

**Knit'ting-ma-chine'.** The art of knitting is modern ; it cannot be traced back farther than about A. D. 1500, and is believed to have originated in Scotland shortly previous to that date. It consists in the construction of a looped fabric in which for the first row a succession of loops are *cast on* or preferably *knitted on* to a needle, and in succeeding rows each loop is passed through the loop of each succeeding row. It differs distinctly from *braiding*, *netting*, and *weaving*, which is, perhaps, the order of invention ; *knitting* being scores of centuries later than either of the others.

*Braiding* is synonymous with *plaiting*, and is found among the most barbarous nations ; none so ignorant that they cannot plait strips of hide or of bark, or braid a number of vines together to make a band. This is one degree of advance upon what nature provides them ready made, a rope of twisted tendrils or vines which, in reaching after a support, have mutually embraced and climbed upward. The natives of Tahiti, when discovered by Cook, were very skillful in making mats, which were plaited so as to resemble a woven fabric, and in other countries such are farther embellished by tufts. The process of making, however, was not by *warp* and *weft*, — was not *weaving*, — but was by braiding or plaiting a given number of strands arranged on two sides of a square, like the crosses we used to make of strips of differently colored papers when at school.

*Netting* is quite another matter, and is a fabric whose meshes are made over a mesh-stick and knotted at the intersections ; as Dr. Samuel Johnson learnedly defines : “ Network. Anything reticulated or decussated at equal distances, with interstices between the intersections.”

The width of the mesh-stick determines the size of the meshes, which are knotted upon it. References to netting are frequent in the Hebrew chronicles, the Book of Job, the Prophets, in Homer, Virgil, and elsewhere. Oppian distinguishes many kinds. They are frequently shown in the Egyptian tombs and temples. See NET.

*Weaving* involves a machine, though this is sometimes of an extremely simple kind. It involves a beam or a means of stretching out the yarns into a flat row ; also some means of dividing the yarns into a series above and one below, the space between being the *shed* into which the weft is laid ; the upper and lower sets of yarns, changing places, lock the weft, and form another shed for a second weft thread, and so on. See LOOM ; also, for list of parts and appliances, see WEAVING.

*Knitting* consists in making a fabric by enchain-  
ing a single thread. It is thought to have origi-  
nated in Scotland about A. D. 1500. It was in use  
for superior articles of hose in England and France  
in the first half of the sixteenth century. Knitted  
silk stockings were worn by Henry II. of France,  
1547, and by Queen Elizabeth in 1560. About this  
time knitted worsted stockings were made by Wil-  
liam Rider of London, after the pattern of some im-  
ported from Mantua. Silk and worsted stockings  
were imported from Spain and Italy into England  
during the reign of Henry VIII. Spain was always  
famous for its sheep and wool. (See MERINO.) In  
1530 the word *knit* was common in England, and  
occurs in Palgrave's grammar. In 1577 the country  
folks knitted their own stockings.

In 1589, William Lee, M. A., of Cambridge, Eng-  
land, invented and made a model of a knitting-  
frame. He applied to Elizabeth for help, and then  
to Henry IV. of France, who promised it. The as-  
sassination of Henry threw him into poverty and  
obscurity, in which he died. His workmen, with  
their stocking-frames, settled in Derbyshire and  
started a factory, which soon threw the hose of  
woolen cloth and leather entirely out of the market.  
Queen Elizabeth refused a patent to William Lee on  
account of the value of his invention; as it would  
interfere with the employment of a great number of  
her subjects, and to make the stockings for a whole  
people was too large a grant for any individual.  
About the same style of remark as was urged by  
Jefferson against one of Oliver Evans's patents, the  
"hopper-boy," so called.

*Cotton* stockings were first made by hand about  
1730. The Derby ribbed stockings were patented  
by Jeremiah Strutt, in 1759.

The knitter frame patented by Horton, 1776.

Of a Chinese village called "the old Duck," the

Abbé Huc writes: "What struck us most in this  
place was that the art of knitting, which we had  
imagined unknown in China, was here carried on  
very busily; and, moreover, not by women, but by  
men. Their work appeared to be very clumsy;  
the stockings they made were like sacks; and their  
gloves had no separation for the fingers. It looked  
very odd, too, to see moustachioed fellows sitting  
before their doors spinning, knitting, and gossiping  
like so many old women."—*Travels in Tartary.*

Lamb's knitting-machine (Fig. 2678) is given as  
an example of that class which employs straight  
rows of needles in contradistinction to the machines  
using a circular system of needles, and to the single-  
needle machine. In the Lamb machine, a tubular  
web is produced by the operation of two straight  
parallel rows of needles, widening and narrowing be-  
ing accomplished by increasing or diminishing the  
number of needles in action.

The frame is attached by thumb-screws to the edge  
of a table, and has its two upper sides inclined to-  
wards each other, their upper edges being separated  
far enough to allow the fabric produced to pass down  
between them. Supported by the needle-bed is a  
carriage, reciprocated by means of a crank. Through  
the arch that passes over the top of the machine is  
a horizontal rod upon which moves a slide that car-  
ries the guide for delivering the yarn into the hooks  
of the needles. Parallel grooves or channels are cut  
across the bed in which the needles are placed. In  
these grooves the needles can be moved their entire  
length, and can thus be brought into operation for  
widening, or thrown out of operation for narrowing,  
without removing them from the machine.

The needles employed are self-knitting, being con-  
structed in such a manner that when fed by the yarn  
and carried an inch forward and back they form the  
loops by their own action. The lower ends of the

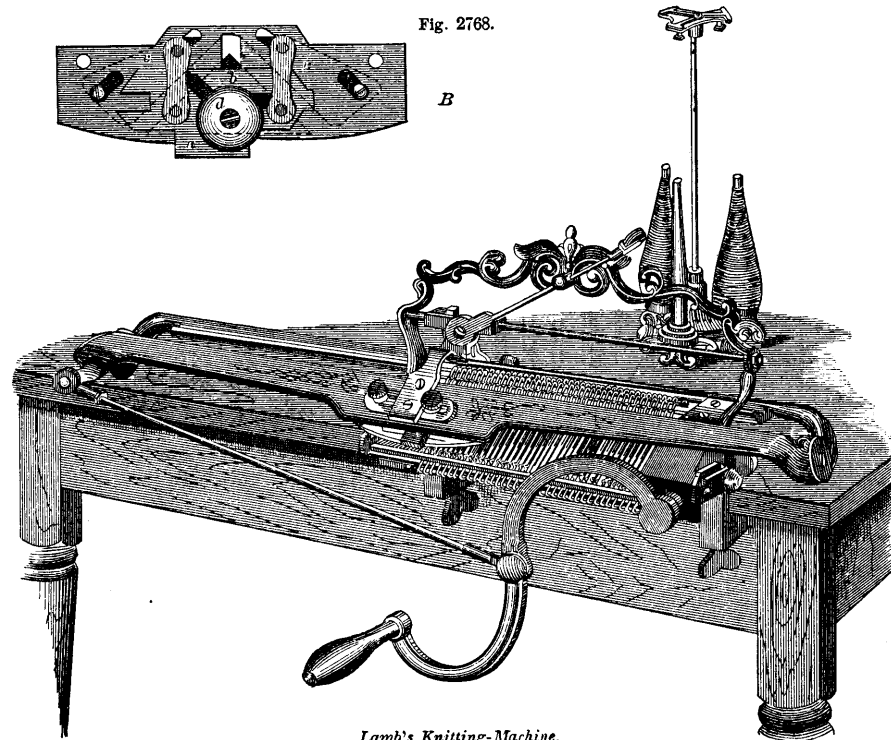


Fig. 2678.

B

Lamb's Knitting-Machine.

needles have an upright shank, extending above the face of the needle-bed, and are operated upon by cams that are attached underneath the center of the carriage in such a manner as to move the needles forward and back. There are two sets of these cams, one for each row of needles.

*B* is a representation of one of the sets of cams, which consists of the plate *a*, the two wing-cams *c c*, and the V-shaped cam *b*, which is held in place by the screws that pass through the washer *d*, in the diagonal slot of the plate *a*. As the carriage to which these cams are attached is drawn back and forth over the needle-bed by the crank, the needles are carried up on one side of the V-shaped cam in the groove or space between that and the wing-cams, the yarn-guide at the same time delivering the yarn into the hooks of the needles, which are then drawn down by the wing-cam on the other side of the V-cam, thus forming the loops.

The slide *a* is made to shift by its lower projection coming in contact with adjustable cam-stops, that are placed at the ends of the needle-bed. When the plate comes in contact with the right-hand cam-stop, the screw through the washer *d* is forced up the diagonal slot, and brings up the V-shaped cam, thus closing the space between it and the wing-cams. When closed, the needles pass below the cam without operating. By the adjustment of the cam-stops either or both of the cams may be left open or closed at the same time, so as to operate the two rows of needles separately, alternately, or together; thus forming three entirely distinct webs, — tubular web, plain flat web, and ribbed flat web.

As any number of needles can be moved up at the start, or be moved up or down at either end of the rows of needles at any time, so any size of web can be set up and any number of loops can be added to or taken from it at will. By thus knitting the fabric, either tubular or flat, plain or ribbed, in any

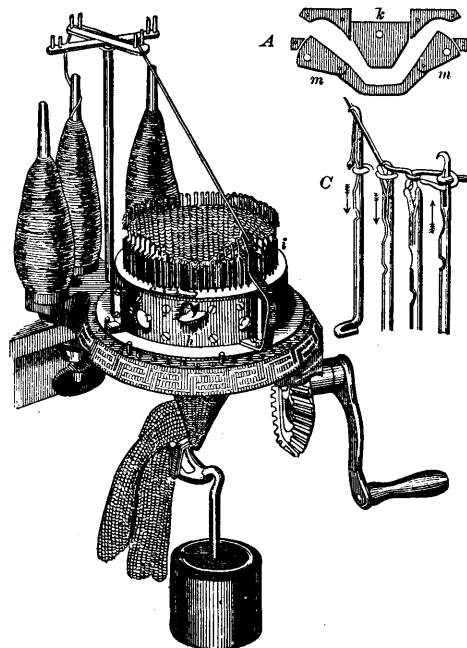
desired shape, a great variety of staple and fancy-knit goods may be produced.

The loops are formed on precisely the same principle as in hand-knitting.

The Bickford knitting-machine (Fig. 2769) is a specimen of the circular system. A bed-plate having a vertically projecting and grooved needle-guiding cylinder or bed *i* is secured to a table or suitable support. On the bed-plate is a loose ring, provided with a thread-guide for conducting the thread to the needles, and about the needle-cylinder is a revolving cylinder *h* having an annular groove interrupted by a cam portion (see *A*) and provided with adjustable cams *k m*, which govern the downward motion of the needles, and consequently the length of the loops, and raise the needles; and two of these latter cams are needed to provide for reversing the machine for knitting the heel or a flat web. The cam-cylinder is moved by a bevel gear connected to a driving-crank, and when moved continuously in one direction knits a circular web; and this web may be narrowed as desired to fashion the leg by removing needles, and placing their loops on adjacent needles. The needle on the left, at *C*, is receiving the thread within its hook, and it is subsequently moved by the cam-cylinder into the positions shown to form the thread so taken into a loop. When the heel is to be formed, a portion of the needles are drawn up, thus retaining their loops, and the number of needles left in action correspond with the width of the heel to be formed. The cam-cylinder is now to be reciprocated in opposite directions, and in order to keep the thread-guide in advance of the descending needles sufficiently far, so that the thread will be caught, pins are inserted in the bed-plate, and engage the heel of the thread-carrier, and stop it just before the cam-cylinder is stopped.

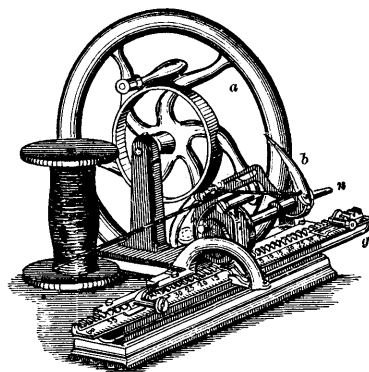
Fig. 2770 is an example of what is known as the single-needle machine. The loops are formed and held on the teeth of a comb, which is moved along, one tooth at a time, by means of a rack on its rear side, whose teeth are engaged by a fin on a wheel *c*

Fig. 2769.



Bickford Knitting-Machine.

Fig. 2770.



Hinckley's Knitting-Machine.

on one end of a shaft *n*, that is driven by the main wheel *a*, one part of the fin being movable, so that it can be swung from side to side, to vary the direction of the motion of the comb by a tri-armed lever located in the wheel *c*, and which strikes one or the other of the movable stops *g*.

A single needle *b*, carrying the yarn, and a looper, are used, the former being shown in the cut as thrown up out of operation, for the purpose of being threaded.

When in operation, it reciprocates in an arc under the comb, the slot in its actuating arm engaging a crank-pin on the side of the wheel *c*. The looper reciprocates in an arc above the comb, a pin in its actuating arm projecting into a groove in the side of the wheel.

The needle and looper being in their rearmost position, and there being a loop on each tooth of the comb, the needle advances under the comb and through one of the loops, which it removes from the comb and holds a while. The looper then advances above the comb, and its point enters between the yarn and the side of the needle. The needle then recedes, leaving its yarn in the form of a loop on the looper; and dropping the old loop, and the looper also receding, deposits its loop on a tooth of the comb, the latter being then moved forward one tooth for the formation of the next loop in the same manner.

Fig. 2771 is a machine of the ordinary circular kind, and produces a plain tube. The needles are bearded and fixed around the periphery of a rotating cylinder. They have no endway motion, but the stitch is formed as follows, it being assumed that there is already a row of them upon the needles and near their lower ends. The yarn delivered through the eye in the end of the guide *a* is taken and

*B*, Fig. 2771, shows a piece of ordinary knitted goods with loops distended.

Fig. 2772 is a machine of the kind which produces a plain, flat strip of fabric; it is an ordinary straight machine, and operates as follows:—

Fig. 2772.

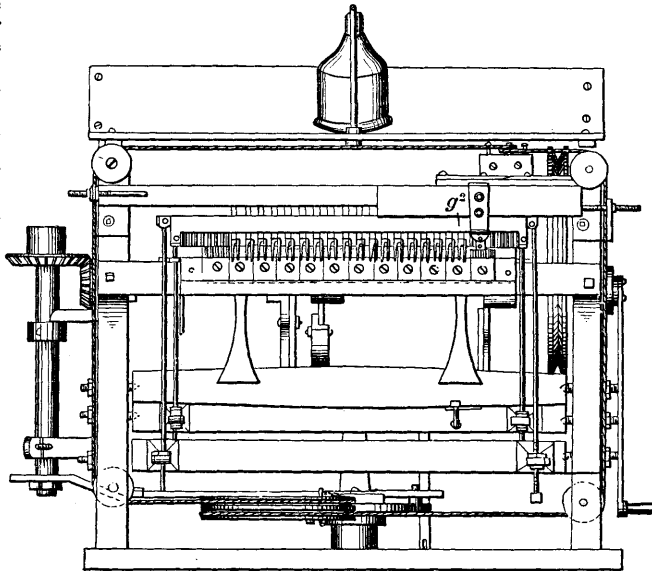
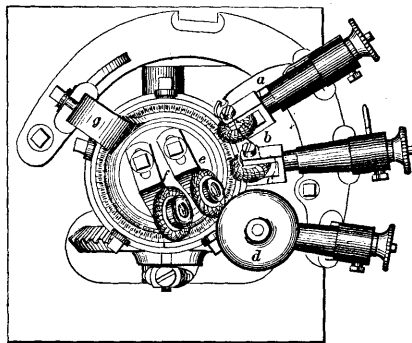
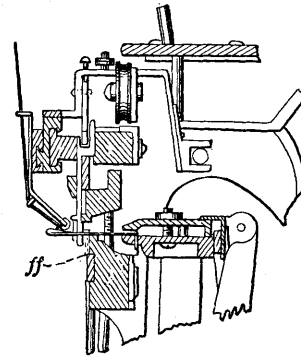
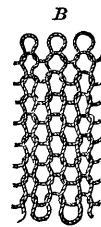


Fig. 2771.



Circular Knitting-Machine.



Flat-Web Knitting-Machine.

pushed by the notched wings on the *loop-wheel b* up under the beards of the needles. The wings of the next or *sinker wheel c* then press the yarn in between the needles to insure that there shall be a sufficient quantity to form the proper-sized loops. The needle-beards are then pressed in, so that their points enter a depression in the stems, by the *presser-wheel d*, the yarn being thus inclosed between the beard and the stem, the old loops being at the same time raised, by the *landing-wheel e*, a short distance above and outside of the points of the beards. The *stripping or knocking-over wheel f* then throws the old loops entirely over the tops of the needles, and the fabric, with the newly formed row of loops, is pressed down to the lower ends of the needles by the curved cloth-presser *g*.

The meshes being in their extreme forward position, and the last-formed row of stitches being near their rear ends, the guide *g<sup>2</sup>* moves along the front of the machine, laying the yarn on the stems of the needles. The sinkers *c* are at the same time depressed, one after another, by the cam or *slur* above them, and depress the yarn into loops between the needles, which latter are then drawn slightly backward so that the yarn may pass under their beards. The presser-bar then descends upon and closes the beards, which then enter the old loops of the fabric, and the sinkers are raised in a body by the lifting bar in their rear (shown below in the sectional view). The needles receding to their extreme backward position, the old loops are thrown over their heads by being drawn against the plates *ff*. As

## KNITTING-MACHINE.

the needles move forward, the sinkers are all depressed in a body in front of the fabric, by the bar in front of the sinkers, to keep the loops back on the needle-stems. The needles then move entirely forward, and the looping operations are repeated.

The following are the technical names of the parts employed in knitting-machines :—

*Beard* ; a long flexible hook on the upper end of the needle, and over and under which the yarn is moved to form the loop or stitch.

*Dividing* (or *bar*) *sinkers* ; sinkers placed intermediate of the *jack-sinkers*, and which, after the *jack-sinkers* have operated, descend in a body to divide the yarn into proper-sized loops between the needles.

*Fashioning-needle* ; one of a series, placed at each or either end of the row of needles, which are brought into or thrown out of operation to *fashion*, that is, widen or narrow the fabric.

*Jack* ; a lever connected directly to and operating the sinkers.

*Knocking-over bar* ; the bar against which the loops and fabric are drawn as the needles retreat, so that the loops shall be thrown or knocked over the heads of the needles.

*Latch* ; a pivoted piece on the shank of a needle, and which swings forward to cover the hook and allow a loop to pass over its head, or back to uncover the hook, so that it may receive yarn to form a new loop.

*Latch-opener* ; a device operating between the latch and the hook of the needle to throw back a closed latch, so that the yarn shall be surely laid under the hook.

*Lead* ; a block of lead cast around and holding the shanks of two or more needles.

*Point-shifter*, or *tickler* ; a pointed instrument which takes a loop from one needle and transfers it to another for narrowing the fabric.

*Presser* ; a device which closes or depresses the beards of the needles.

*Presser-bar* ; the bar which carries the presser in a straight machine.

*Shifter*. See POINT-SHIFTER (*supra*).

*Shogging* ; giving endway motion to a bar carrying yarn-guides.

*Shifter-bar* ; the bar which carries the *shifters*, *pointers*, or *ticklers*.

*Sinker* ; a device which presses the yarn down on to and between the needles.

*Slack course* ; a row of long loops made at the end of a piece of ribbed fabric (a sock-top, for instance), to facilitate its being placed upon the needles of another machine.

*Sley* ; a grooved or partitioned bed or bar in which the needles or sinkers slide.

*Slur-cock* ; a cam which depresses the sinkers.

*Spring take-up* ; a spring-actuated device which bears against the yarn to prevent slackness.

*Thread or yarn guide or carrier* ; a device which delivers the yarn or thread to the needles.

*Tickler*. See POINT-SHIFTER (*supra*).

*Welt* ; a portion of the knit fabric turned over on itself and fastened down, to prevent raveling ; resembling a hem in woven fabrics.

*Work-roller* ; the roller upon which the finished fabric is wound.

Besides these are some other terms, some local, probably, some synonyms :—

Beater.	Hook.	Neck.
Bowl.	Knock-off.	Shifter.
Catch-bar.	Jack-sinker.	Slur.
Clawker.	Latch-closer.	Warp roller-reel.
Fly.	Lifting-bar.	Wiper.