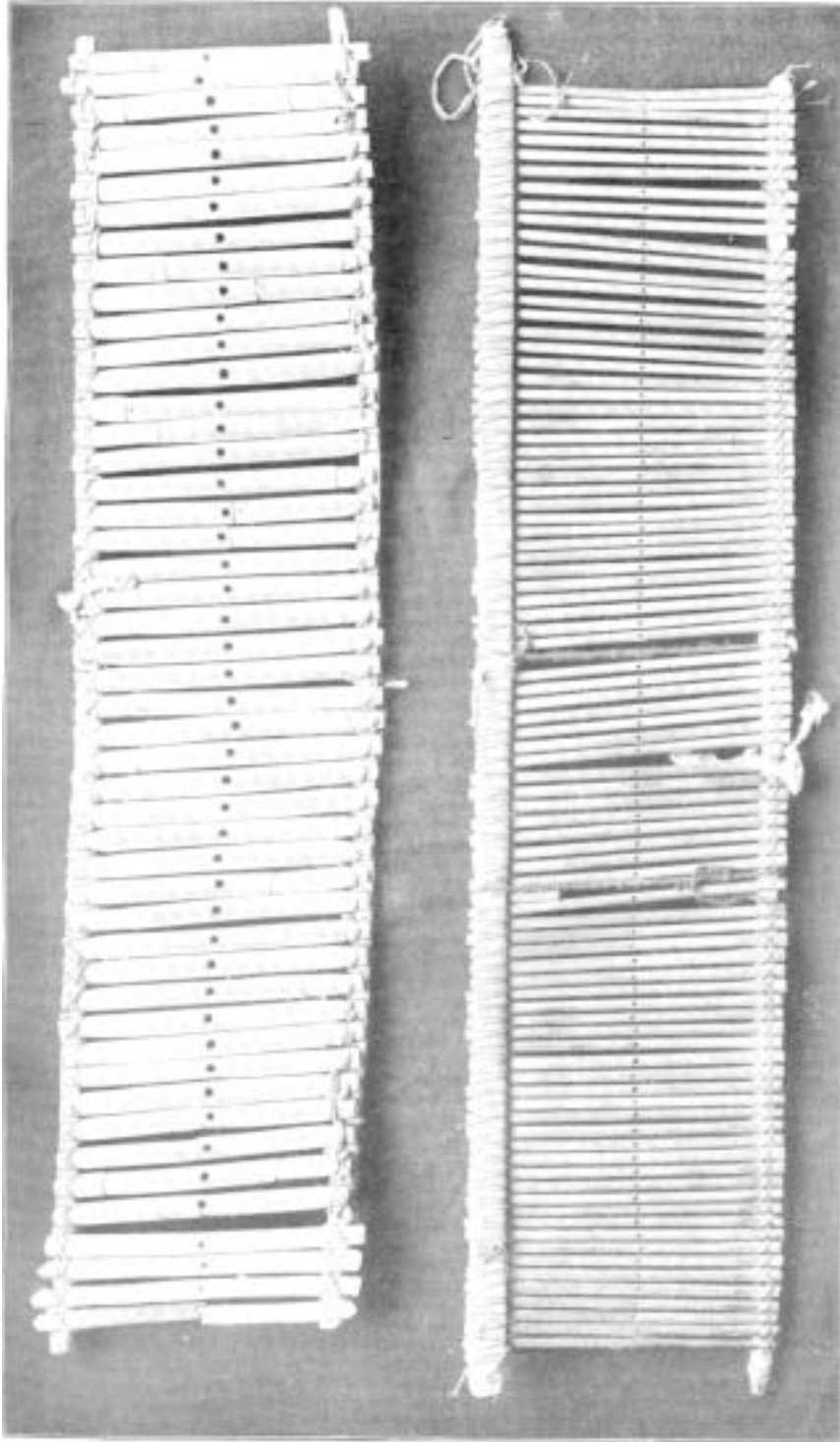
BELT AND GARTER PATTERNS FROM PUEBLOS.



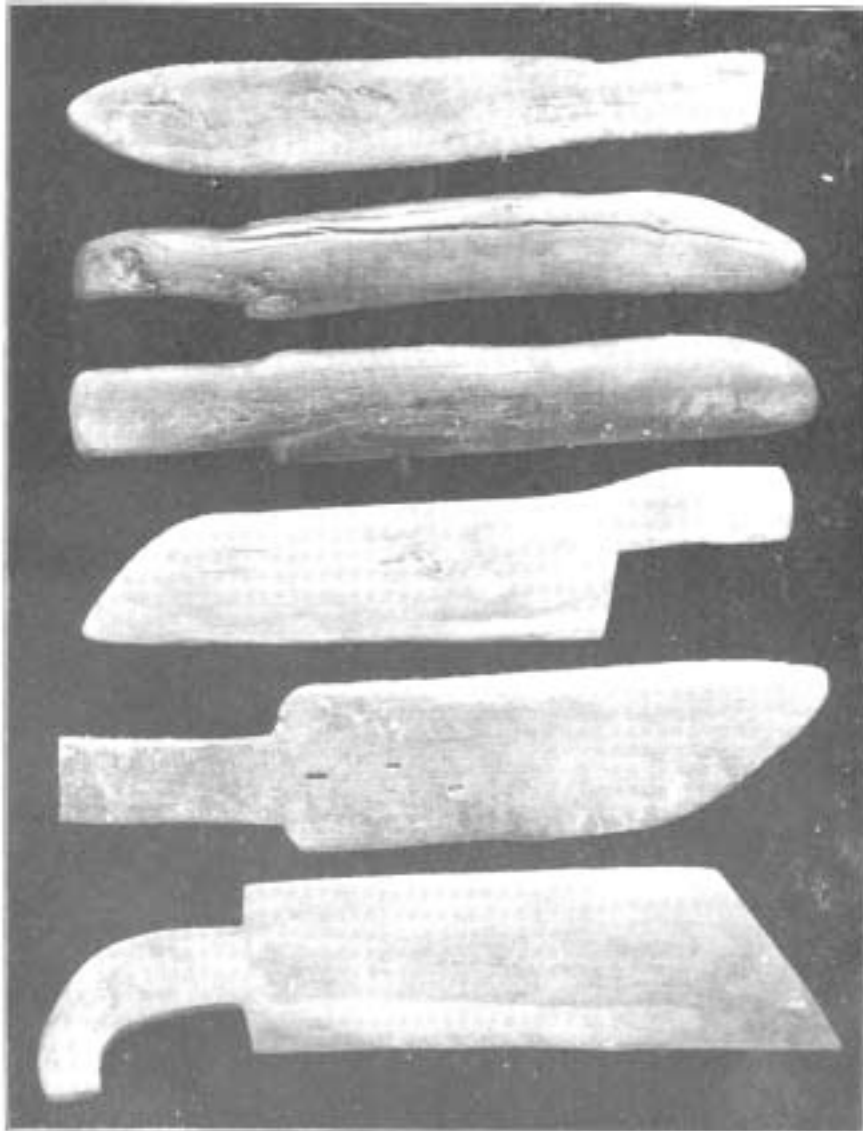
CONSTRUCTION OF PUEBLO HEDDLE FRAME.



TYPES OF PUEBLO HEDDLE FRAMES.



TYPES OF PUEBLO HEDDLE FRAMES.



PUEBLO BATTEN KNIVES FOR BEATING HOME THE WEFT.