perienced master; and even then, they will find that considerable practice and application will be necessary, before much proficiency can be expected. With a little attention and perseverance, however, a person of moderate capacity may acquire as much command of the pencil, as enable him not only to copy any pattern from a sketch or cloth, but also to delineate with accuracy, such objects or ideas as his own fancy may suggest.

The first attempts of a learner in this art should therefore be to acquire a facility in sketching a variety of simple objects, such as straight lines, circles, ovals, and other curved figures. After he has made some progress in these exercises, he may proceed with copying from good sketches, particularly at first, from the most simple specimens of that kind of patterns to which his attention is to be afterwards directed. It must however be observed, that when he has attained as much practice as enables him to sketch from his own fancy, he should be very cautious at first, both with respect to the objects which he selects for his designs, and the manner in which they are to be disposed; for on his taste and judgment in making these experiments will depend, in a considerable degree, his peculiar style afterwards. He will therefore derive much advantage, in the early stages of his progress, by procuring as great a variety of appropriate objects for his patterns as possible, such as leaves, flowers, fruits, shells, &c. which may be copied either from drawings, or the originals: and from this fund he will afterwards, with a little modification of their forms, be able to give a considerable diversity to his designs; at the same time, he ought to avoid, as much as possible, a certain sameness of style, which is sometimes found in the productions even of the best drawers.

Harness patterns are, in general, first drawn on common paper, of the same size that they are to occupy on the cloth, which is ascertained by taking their dimensions from a reed

scale; and these are denominated sketches. For patterns which are to be all white, the sketches may be finished with a black lead pencil, either shaded or not, as the pattern drawer may find occasion. In drawing sketches for allovers, or other kinds of running patterns, particular care must be taken where the stalks, or other members join, to avoid stiffness or unnatural turns, and to observe that none of the parts be too much crowded, nor improper vacancies left.—At these joinings, the stalks, &c. may be continued beyond the limits of the sketch until they be completed, or until their curvatures or bendings be accurately ascertained, and then transferred, by means of a bit of spare paper, to the opposite side of the pattern.

For coloured patterns, a rough sketch is commonly drawn out on coarse paper, which, after all the necessary corrections are made, is traced on clean drawing paper, when it is ready for colouring. The method of tracing these sketches is as follows: prepare a sheet of wove writing paper by rubbing it over on one side, first with sweet oil, and afterwards with ground verditure; when it is dry, lay it on the clean drawing paper, and over it the rough sketch. Then with a blunted steel point trace over all the outlines, and a very fine delineation of the pattern will be produced. This done, the different colours are laid on with camel's hair pencils, agreeably to the taste of the manufacturer, or to the style of work to which the patterns are to be applied. It is necessary to observe, however, that as in many kinds of patterns, particularly those intended for low priced goods, the greatest economy is frequently necessary in introducing the colours, the pattern drawer's chief study should be to produce as much effect with as few colours as possible.

Pattern drawers have also frequent occasion to copy extensive patterns from the cloth, such as coloured shawls, pine plaids, &c. This is easily effected by laying a sheet of transparent paper over the pattern to be copied, through

which, every object and colour will be distinctly seen, and traced with a black lead pencil; it may be afterwards transferred to a sheet of clean drawing paper by means of a tracing paper and steel point, and coloured in the same manner as the original. For present use, a sheet of silk or tissue paper may be brushed over with sweet oil until it be all thoroughly wet, and when dry, it will be fit for use. But as this paper will soon turn dim by exposure to the air, the following recipe has been recommended in the Panorama of Arts: "Take one quart of the best rectified spirits of turpentine, and put to it a quarter of an ounce of the sugar of lead finely powdered; shake it up and let it stand a day and a night; then pour it off, and add to it one pound of the best Canada balsam; set it in a gentle sand heat, and keep stirring it till it is quite mixed, when it will be fit for brushing over the paper, which, in about four days will be fit for use. The paper rendered transparent is that which stationers call bank post, but when great nicety is required, tissue paper which is still thinner, will be proper. Before it is brushed over with the mixture, after having been made damp by laying it over another damp sheet of stronger paper, it should be pasted by the edges upon a frame, and suffered to dry."

PIGMENTS.

The pigments used by pattern drawers and designers, are, in general, the same as those which are made up into cakes, and sold in the shops under the name of water colours. In water colour paintings, however, such as flowers, landscapes, &c. the pigments employed are chiefly the transparent kind, and the different shades are wrought up by repeated touches of the pencil, till they have acquired their full effect; but in the sketches for patterns, the colours must be all opaque, or of such a body as may be easily laid on the paper with

only one touch of the pencil, and at the same time stand distinct, without allowing one to appear through or blend with another. Colours, therefore, which are naturally transparent, must be made opaque, by mixing with them a little flake or other fine white.

The colours used for designing, however, ought to be rather of a semi-transparent nature, that they may not only work freely and expeditiously with the pencil, but that the flower-lasher may be able to see the lines of the design paper distinctly through them. Some of the London designers have indeed carried this idea so far, as to have their design paper transparent, and to paint the pattern on the back with opaque or body colours.

In drawing sketches for most kinds of harness patterns, it is of considerable importance that the colours on the sketch be adapted, as nearly as possible, to the tints of the materials of which they are to be fabricated on the cloth. This would often prevent disappointment in the manufacturer, who, without considerable experience, is liable to be deceived by a brilliant display of colouring on the sketch, which cannot be realized in the loom; and this is more particularly the case in the cotton manufacture, which does not admit of such a beautiful variety of tints as either silk or worsted.

Pattern-drawers, therefore, generally prefer colours of their own preparation, to those sold in cakes, not only on account of economy, but that they can more easily obtain those tints, and of that consistence, which this species of drawing requires. For these reasons, it may not be improper here to introduce a list, with some useful remarks, of those pigments which are most commonly employed in water colour painting, leaving to the artist the choice of those which may seem best suited to that branch of manufacture in which he is more immediately engaged.

The principal colours used in water painting are yellow, orange, brown, red, purple, blue, green, black and white; of

the seven first of which there is a great variety of shades, besides their compounds.

YELLOWS.

Gamboge is a gum brought from the East Indies. It requires no preparation, but dissolves immediately on rubbing it with the addition of water. It is a fine transparent yellow.

King's Yellow is orpiment, or arsenic coloured with sulphur. It is poison, and ought to be used with caution. It is a good body colour, and when mixed with blue pigments, makes a good green.

Yellow Ochre is a mineral earth, which is found in different degrees of purity. It is a good standing colour.

Masticot or *Massicot* is ceruse or flake white calcined by a moderate fire, but it acquires a lighter or deeper tint according to the degree of calcination.

Chrome Yellow is a preparation of the metal chromium. It is a good working yellow for designers.

Turpeth Mineral is a preparation of mercury, by calcining it together with oil of vitriol. It is a good bright body colour. Mixed with Prussian blue it makes a fine green. Good yellows are also procured from French berries, saffron and turmeric, by dissolving either of them in water; but in order to preserve the bright tincture of the turmeric, it must be dissolved in spirits of wine.

ORANGE.

This colour is usually a compound of some of the red and yellow pigments. Orange lead, which is ceruse calcined to a higher degree than masticot, is a fine bright orange, works very freely on design paper, and is commonly employed in designing patterns of only one colour.

BROWNS.

Bistre is the burnt oil extracted from soot. It is of a fine brown transparent colour, and is sometimes used for washing designs instead of Indian ink.

Umber is an ochrous earth of a brown colour. It stands well, and when burnt gives it a redder hue.

Spanish Juice is the succulent part of the liquorice root, extracted by decoction in water, strained and evaporated to dryness.

Japan Earth is a gummous substance extracted from some kind of vegetable. It dissolves to a great degree in water, and is of a full brown colour inclining to red.

REDS.

Vermilion. This is a bright scarlet pigment, formed of common sulphur and quicksilver. When found in its natural state it is called native cinnabar, but factitious cinnabar, when produced by a chemical process.

Red Lead is merely lead calcined to a higher degree than orange lead, by exposing it with a larger surface to the fire.

Scarlet Ochre is the ochrous earth, or rather iron which is the basis of green vitriol, separated from the acid of the vitriol by calcination. It is of a broken scarlet colour, and stands well.

Common Indian Red is of a hue verging on scarlet, but the true Indian red is greatly inclining to purple.

Venetian Red is a native red ochre, rather inclining to scarlet.

Carmine affords the brightest and most perfect crimson, and is the most beautiful of all reds. It is produced from the tinging substance of cochineal brightened with aquafortis, by a process similar to that used for dying scarlet in grain.

It produces a variety of fine tints, from the deepest crimson to the lightest pink. It is mixed with the spirits of harts-horn, and reduced to the requisite shades with water.

Lake is a white earthy body, as the basis of alum or chalk, tinged with some crimson dye, such as is obtained from cochineal or Brazil wood, dissolved or taken up by means of some alkaline salt, and precipitated on the earth by means of an acid.

PURPLES.

Purples are commonly prepared by mixing red and blue pigments. A very good working purple for sketches, however, is made from the following recipe: Take eight ounces of logwood, an English pint of rain-water, and an ounce of alum; infuse them well over a slow fire in a glazed pan or earthen pot, for about twenty-four hours; add a quarter of an ounce of gum arabic, let it stand for a week, strain it through a piece of fine cloth, and keep it close. But the richest purple is made by blending carmine and Prussian blue or indigo.

BLUES.

Ultramarine is a preparation of calcined lapis lazuli. It is an extreme bright blue colour, but it is both high priced and often adulterated.

Prussian Blue is the fixed sulphur of animal or vegetable coal, combined with the earth of alum. It is a very useful pigment both in sketching and designing.

Verditer is a fine light blue, formed by a mixture of chalk and precipitated copper. It is without transparency, and is much employed both in sketches and designs.

Indigo is a tinging matter extracted from certain plants, by means of putrefaction, and a coagulation by the air.

Bice is smalt, which is glass coloured with zaffer, reduced to a fine powder by levigation.

Litmus is a blue pigment brought from abroad, and formed from archil, a species of moss brought from the Canary and Cape de Verd Islands.

GREENS.

Green is a compound colour, commonly made by mixing some of the yellow and blue pigments. The following, however, are simple greens.

Verdigris is a rust or corrosion of copper formed by the action of some vegetable acid. It is dissolved in vinegar.

Distilled Verdigris is the salt produced by the solution of copper, or common verdigris in vinegar. It makes a fine light green both for sketching and designing.

Sap Green is the concrete juice of the buck-thorn berries expressed from them.

BLACK.

Lamp Black is the soot of rosin received in sheep skins, or pieces of coarse linen fixed at the top of a chimney, where it is burnt for that purpose. To prepare it for use, put a small quantity on an iron shovel, or in the bowl of a tobacco pipe, and set it over the fire, when it will begin to smoke. When the smoking ceases, the black will be freed from the oily substance with which it was originally combined, and when mixed with gum, will be fit for use.

Ivory Black is ivory burnt between two crucibles; and requires to be well ground with water, before it is used in fine painting.

Spanish Black is burnt cork.

Cherry and *Peach Stones*, and other vegetable substances, when charred in a covered crucible, make likewise excellent black pigments.

Indian Ink. The genuine Indian ink is imported from the east, but the greater part is manufactured in this country; for which the following recipes are given: Take lamp black purified, eight ounces; indigo, two ounces; ivory black, an ounce; peach stone black, half an ounce; beat all together into a mass, make it into a paste with water in which a little gum arabic has been dissolved, and then form it into long square tablets. Another: Take horse beans, burn them till they are perfectly black, grind them to a fine powder, and with a weak gum arabic water make it into a paste, which form into long square cakes, as before.

WHITES.

Flake White is only white lead in a more refined state, being an oxide or rather carbonate of lead, obtained by exposing the metal to the steam of vinegar.

Zinc White, or Constant White, is formed by the calcination of zinc, by raising it to a red heat in a crucible.

White Lead, or Ceruse, is the corrosion or rust of lead formed by means of vinegar.

Pearl White is the powder of pearls or the finer parts of oyster shells.

Troy White, or Spanish White, is chalk neutralized by the addition of water in which alum is dissolved, and afterwards washed.

Egg Shell White is preferred to flake or troy white. It is made in the following manner: Take off the inner skin of egg shells, then levigate or pound the shells to a proper fineness, and wash over the powder.

Calcined Hartshorn is the earth which makes the basis of horn rendered pure by the action of fire, which separates from it all saline and sulphureous substances. It is of the first degree of whiteness, and not subject to be changed by the air or time.

There are several other pigments used in water colour painting besides those which are here enumerated; but from the above list, the pattern drawer and designer may select what will sufficiently answer their purpose, especially, if the great variety of tints be taken into account, which may be produced by mixing two or more of them together.

For example, a good orange is made by mixing vermilion and gamboge; a sea green, with indigo and sap green; another with indigo and gamboge well ground together; a transparent green, by mixing verdigris and yellow, to various tints, by leaving either predominant; a brown, by mixing sap green and carmine; a lead colour, with indigo and white; a light green, with verditer and gamboge, or with gamboge and verdigris; an olive, with sap green and lake; a lilac, with carmine, Prussian blue and flake white; and so forth.

The greater part of these pigments require to be ground as fine as possible before they are fit for use. This is done on a marble flag with a mullar, adding occasionally a little water, till the mass is brought to the state of fine paste, after which, a little gum arabic water is added. Some dissolve a small bit of refined sugar in the gum water, which prevents the colour from cracking.

After the pigments are ground, it will frequently happen that some of them are still too gross to be used in fine works. To obviate this, mix a quantity of the mass with water in a clean vessel before the gum is added, shake it well, and after it has settled till the grosser parts have fallen to the bottom, pour off the top, and whatever part of the pigment comes over will be as fine as necessary when it is settled, and the water poured off.

Those who desire to know how these pigments are prepared from the original, will find ample satisfaction, by consulting a very valuable work chiefly on this subject, entitled, "*The Handmaid to the Arts*," to which I am indebted for some useful information on this head.

CHOICE OF OBJECTS FOR PATTERNS.

In draw loom patterns, in general, there are usually some principal objects introduced, which are technically termed heads, while the intermediate spaces are filled up with some kind of subordinate members. Hence it is apparent, that the excellence of a pattern will chiefly depend on the tasteful selection and judicious arrangement of these objects, taken as a group.

Those who have paid most attention to the effects of drawing, in general, have uniformly recommended figures bounded with curve lines, in preference to such as are straight, or forming angles. Easy flowing curves and waving lines have always given delight, and still continue to hold a place in the best patterns. So much was Hogarth pleased with the waving or serpentine line, that he termed it the line of beauty; and the spiral line, or that which is represented by the worm of a screw, he denominated the line of grace; and showed, by many instances, how nature delights to employ these lines in the ornamental parts of her works. The serpentine line has long maintained the character given it by Hogarth, and is still introduced into patterns without becoming stale or offensive. The spiral line has likewise its peculiar beauties, which may be traced in the writhes of shells, the ivy round trees, and many other natural productions, which have been also copied, with considerable effect, into different kinds of patterns.

In the choice and arangement of objects, however, for those patterns which are more immediately designed for the draw loom, an imitation of nature has always been recommended as the surest guide to the pattern drawer: not that nature is, in all respects, to be too servilely followed, but that her productions, even in the greatest exuberance of fancy, and in the widest latitude of imagination, may still be kept in

view. As the whole vegetable kingdom teems with a profusion of objects, which vary in succession with every season of the year, the pattern-drawer has here an inexhaustible store, from which he can be at all times supplied with ideas. The stalks, leaves, flowers and fruits of vegetables, are more appropriate and becoming for female decoration, than unmeaning groups of grotesque and uncouth objects; and ought therefore to form the basis on which a good pattern is founded. The ideas, however, which are suggested by the different parts of plants, may be varied and compounded in a thousand different ways; yet still the imaginary figures which are thus produced, may have some resemblance to the originals, and be kept within the probability of nature. They ought to excite in us the same surprise and delight which we feel on seeing a rare exotic plant, which, though widely different in its foliage from those which are common amongst us, yet is still recognized to be a genuine production of nature.

Notwithstanding this general appeal to natural productions, there are times and circumstances which frequently give a new character to the style of patterns: such are the Camperdowns, Waterloos, Coronations, &c.; but if these effusions be not founded on a correct and genuine taste, the patterns which are thus introduced will become stale as soon as the effervescence of the moment begins to subside; and the pattern-drawer must again return to natural objects, to refresh and enliven his imagination.

The Chinese and Indian patterns which have been imported into this country, are likewise in some measure exceptions to the easy natural style above recommended; and although they have been long favourites in the market, they still continue to be sought after with avidity, and are imitated to a very considerable extent. But as the genuine patterns of India are often more remarkable for the artificial arrangement of their component parts, than for a brilliant

display of colours, it frequently requires no small degree of skill in the pattern-drawer to preserve the peculiarities of their style; without which, the imitations will want much of that exotic appearance which stamps so high a value on the originals.

ARRANGEMENT OF COLOURS.

In the coloured branches of weaving, the distribution or arrangement of colours in a pattern is of no less importance than the choice of objects. Any person who has the least experience in disposing of colours, either in pictures or patterns, will perceive, that some colours will have more brilliancy and effect when placed together, than when they are placed separate, or beside some others. This arises neither from taste nor caprice, but is founded in nature, and may be explained on the principles of optics: for it is well known that the seven prismatic colours have exactly the same relation to each other as the notes in an octave in music; and, therefore, the effect produced by artfully disposing of the kindred colours is no less pleasing to the eye, than the concords of musical sounds are grateful to the ear.

Colours, therefore, with respect to the effect which they thus produce, may be arranged under two heads, namely, those which are contrasting, and those which are harmonizing. The contrasting colours are such as are most opposed to each other; the harmonizing colours are those intermediate tints which lie between the contrasting ones, and as it were blend them together.

The contrasting colours may be discovered by a very simple optical experiment. Place, for example, a red wafer on a sheet of white paper, and look on it steadily for some time till the eye becomes tired, and a ring of green will begin to appear round its edge; and even after the eye has

been removed to another part of the paper, the green ring will still be visible. Hence, green is said to be the contrasting, or as it is sometimes termed, the accidental colour of red; as red, on the contrary, is the contrasting colour of green. In like manner it may be found that purple is the contrasting colour of yellow; blue of orange; violet of a mixture of yellow and orange; and black of white.

The compounds of these colours will also have their contrasting and harmonizing ones. Thus, purple inclining to red, has for its contrasting colour, yellow inclining to green; purple inclining to blue, has yellow inclining to orange; and so likewise with the other compounds.

On the other hand, a harmonizing colour will be the nearest tint to the original, but farthest, except the original, from the contrasting colour. Yellow, therefore, is the harmonizing colour of white, orange of yellow, red of orange, violet of red, and blue of violet, &c.

Different shades of the same colour, such as light and dark green, light and dark red, light and dark blue, &c. when they are distant, form, likewise, very bold contrasts; but when the same colour runs through a variety of shades, from a very dark to a very light tint, such tints approach to the nature of harmonizing colours.

In applying these remarks to practice, it will be necessary to recur to a former observation, that there are usually some principal objects introduced into patterns which are called heads, and that the other parts are occupied with some kind of inferior members. These heads, therefore, have generally a reference to the flowers or fruits of plants, while the subordinate objects are meant to represent the stalks, buds, and leaves. By keeping this observation in view, the pattern-drawer will have an extensive field for a display of his judgment and taste, in the selection and arrangement of the harmonizing and contrasting colours; especially if he examines attentively the order in which nature commonly dis-

poses them. Thus, for example, in the centre of a red rose, he will find a yellow tint blended with the orange hue of the stamens, while the petals, or leaves of the flower, are red. These tints, agreeably to the order above-mentioned, are harmonizing colours; while the calyx or cup, which comes in contact with the petals, as well as the other parts of the shrub, are green, the natural contrasting colour of the red. Examples of the contrasting colours in flowers will be found in some species of the violet, the wall-flower, and many other productions of the flower garden.

This account of the arrangement of colours is of the greatest importance at the present time, as that beautiful mixture of shades and tints displayed in the silk manufacture lately imported from France, depends on the theory here laid down.

REED SCALE.

This instrument is of great use in every branch of fancy weaving, particularly in the draw loom department. Fig. 7, Plate 11, is a representation of this instrument adapted to the Scotch standard, which is 37 inches. At A are the number of splits in one inch for each sett in the left hand column. The numbers at B are the nearest setts to these, for the Manchester and Bolton count, which is regulated by the number of beers or porters in $24\frac{1}{4}$ inches; and the nearest corresponding setts of the Stockport count will be found at C, which is estimated by the number of ends or warp threads in an inch. This column also shows, very nearly, the number of weft shots in an inch, when the complete hundreds in the left-hand column are accounted shots on the common web glass for 37 inches. It would have shown them more accurately, had it not been calculated to the nearest even numbers, to adapt it to the setts, or of the Stock-

port reeds; the scale of which excludes the odd numbers. The divisions at the bottom of the scale are inches.

The construction of the reed scale is very simple, and may be as follows: having drawn the requisite lines for distinguishing the different setts of reeds, find by calculation the length of one porter for each sett, to the hundredth parts of an inch. This may be done by the following proportion: as the porters on ell: 37 inches:: 1: to the length of one porter. Take this in a pair of compasses from a diagonal scale, and set it off from left to right along the space intended for that sett, which will divide it into porters; after which, one porter may be again divided into twenty parts for splits.

In like manner a scale may be constructed for the Manchester and Bolton reeds: for it will be, as the number of beers in $24\frac{1}{4}$ inches: $24\frac{1}{4}$:: 1: to the length of a beer, which may be divided either into nineteen or twenty dents, as the manufacturer may find answer his purpose.

The Stockport scale may be constructed by dividing an inch into the number of dents peculiar to the number of each sett, which will always be equal to half the number of the reed.

By comparing these standards or scales together, it will be found that a 1400 Scotch reed, which is the most common sett of harness work, in the cotton manufacture, will be very nearly equivalent to a No. 46 of the Manchester and Bolton count, and to a No. 76 of that of Stockport.

DESIGN, POINT, OR RULE PAPER.

This paper, of which frequent mention has been made in the course of this work, is an impression of a copperplate engraving, consisting entirely of straight lines crossing each other at right angles, the spaces between which representing sometimes the threads of warp and woof in a piece of

cloth, and sometimes the simple cords and lashes of a draw loom; without any regard to the number of threads in the mail, or the number of shots on the lash. The paper is again divided into larger squares called designs, which contain various proportions of the smaller spaces, to suit the different purposes to which it is applied.

The varieties of design paper in common use are, 8 by 8, 8 by 9, 8 by 10, 8 by 11, 8 by 12, 8 by 13, 8 by 14, 8 by 20, and 10 by 10; that is, 8 by 8 is even paper, or has 8 small spaces, both by the breadth and depth in each design; 8 by 9, has 8 by the breadth and 9 by the depth, and so of the others. In using these varieties for draw loom patterns, 8 is commonly considered the simples or mails in a design, and the variable numbers 9, 10, 11, &c. the lashes; to adapt the pattern either to the quantity of woof on the ground, or the number of shots on each lash. In some cases, however, the variable figures represent the simple cords, and 8 the lashes; which adds considerably to the number of varieties above specified.

The scale on which design paper is drawn, does not coincide with any particular sett of reed, but appears to have been originally calculated for two designs to the inch; although what we have in the market at present be somewhat below that standard. This small difference has probably arisen from each successive engraver copying from the sheet of his predecessor, which is always less than the plate, on account of its being printed in a damp state and shrinking a little as it dries. Were the design paper, however, drawn accurately to a scale of two designs to the inch, then that kind which has ten spaces in the design would coincide nearly with a 700 reed; for it will be found by the reed scale that there are 19 splits in one inch of that sett; so that the difference would only be one split in twenty. In the same manner it will be found that 8 simples in the design would correspond with a 600 reed; and so of the other varieties.

DESIGNING PATTERNS.

The term designing implies, here, the painting of any pattern on design paper, either directly or from the sketch, preparatory to its being read or lashed on the simple of a draw loom. This species of painting is performed with camel hair pencils, and appropriate pigments selected from the preceding or any other list, reduced, if necessary, to a semi-transparent state, as already mentioned. The pencils should be chosen of a middle size, with a good spring and point, both of which may be discovered by drawing them gently through the mouth, and pressing them on the thumb nail; when, if on being moderately wet, they spring again into their form after being bent, it is a sure indication of these qualities. The points of the pencils too, should be adapted as nearly as possible to the size of the small spaces on the design paper on which they are to be employed, that the designer may be able to fill any individual space with only one touch.

A learner in this department, before he attempts the designing of patterns, should endeavour to acquire a dexterity in filling up these little spaces on the design, whether they run in straight or curved lines; taking care always to fill them exactly, without allowing the paint to spread beyond their boundaries, or leaving any of them broken or imperfect. In this exercise he will find some assistance by consulting Figs. 1 and 2, plate 12; in the former of which he will see how straight lines may be designed, so as to form any given angle with the bottom of the paper; and in the latter, the method of designing circular and elliptic figures, which may be easily applied to the delineation of any other kind of curves. He may next attempt what are termed set objects, such as *a*, *b*, and *c*, Figs. 2 and 3. Of these he will afterwards find it of advantage to produce as great a

variety as possible; for such figures will not only be found convenient, on many occasions, to introduce as heads into those draw loom patterns, which are designed without a sketch, but to form a happy diversity of ornament in several of the other branches of fancy weaving. When the learner has made some proficiency in these exercises, he may proceed to the designing of patterns from the sketch; an example for which, on a small scale, will be found in Figs. 4 and 5, which may be copied by means of the trace paper and point, after the manner described, under Paper Spots.

In the designing of draw loom patterns, the first thing to be ascertained is the tye of the harness, or the number of cords in the simple. When the pattern is required for a harness which is already mounted, the tye or number of simple cords is given; but when a new harness is to be constructed for any particular kind of pattern, the quantity of warp requisite for the web must first be determined, together with the number of threads which is destined to each mail. Then, if the warp reduced to splits, be divided by the proposed number of parts, provided they are alike, the quotient will be the number of splits in one part; which when reduced to mails, will give the tye of the harness; or, if the warp be divided by the number of splits intended for one part, the quotient will be the number of parts, or times the pattern is to be repeated in the breadth of the web.

Examples.—Suppose a 1400 split harness containing 112 porters warp, to be tied in twelve parts; then, to find the tye, we have

112 porters.
20

12)2240 splits.

186 8 over.

Here, as there is one splitful of warp in the mail, we have 186 for the tye of the harness, and 8 of a remainder, to which a few more may be added for selvages.

Again, Suppose a 1400 damask shawl harness, four threads in the mail, were to be constructed; the quantity of warp being the same as in the last example, and the borders to contain 80 cords each: then, the two borders added together make 160 mails or 320 splits, which deducted from 2240, the number of splits in the warp, leaves 1920 for the body of the shawl. Now if we would have the body parts nearly of the same extent as the borders, we divide the 1920 by 160, the splits in 80 mails, and the quotient, 12, is the number of parts. But, as in this case, there is no remainder for selvages, these must be supplied either by adding the usual allowance to the warp, or making an adequate deduction from the tye of the body.

In making calculations of this kind, however, it must be observed, that for harness ties in general, a number should be selected which contains as many small divisions as possible, that when minute objects are introduced, such as are frequent in the guards and bosoms of shawls, the spaces allotted to these objects may be uniformly of the same size, to prevent the appearance of striping, or as it is usually termed, *roading*, which is sometimes seen in small patterns. Thus, for example, a tye of 80 cords may be divided by the numbers, 2, 4, 5, 8, 10, 16, 20 and 40; and one of 72 cords may be divided by 2, 3, 4, 6, 8, 9, 12, 18, 24 and 36, without leaving a remainder in either case; so that these ties will admit of a considerable variety of small patterns without any irregularity or imperfection. On the contrary, were 82 fixed on for a tye, it would soon be found that this number has no other divisions but 2 and 41; and therefore, were objects to the extent of 8, 10 or 12 cords to be woven in this harness, either some of these objects or their intervening plains would necessarily be a cord

larger than the others, and occasion the faultiness above mentioned.

When a pattern is to be designed for any proposed harness, the number of cords are first counted off on the design paper, either from right or left, each space, as formerly mentioned, representing one mail. The number of lashes, which may be variously ascertained, are next counted off from the bottom upwards; each space likewise representing a lash, provided the pattern is to be only one cover; but when there are more covers than one, the number of lashes will be proportionally increased, while the number of spaces will remain the same as for the first or ground cover. The design thus marked off, will give the extent of the pattern in its enlarged or diminished state; for in some cases, the design will be greater, and in others smaller than the cloth size. Then, when there is no sketch of the cloth size given, the extent thus found, both by the mails and lashes, is marked off on a piece of clean paper, on which the pattern is now sketched, and traced on the design paper by means of the trace paper and steel point. It is a pretty common practice, however, particularly when much accuracy is not required, to draw the pattern directly on the design without an intermediate sketch. The several members of the pattern are then filled up with the paint and camel-hair pencil, one colour being, in general, sufficient for one cover; but where there are more covers than one, the different colours are painted on the design in the same order that the weaver is to insert them in the cloth. For some kinds of weaving, such as the several varieties of pressures, seeding, &c. the principal objects in the pattern require to be painted solid; while for others, they must be tweeled, flushed, or diced, agreeably to the nature of the texture to be produced. Examples will be found in Plate 12, Figs. 7, 8, 9, and 10.

The trace paper employed for the sketches in designing

is the same as that mentioned under Paper Spots, not the blue trace paper described under the article Sketching in the present section; the former being prepared merely by rubbing black lead on a sheet of writing paper, whereas in the latter, the verditer is mixed with oil, which prevents it from being rubbed out when corrections are necessary.

When sketches of the cloth size are given, they may be easily transferred, in the following manner, either directly to the design paper, or to another sheet, for the purpose of tracing them on. Draw a straight line immediately above, and another at the bottom of the original sketch: do the same at the two sides, making right angles at the four corners. Then, if the number of splits in one design or large square of the design paper be taken in a pair of dividers from the reed scale, for the given sett of reed, and set off round the sketch, and these points be connected by lines drawn from the opposite sides, the sketch will be divided into a number of small squares, corresponding with the larger squares on the design paper. But if the cloth sketch be not drawn exactly for the tye of the harness, it must nevertheless be divided into the same number of squares as it is to occupy of designs, without regarding the number of splits in the design, by which means the same sketch may be adapted to harnesses of different tyes, and still preserve the proportion of all its parts. Should the squares thus formed on the sketch, however, be considered too minute for practice, as would be the case for several kinds of harnesses, the extent of two or three designs may be taken and set off round the pattern, and each of the squares thus formed would be equivalent to four or nine on the design paper. The pattern may now be copied from the original on the new sketch or design, by observing what particular parts or members of it are in any square of the former, and drawing similar parts on a corresponding square of the latter;

and so on till the new sketch be finished. To facilitate this process, however, all the squares of both sketches are numbered in the same order, as well from right to left as at the sides, after the manner represented in Figs. 6 and 9.

These observations will be sufficiently illustrated, by referring to Figs. 6, 7, 8, 9, and 10. Fig. 6 is a cloth sketch for an imitation sprig, drawn for 24 splits of a 1400 reed. Fig. 7 is the same on design paper for a four thread pressure harness, which consequently will occupy twelve mails. It is designed on 8 by 10 paper, and will therefore stand square with between 17 and 18 shots of weft on the ground, and four shots of spotting on each lash. Fig. 8 is the same sprig designed for a three thread pressure harness. In this case it occupies sixteen mails; for, as there are 48 threads in 24 splits, and three threads in each mail, 48 divided by 3 gives 16 for the number of mails. Likewise, as there are four shots on each lash, this design will require nearly 19 shots of weft on the ground, to make it square; for as three threads in the mail are to four shots on the lash; so is 14, the threads of warp on the glass, to $18\frac{2}{3}$; the number of shots on the same extent. Fig. 9 is the design of Fig. 6 for a split, and Fig. 10 the same for a full or one thread harness, and their dimensions are enlarged accordingly. These two designs are adapted to flushing; that is, the spotting warp is not pressed by the leaves to form the sheds, as in the two preceding examples; but the spotting weft is loose or flushed between the small spaces that are marked black on the design, which marks regulate the distances at which it is catched by the harness. It may be farther remarked that Fig. 9 has two shots on each lash, and Fig. 10 only one; and as they are both designed on 8 by 10 paper, the warp and weft will be in the same proportion as in Fig. 7.

This pattern, although woven with different colours of spotting, is said to be only one cover, except the small

yellow diamond in the centre, which is termed double shotting, because additional lashes are requisite, wherever the spaces are painted yellow in these designs. On the same principle, when there are three, four, or more colours going at the same time, that part of the pattern is said to be three, four, or more covers; and their respective lashes are all drawn in succession, without any of the ground weft intervening.

The preceding descriptions apply equally to detached figures, robes, flounces, colonnades, diagonals, or allovers of any other kind of which the parts are alike, or are connected to the same simple; but where there are more simples than one, as the borders, corners, and centres of shawls, each simple must have a space allotted for it on the design paper, and its respective part of the pattern designed on it accordingly. Thus, for a shawl pattern with only a body and border, the border part must be counted off at one side of the body, commonly at the right, if for a right hand harness, but on the left, if the contrary. This distinction, however, is the less necessary for the designer, as the flower-lasher can adapt the same pattern to either of these harnesses, merely by changing its position in the frame, and reading it upwards or downwards as the case may require.

Suppose, for example, Fig. 11 to be the plan or pattern of a damask shawl on a small scale, adapted to a tye of 80 and 80; that is, 80 cords for the border, and 80 for the body: then, as these patterns are usually designed on 10 by 8 paper, or 10 simple cords and 8 lashes in each design, 160 spaces are counted off from right to left, namely, eight designs for the border, and other eight for the body. But as the pattern is to be square, the depth must be taken in designs also; and therefore, the same number of designs, viz. sixteen, counted upwards, will give 128 lashes, which must be marked off also. The extent of the

guards is next ascertained, and counted off on the design. In this example, ten mails are allowed for each guard, including the two dead lines or simples at 1, 1. Then set off the dimensions of the intermediate space A, between the guards, on a piece of clean paper, on which draw the sketch of the pattern. This is now to be traced on the design paper, first on the space A, for the cross border; after which, turn up the under side of the sketch, on which the outlines of the pattern will be visible from the mark left by the tracer, and lay it over the space B, and again trace it on the design, thus reversed, for the side border. Another sketch is requisite for the corner C, which is traced on in the same manner; after which, all the parts of the pattern are painted as already directed.

If the bosom of the shawl is to be a running pattern, it is sketched and traced on after the manner of an allover; but if it is to consist of detached or set sprigs, as in the present example, equal spaces must be allotted to each, agreeably to the intended size of the objects, or the distance at which they are to stand from each other; taking care always, that the joinings be made perfectly correct, and that the plains, at least when small, be of the same number of cords.

Fig. 12 is the plan of a shawl with a centre and corners, which, for example, may be taken for a 700 four thread Angola, with 48 mails for the border, and 45 for the body, corner, and centre, respectively. The calculation for the several parts will then stand as under.

The two borders, ...	48+48=96
The two corners, ...	45+45=90
The centre gathered, two parts,	45+45=90
	276
For splits, multiply by	**2**
	552

Suppose 56 porters warp = 1120 splits.
Deduct 552

Divide by the body tye, 45)568(12 parts.
45

118
90

28 over, which 28 splits will be sufficient for selvages, and the quotient gives 12 parts for the body, or six between the corner and centre on each side.

In designing patterns for shawls of this description, the parts for the border, corner, body, and centre, must all be marked off on the design paper, and, for a guide to the designer, may be formed into square compartments as represented in the Fig. Then, when the borders have been sketched and designed as directed in the preceding example, a sketch is made for the corner at *a*, and another for the centre at *e;* each commonly forming the quadrant of a circle within the limits of its respective part. When these have been likewise designed, it will remain to finish the filling of the body, which requires some little attention with respect to the different parts where they join. For here it must be observed, that as the lashes are wrought down the simple at one time, and up at another while weaving the corners and centre; and further, that both the corners and centre are gathered; it follows, that no figure but what is alike on all its four sides will suit for a filling: for were sprigs, for instance, introduced for this purpose, their tops would be turned towards each other in some parts of the shawl, and their stalks in others.

It is also to be remarked, that when there is to be only one object in the part; as th diamond in the present instance, it must be placed exactly in the centre of each square or division of the body; for, were this precaution

not taken, some of the objects would either be thrown closer together, or farther distant at the turning of the lashes and gatherings of the harness, than in the other parts of the shawl; but when placed in the centre of each part, they will stand clear of the borders, and at equal distances from them all round. When the objects are to be embosomed with others, however, such as the circular figures in the present example, they must be placed at the corners where the several parts join, with the fourth part of the object in each corner of the contiguous squares; so that, wherever four of these corners come in contact, the figure will be completed. All this will be evident by an attentive perusal of Fig. 12.

Sometimes the corners and centre are woven with one simple, which is a considerable saving of the cordage and pulley-box; but when this method is adopted, the corner and centre parts are tied together, and consequently, one half of the centre is woven along with the corners, and the double of the corners along with the centre; the half parts thus formed being termed shoulders. These shoulders are represented in Fig. 12 by the dotted circular lines *i* and *o*, and are merely two quadrants of the centre joined together. In designs of this kind, the centre part is wholly omitted, and no more of the pattern is requisite than the four squares *x*, *y*, *w*, and *z*, for the corners, and filling together with the corresponding parts of the borders; but the same attention is necessary for joining the filling objects as in the last example.

In ascertaining the kind of design paper suitable for any pattern, regard must be had, both to the number of shots on the glass compared with the sett of reed, and the number of shots thrown in on each lash, with respect to the number of threads in the mail. When the number of shots on the lash is equal to the number of threads in the mail, the proportion will be, as the complete hundreds

of the sett of reed, or warp threads on the glass: to the shots on the glass :: so is 8, the number of mails in one design common in such cases: to the number of lashes in one design.

For example—Suppose we wish to know the design paper for a 1400 split harness shawl, to count 17 shots on the glass—here, as there are two threads in the mail, and two shots on the lash, we have

$$14 : 17 :: 8 : 9\tfrac{5}{7}.$$

$$\begin{array}{r} 8 \\ \hline 14)136(9 \\ 126 \\ \hline 10 \end{array} \quad = \quad \tfrac{5}{7}$$

That is 8 by $9\frac{5}{7}$, the nearest to which is 8 by 10—but if we suppose $17\frac{1}{2}$ shots on the glass, we will have 8 by 10 exactly, for 14 : 17.5 :: 8 : 10.

When there are more shots on the lash than threads in the mail, there are generally fewer lashes than mails in the design; and therefore 10 is usually taken for the mails. Thus, for a 1400 damask shawl, which has four threads in the mail, and eight shots on the lash, even paper, such as 10 by 10, would give 28 shots on the glass, or double the quantity of the warp. But suppose $22\frac{1}{2}$ shots on the glass, which makes a pretty fair fabric, then we have this proportion.

$$14 : 22.5 :: 10$$

$$\begin{array}{r} 10 \\ \hline 14)225(16 \\ 14 \\ \hline 85 \\ 84 \\ \hline 1 \end{array}$$

The answer here is 16, but as the number of shots on the lash is double the number of threads in the mail, we must take only the half of this answer, which is 8; and therefore, 10 by 8, or 10 simple cords for 8 lashes is the proportion required.

When a pattern is to be designed for a given number of shots in an inch, and the ground thicker by the weft than by the warp, which is generally the case; the proportion will be, as the number of warp threads in an inch, to the shots in an inch; so is 8, to the number of lashes in a design.

Example—If a pattern is to be designed for a 1400 reed, to count 100 shots in an inch, what proportion of design paper will it require?

Note—The number of warp threads in an inch may be found by multiplying 5.4, the number of times the web glass is contained in an inch, by the complete hundreds of the reed—thus,

$$\begin{array}{r} 5.4 \\ 14 \\ \hline 216 \\ 54 \\ \hline 75.6 \end{array}$$

That is $75\frac{3}{5}$, or 76 nearly—then say,

$$\begin{array}{r} 76 : 100 :: 8 \\ 8 \\ \hline 76)800(10\frac{1}{2} \\ 76 \\ \hline 40 \end{array}$$

Here is 8 for the simples, and somewhat more than $10\frac{1}{2}$ for the lashes; so that either 8 by 10, or 8 by 11 may be

taken, according as the manufacturer wishes his cloth of thickness.

Again, a 1600 with 120 shots in an inch, will require 8 by 11; for in a 1600 there are 86 warp threads in an inch —therefore,

$$86 : 120 :: 8 : 11$$

$$\begin{array}{r} 8 \\ \hline 86)960(11 \\ 86 \\ \hline 100 \\ 86 \\ \hline 14 \end{array}$$

In designing patterns for gauze harnesses, each splitful of warp counts for a simple cord, while only one shot of weft is equivalent to a lash. One half of the sett of reed therefore must be taken to find the proportion between the mails and lashes in a design.

For example—A 700 gauze harness is commonly woven with from five to six shots on the glass: suppose five shots —then the half of 7, the complete hundreds in the sett is $3\frac{1}{2}$ or 3.5—and

$$3.5 : 5 :: 8$$

$$\begin{array}{r} 8 \\ \hline 3.5)40.0(11 \\ 35 \\ \hline 50 \\ 35 \\ \hline 15=\frac{3}{7} \end{array}$$

So that 8 by 11, or 8 by 12 may be taken in this case, and so of others.

It was formerly noticed, that the number of lashes for the ground or first cover of any pattern might be variously ascertained. For instance, if the patterns be square, as those for allovers, diagonals, &c.; the number of designs in the tye will always be equal to the number of designs in the lashes, whatever be the proportion of the mails to the lashes in a design. But if a pattern be deeper than it is broad, as is commonly the case with the ends of plaids, &c. or broader than deep, as in the cross borders of shawls; then the breadth of the tye taken from the reed scale for the given sett, will be to the depth of the sketch taken from the same scale, as the number of designs in the tye, to the number of designs in the depth of the pattern; or if the sketch be divided into small squares, similar to the large squares of the design paper; then the number of these divisions counted upwards, will give the number of designs that the pattern is deep.

When the pattern is to stand on any given number of inches on the cloth, independent of the depth of the sketch; first find the number of shots on an inch from the number of shots on the glass, if necessary; then multiply them by the inches in the depth of the pattern; divide this product by the number of shots on the lash, and the quotient will be the answer.

For split harness patterns, when small, such as sprigs, cross borders of shawls, &c. five designs of paper that has eight mails in the design, will be sufficiently near for the lashes of one inch of cloth woven in a 1400 reed; whatever number of lashes may be allowed to the design. This arises from the consideration, that five designs of eight mails each, are equal to 40 cords of the simple: but as 38 splits or cords of a 1400 reed are equal to one inch, the difference is only two cords, which, for small objects, as already noticed, will be inconsiderable; consequently, five

designs deep will likewise give the same extent by the weft.

For deep patterns, however, such as pine plaids, one twentieth part must be deducted from the number of designs given by the above rule; but the number of designs or lashes may be more readily found by the following table. The left hand columns contain the hundreds of the reeds for the different setts, from 700 to 3200 inclusive; but when the two ciphers are cut off from the right, they exhibit the shots on the glass for their respective setts. In the right hand columns are the shots on an inch, and in the others, the splits contained in the inches and parts of an inch marked along the top.

DESIGNING TABLE.

Hds. reed.	¼ in.	½ in.	¾ in.	1 in.	2 in.	3 in.	4 in.	Sh. on in.
700	5	9	14	19	38	57	76	38
800	5	11	16	22	43	65	86	43
900	6	12	18	24	49	73	97	49
1000	6	13	20	27	54	81	108	54
1100	7	15	22	30	59	89	119	59
1200	8	16	24	32	65	97	130	65
1300	9	17	26	35	70	105	140	70
1400	9	19	28	38	76	113	151	76
1500	10	20	30	41	81	121	162	81
1600	11	21	32	43	86	130	173	86
1700	11	23	34	46	92	138	184	92
1800	12	24	37	49	97	146	195	97
1900	12	25	38	51	103	154	205	103
2000	13	27	40	54	108	162	216	108
2100	14	28	42	57	113	170	227	113
2200	14	29	44	59	119	178	238	119
2300	15	31	46	62	124	186	249	124
2400	16	32	48	65	130	195	259	130
2500	17	33	50	67	135	203	270	135
2600	18	35	52	70	140	211	281	140
2700	18	36	55	73	146	219	292	146
2800	19	38	57	76	151	229	303	151
2900	19	39	59	78	157	235	314	157
3000	20	40	60	81	162	243	324	162
3100	21	42	63	84	168	251	335	167
3200	21	43	65	86	173	259	346	173

DESIGNING TABLE CONTINUED.

No. reed.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.	Sh. on in.
700	95	113	132	151	170	189	208	38
800	108	130	151	173	195	216	238	43
900	122	146	170	195	219	243	267	46
1000	135	162	189	216	243	270	297	54
1100	148	178	208	238	267	297	327	59
1200	162	194	227	259	292	324	357	65
1300	175	211	246	281	316	351	386	70
1400	189	227	265	203	340	378	416	76
1500	202	243	283	324	365	405	446	81
1600	216	259	302	346	389	332	475	86
1700	230	276	322	367	413	459	505	92
1800	243	292	340	389	438	486	535	97
1900	257	308	359	411	462	513	565	103
2000	270	324	378	432	468	540	594	108
2100	284	340	397	454	511	567	624	113
2200	297	357	416	476	535	594	654	119
2300	311	373	435	497	559	622	684	124
2400	324	389	454	519	584	649	713	130
2500	338	405	473	540	608	676	741	135
2600	351	422	492	562	622	703	773	140
2700	365	430	511	584	657	730	803	146
2800	378	454	530	605	681	757	832	151
2900	392	470	546	627	705	784	862	157
3000	406	487	568	649	730	811	892	162
3100	419	503	586	670	754	838	922	167
3200	432	519	605	692	778	865	951	173

DESIGNING TABLE CONTINUED.

Hds. reed.	12 in.	13 in.	14 in.	15 in.	16 in.	17 in.	18 in.	Sh. on in.
700	227	246	265	274	303	322	340	38
800	259	281	303	324	346	367	389	43
900	292	216	340	365	309	413	438	49
1000	324	351	378	405	432	459	486	54
1100	357	386	416	446	476	505	535	59
1200	389	422	454	486	519	551	584	65
1300	421	456	493	527	562	597	632	70
1400	454	492	530	567	605	643	681	76
1500	486	527	567	608	649	689	730	81
1600	518	562	605	648	691	734	778	86
1700	551	597	643	689	735	781	827	92
1800	584	622	681	730	778	827	876	97
1900	616	668	719	770	822	873	924	103
2000	648	702	756	810	864	918	972	108
2100	681	738	794	851	908	965	1021	113
2200	713	773	832	892	951	1011	1070	119
2300	746	808	870	932	995	1057	1119	124
2400	778	843	908	973	1038	1103	1167	130
2500	811	878	946	1013	1081	1149	1216	135
2600	843	913	984	1054	1134	1204	1275	140
2700	876	749	1029	1094	1167	1240	1313	146
2800	908	934	1059	1135	1211	1286	1362	151
2900	940	1019	1097	1176	1254	1332	1411	157
3000	973	1044	1135	1216	1297	1378	1460	162
3100	1005	1089	1173	1257	1340	1424	1508	167
3200	1038	1124	1211	1297	1384	1470	1557	173

The use of this table is as follows:—Suppose it were required to find the number of lashes for the first cover of a plaid bottom, to be woven in a 1400 split harness, with 18 shots on the glass, and to stand 15 inches deep on the cloth. Look below 15 on the top, and on a line with 18 in the left hand column will be found 730, which, as there are two shots on each lash, will be the number of lashes required. Now as the design paper for this thickness is 8 by 10, it is only necessary to cut off the right hand figure, and the number of designs will be 73. Hence it is evident, that a full or one thread harness will have double the number of lashes given by this table; and a four thread harness, having four shots on the lash, only one half thereof; and so of any other.

To find the number of covers on any design, first, let the lashes on the ground or first cover be ascertained, which will always be equal to the number of small spaces of the design counted from the bottom upwards; then count the number of lashes in each of the other colours separately, and add them together. This sum divided by the number of lashes in the ground cover, will give the number of additional covers; and where there is a remainder, place it over the divisor in form of a vulgar fraction, and reduce it to its lowest terms. Then, when the price of weaving, or the quantity of weft requisite for one cover, is multiplied by the numerator and divided by the denominator of this fraction, the result will be the price, or quantity of weft requisite for the fractional part of the cover; sometimes, however, the first cover consists of more than one colour, but when this occurs, these lashes must be kept distinct from those of the additional shotting, and counted as if they were only one, when calculating the price of weaving.

Example:—Suppose a design with 160 lashes of black spotting for the ground cover; then, if there be 140 green,

86 red, 68 yellow, and 46 light blue, we have 140+86 +68+46=340, which divided by 160, the ground cover, gives 2 and 20 of a remainder. Now this remainder placed over the divisor, is $\frac{20}{160}$; and this reduced to its lowest terms, is $\frac{1}{8}$; so that the whole covers of the pattern, by adding the first, will be $3\frac{1}{8}$. Whatever therefore be the price of weaving one cover, the whole price of weaving will be $3\frac{1}{8}$ times that sum.

Again—were it required, from the number of lashes on the first cover of a design, to find the depth of the pattern on the cloth, it is only necessary to look along the line, either with the shots on the glass, or in an inch, for the nearest number to the lashes, provided it be for a split harness, and the depth in inches will be found on the top of the table—and so for any other kind of patterns.

READING, OR LASHING PATTERNS.

This process, which consists merely in transferring the design of a pattern to the simple of a harness, was, till of late, conducted by two persons, one of whom read the flower off the design, while the other picked out the corresponding simple cords with a long needle, for the purpose of applying the lashes afterwards.

This method, however, requires no further explanation here, as it is now entirely superseded by another invention lately introduced, by which one person not only performs the work of two, but applies the lashes at the same time that he is reading the flower. The method of lashing here alluded to is as follows: The lower end of the simple A is fastened to the cross bar B in the lashing frame, Fig. 13, plate 12, and after each simple cord is placed in a separate interval of the reed C, which is open at one side, so as to resemble a comb, the other end of the simple is fastened at the back of the frame. This reed must be made of such a fineness, that each cord of the simple

may stand directly opposite to that space of the design paper to which it corresponds in the pattern; with allowance for one empty interval of the reed at the end of each design. The pattern is now placed immediately above the reed as represented in the Fig.: and over it the ruler E, which is made to slide up and down in grooves cut in the sides of the frame.

These arrangements being made, and the ruler E fixed above the space of the design paper that represents the first lash, the operator fastens one end of the lash twine round the pin *a*, in such a manner that he can disengage it again at pleasure; then, after counting off such spaces at the left of the design as are to be omitted, if any, he takes a turn of the lash twine round the first parcel of simple cords that are to be taken for the lash, bringing the loop of the twine over the pin *a*, then round the next parcel of cords that are to be taken, and again bringing the loop of the twine over the pin *a;* and so on, alternately, until the lash be completed; taking care at the same time, never to take above six or seven cords into one tack or loop of the twine; for, when a greater number of cords come together, they must be divided into different tacks, not exceeding either of these numbers in each. After the lash has been applied in this manner, the two ends of the lash twine are knotted together, close to the pin *a*, which is now taken out, and the loop that it has formed is twisted round and made into a snitch for the purpose of fastening it to the head. The lash is now pushed down behind the board *m* to make room for another.

For example: Suppose the sprig, Fig. 5, plate 12, were to be read on a simple of 96 cords, and that one row of sprigs were to be thrown into the bosom of the other. Here it is evident, that as this sprig contains 48 cords, which is exactly the half of the simple, the other half will be appropriated to the intervening plains. Then, when

the design is placed in the frame and adjusted to the simple, as already mentioned, the lasher, after fastening one end of his twine, counts off 20 cords at the left side of the simple, corresponding with the 20 blank spaces on the first space of the pattern; then takes a turn of the twine round the next two cords and brings the loop over the pin *a;* he again passes 7 cords and takes 9; but as 9 cords are too many for one tack, he divides them into two parcels, or tacks, one of 5 and the other of 4, which he separates by a turn of the twine. The two ends of the twine are now knotted, the pin taken out, the loops twisted, and the lash put over the bar *m*. The other lashes are applied in the same manner till the sprig be finished. The bosom sprig is next read on that half of the simple that was set aside for the plains of the first row; but as the position of the sprigs in these two rows is commonly reversed, the reading must commence at the opposite side of the design, which is done either by taking the tacks from right to left, or by turning the design upside down, and reading downwards.

The small pattern in the frame is the same as Fig. 7, which is given as an example of double shotting on a small scale. For, suppose the lasher had already applied the first seven lashes, which are all adapted to one cover, the ruler E would now be shifted to its present position, which is immediately above the eighth space, in which there are two cords of yellow or double shotting in the centre of the sprig. Then, after applying the red lash for the ground cover, as already directed, he would take another tack for the two cords of yellow, which must be kept as a distinct lash from the other.

Although in these examples the instructions are given to take the painted parts of the design; yet in some cases it is of advantage to the weaver to take the ground simples and pass the flower, especially when the latter is con-

siderably heavier to draw than the former; and in others it is absolutely necessary, as in shawls, for instance, the pattern of the side borders of which are thrown up by the warp and of the cross borders by the weft; for in the one the flower is taken, and in the other the ground.

It may be here observed, that the cross bar or board *m*, in the frame, should be made somewhat circular at the back, that when the simple cords are spread round it, the lashes may be all of an equal length from the simples to the pin *a*. Also, that the cross board *a* should be moveable on the side pieces, so that it may be fixed nearer to, or farther from the board *m*, according to the intended length of the lashes.

SECT. III. APPLICATION OF THE DRAW LOOM.

It has been already observed, that the draw loom must assume different forms, to suit the various branches of fancy weaving in which it is employed. This diversity arises sometimes from the construction of the harness, and sometimes from the mode of opening the flowering sheds. In some draw looms these sheds are opened directly by the harness; in others, by the front leaves, after certain portions of the warp have been raised by the mails. The former of these are either the full, or flushing harnesses; the latter are generally termed pressers, and have always more than one thread in the mail. The pressers, also, may be divided into two kinds, namely, those which incorporate the whole of the weft into the fabric of the cloth, such as the several species of damask; and those which have parts of the spotting weft cut away between the flowers, as in some of the imitations. The general principle however on which the presser harnesses operate, will be easily understood by an explanation of a very simple apparatus called the

DIAPER HARNESS, OR BACK CAAM.

Fig. 4, plate 11, is a side view of this apparatus, adapted to a diaper pattern of five divisions, and woven with a five leafed tweel. 1, 2, 3, 4, 5, are leaves of heddles with mails instead of eyes, and are the substitute for the harness. They are mounted with bow cords as already explained; from each of which a cord passes over a pulley in the box *o*, and extends above the weaver's head to a convenient distance, where it is fastened like the tail of another harness. To each of these tail, or rather simple cords, is tied a knot cord *a*, to which is appended a bob or handle *e*, and is secured by pulling the knot into a notch in the board *u* when drawn by the weaver's hand, as exhibited in Figs. 13 and 16, plate 1. To the under shafts are attached the weights *i*, one at a little distance from each end of the shaft, to sink the leaves when relieved from the notches. 6, 7, 8, 9, 10, are the front or ground leaves, which are equal to one set of a five leafed tweel, and with eyes of a length sufficient to allow the warp to rise in the harness sheds without obstruction.

In each mail of the harness leaves are commonly 4, 5, or more threads, generally one set of the tweel draught, which, in the present example, is five. These threads are again drawn through the front leaves in the order exhibited in Fig. 5; that is, each mailful of the back leaves A is separated and drawn in regular succession through the eyes of the ground leaves B. On the treadles at C is the plan of cording; but here it must be observed, that the ciphers denote raising cords, the crosses sinking ones, and the blank squares the leaves which are stationary when any shed is opened; so that by comparing the plan of cording at C, with the position of the front leaves in Fig 4, it will be found, that when the treadle 1 is pressed down, the back leaf 6 is stationary, the leaf 7 is raised, the

leaf 8 is stationary, the leaf 9 is sunk, and the leaf 10 is stationary. Hence it is evident, that when one or more of these back leaves are raised by pulling the bobs, all the warp threads which pass through their mails will be raised to the top of the eyes of the front heddles; and when any treadle, as No. 1 is pressed down, the leaf which is sunk will take along with it one thread out of each mailful which was previously raised, and the leaf that rises will take along with it one thread out of each mailful that remained at the bottom of the shed; consequently, four-fifths of the flower warp, and one-fifth of the ground will be above the shuttle in this shed; which produces exactly the same effect as the turned or reversed tweeling, formerly explained. Now it will appear that by this method of pressing, all the weft, both in the ground and pattern, will be incorporated with the warp; but were one leaf sunk without raising the other, the parts of the weft then thrown in would be flushed over those portions of the warp that were not pressed, which makes the distinction already noticed in the presser harnesses.

By referring back to the process of weaving diaper, it will obviously appear, that this simple apparatus will produce the same effect as twenty-five leaves and as many treadles mounted in the common way. Hence it is, that the back harness or caam is frequently employed for weaving such patterns as are of an intermediate extent, between the power of single leaves and what is properly termed the damask harness. It is also farther to be observed, that as the number of back leaves in these mountings must be exactly the same as those in the binding plans of the patterns for which they are intended, the draught over these leaves will also follow the very same order of succession; and the weaver must likewise pull the bobs or handles in the same order in which he would work over his treadles.

Fig. 12, Plate 4, is a shawl pattern adapted to the back harness. It is one of the gathered kind, the two dark spaces at the left hand being the centre of the border. It requires 36 back or harness leaves, seven for the borders and twenty-nine for the bosom sprigs.

DAMASK.

This beautiful branch of ornamental weaving takes its name from Damascus, where it is said to have been invented.

Silk damasks are manufactured in abundance in several parts of England for ladies' shawls, &c. This branch is also carried to a great extent in the manufacture of table linen, and has also, of late, been introduced into the cotton manufacture with considerable success, in the form of shawls and other kinds of ornamental dresses; which latter are chiefly made for the export trade.

Damask, like the diaper, is merely a branch of fancy tweeling; or rather, it is the principle of diaper weaving conducted on a more extensive scale by means of the draw loom. Damask patterns, therefore, are formed on the cloth merely by reversing the tweel, which is considerably diversified by employing different sets of front leaves, or by varying the arrangement of the raising and sinking cords on the treadles: Some of the most useful plans of which are as follow.

No. 1, 4 leafed. Biassed.

		x	0	1
	x	0		2
x	0			3
0			x	4
4	3	2	1	

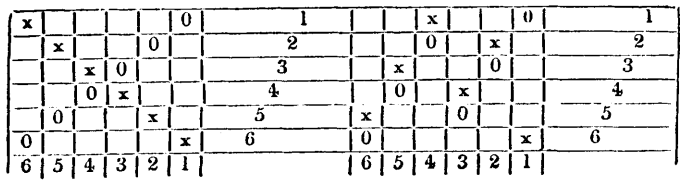
No. 2, 5 leafed. Biassed.

			x	0	1
		x	0		2
	x	0			3
x	0				4
0				x	5
5	4	3	2	1	

No. 3, 5 leafed. Broken.

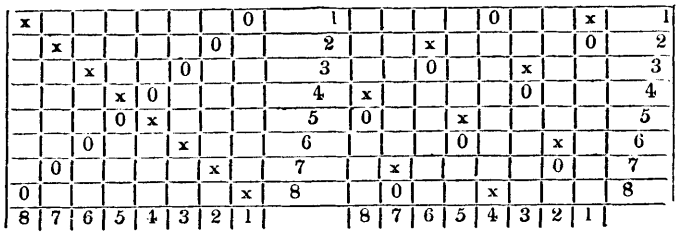
x	0				1
			x	0	2
	x	0			3
0				x	4
		x	0		5
5	4	3	2	1	

No. 4, 6 leafed.
Biassed.



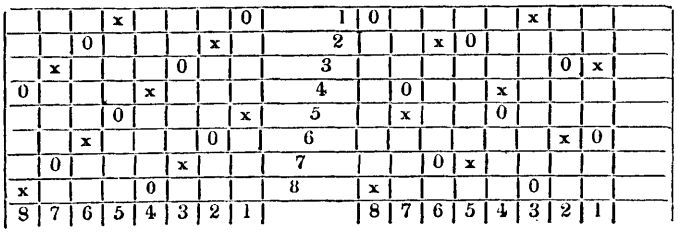
No. 5, 6 leafed.
Broken.

No. 6, 8 leafed.
Biassed.



No. 7, 8 leafed.
Broken.

No. 8, 8 leafed.
Broken.



No. 9, 8 leafed.
Broken.

Damask for table linens are sometimes woven with a five leafed tweel, and sometimes with one of eight or more leaves. When woven with a five leafed tweel, they are usually denominated bastard damask; and when more than eight leaves are employed, they are called superfine dam-

asks. The eight leafed tweel, therefore, is that which is usually termed the damask tweel.

The number of threads in each mail of these fabrics, is likewise variable, being sometimes three, four, or more, according as the web is intended of fineness. Taking advantage of this circumstance, the damask weaver has seldom use for more than one harness, though he may have occasion to weave different setts of reed; for, by thus varying the number of threads in the mail, and even the number of threads in a split, the number of setts may be considerably increased without either changing the reed or harness: and this plan of economy is still carried farther, where much accuracy is not required, by sometimes drawing a thread more in one mail than in another, and disposing of these additional threads at regular intervals, in the same manner that weavers set their overplus heddles when they are finer than the reed. Damasks, however, when wanted very fine, and much accuracy and delicacy required in the design and shading of the pattern, may be woven in a full harness; but as these require an immense quantity of cordage, and, consequently are so very expensive in mounting, especially when the pattern is large, the full damask harness is not common.

In looms mounted for extensive patterns, considerable economy is also observed by introducing what is termed single and double mounting. In the single mounting every mail in each part has a simple cord to itself, and therefore can be raised independent of any other. The double mounting is merely certain portions of the border, or body gathered; by which means, not only the tail and simple are considerably curtailed, but a vast deal of expenses are saved in drawing and designing these extensive patterns.

For example: Suppose a damask napkin were to be woven, which has 63 porters warp and 5 threads in each mail; then we have

Porters warp, . . .	63
40 threads in one porter mult, .	40
Divide by the threads in a mail,	5)2520
	504 mails.

Now these may be divided into parts, thus,

For one side border, .	9	designs,	single.
For the body, . .	13	do.	double.
Do. . .	6	do.	single.
Do. . .	13	do.	double.
For the other side border,	9	do.	single.
	50	designs.	
10 mails in a design,	10		
	500	mails.	

which deducted from the given quantity of warp, leaves four mails or ten splits for selvages. Here the designer can draw any pattern he pleases for the borders, to the extent of 9 designs or 90 cords. In the body of the napkin, however, he may draw what he pleases also on the 6 designs in the centre, as that part is single mounting; but it must be such a figure as will join with the 13 designs of double mounting on each side, so as to form the whole pattern into one complete group. The tie of this harness will therefore be 90 cords for the border, 130 double and 60 single for the body; making in whole 28 designs, or 280 cords for the simple.

Patterns for damask tablecloths are designed on 10 by 10 paper, and may be woven square by adapting the number of shots on each lash, to the intended thickness of the cloth. They are generally composed of coats of arms, groups of flowers, landscapes, birds, trees, &c. and are shaded off after the manner of the sprig, Fig. 5, so as to render all the component parts of the pattern perfectly distinct.

Damask harnesses are sometimes mounted for the draw-boy, sometimes on the comb or patent plan, explained already, and sometimes these two principles are united: as, for example, when a coat of arms is woven in the centre of a tablecloth, the borders and part of the body are commonly mounted for the comb, while the part that works the armorial bearings, is adapted to the draw-boy. In large mountings, however, there are frequently two or more simples, and sometimes two or more pulley boxes, which are placed in the most convenient position for the weaver; and when any of the simples are not employed, they are tied up and laid aside until they be wanted in their turn.

It may be further observed, that in weaving damasks in general, when any portion of the simple cords are pulled down to form a flowering shed, these cords must be kept down during the time the weaver throws in the whole number of shots on one lash. To ease the draw-boy of this exertion, he has a small apparatus attached to the side of the loom, called a dog, which, by pressing down a treadle with his foot, he runs a bolt through above the tail cords which are pulled down by the simple, and thus prevents them from recovering their natural position without any further trouble, till it becomes necessary to change the lash.

It is likewise, evident, that as in damask weaving, there is only one leaf raised and another sunk by each treadle, while the others remain stationary, these two leaves will nearly balance each other, and so prevent them from recovering their former position after the weaver has withdrawn his foot from the treadle. To remedy this, a weight is attached to the long and short marches of each leaf, nearly in the same manner as in gauze mountings; so that when any leaf is raised, the weight acts on the short march to sink it, but when sunk, the weight is transferred to the long march, which brings it back to its former position. In high mounted damask looms, however, the weights are attached to the top levers.

The following varieties in the cotton manufacture, are woven on the damask principle, namely, common damask shawls, improperly called dumb flower shawls; Lachores, Bungoes, Waterloos, double damask shawls, (double dumb flowers,) cross Zebras, and Angolas.

THE COMMON DAMASK SHAWL,

which was explained as an example in the article designing, has uniformly four threads in the mail, is woven with an eight-leafed satin tweel, such as Nos. 7, 8, 9, in the preceding list, and with eight shots on the lash. The warp and weft of this class are, for the most part, of different colours.

LACHORES,

imitations of a manufacture of this kind in the province of Hindostan, are damasks striped by the warp, with only one shuttle for the weft. The patterns are made to suit the stripes, although they have frequently borders, and pines on the ends, in the form of scarfs.

BUNGOES,

from Strathbungo, in the vicinity of Glasgow, where they were first made, are Lachores spotted to a certain extent of cover.

DOUBLE DAMASK SHAWLS,

a kind of allover spotted damask, with the spotting weft sometimes flushed over the intervals of the ground, though more frequently incorporated with it on the opposite side from the pattern. They have also four threads in the mail, and are woven with the same tweel as the common damask shawl, though No. 7, in the preceding collection, is commonly preferred. The greater part of these shawls have eight shots of the ground, and eight of the spotting on each lash, though sometimes they have only four of

each kind. The two shots of the ground and two of spotting are thrown in alternately; that is, supposing No. 7 to be the draught and cording, there would be two successive shots of the ground, and two of the spotting thrown in on the treadles 1 and 2; two of each on the treadles 3 and 4; and so forth. The first two of these shots, however, are thrown in on the lash, which is drawn first, and the other two on the remaining part of the simple, which is denominated the back lash. To assist the draw-boy in this process, he has the apparatus called the dog, fixed to the lower side rail of the loom. This apparatus consists of a piece of wood rounded and brought to a point at one end, and the other end is nailed to a flat piece of wood at right angles, which is moveable, horizontally, on an iron rod. When, therefore, the simples of any shed are separated from the rest by the lashes, the draw-boy runs the dog between them; and then turns it on its axis toward the floor, which pulls down the simples of the pattern, in which position he holds it till the weaver throws in two shots; then turns it in the contrary direction, which draws down the back part of the simple or back lash, on which the other two shots are thrown in.

Another method of weaving double damasks was some time ago introduced by Mr. William Kyle, Glasgow, on a silk shawl, although it has not yet been adopted in the cotton manufacture. The object of this method is, to display a greater diversity of colouring than can be produced in the present method, without increasing the number of shuttles. For instance, were the ground weft white and the spotting red; then, all the ground could be made white, one part of the pattern red, another part pink, or a mixture of the two wefts raised together; and farther, the reverse side of the mixture could be thrown up in other parts, to increase the variety of shades; which, were the warp also of a different colour, would often have a good

effect. This diversity arises merely from the manner in which the lashes are applied; for instead of drawing the back lash, as at present, there must be two lashes for each space of the design paper. For the first of these lashes, the white parts for the ground are missed, the red taken, and the parts for the pink or mixture are missed. For the second lash or red shot, the whites or ground are taken, the red and mixture missed; that is, the mixture is always missed, but when the reverse is wanted, these parts are always taken. The other two are taken and missed alternately.

CANTON CRAPES.

These fabrics are an imitation of a species of silk shawls imported from Canton, the capital of the Province of Guangton in China, and centre of the European trade in that country. These shawls are sometimes woven plain, and sometimes flowered in the draw loom. The plain ones are, for the most part, ornamented with needle work. The grounds are plain texture; but the flowered parts of those woven in the draw loom are tweeled with an eight-leafed satin tweel, the same as on the finer kind of damask. The shawls, robes, &c. manufactured in this country, are commonly woven in an 1800 reed, and have from three to five threads in the heddle, according to the fineness of the silk; and when woven in the draw loom, the greater part have four threads in the mail; though some have been woven in a three thread, and some in a split harness. There are two wefts, very hard twisted, the one twist contrary to the other: so that when the cloth is boiled for a considerable time in soap and water, it assumes the crimped or curled appearance of the common mourning crape. The following plans of cording will show how the ground and pattern of a harness shawl are produced.

No. 10.

	0	x	0		0		0	1
0		0		0	x	0		2
x	0		0		0		0	3
0		0	x	0		0		4
	0		0		0	x	0	5
0	x	0		0		0		6
	0		0	x	0		0	7
0		0		0		0	x	8
8	7	6	5	4	3	2	1	

No. 11.

	x			0	0	0	0	1
0	0	0	0			x		2
x				0	0	0	0	3
0	0	0	0		x			4
			x	0	0	0	0	5
0	0	0	0	x				6
		x		0	0	0	0	7
0	0	0	0				x	8
8	6	4	2	7	5	3	1	

In these plans, the crosses ×, represent sinking cords, and the ciphers raising ones, as in the damask plans of cording. No 1 is the regular or progressive plan of cording, and No. 2 is the same, arranged for the weaver's use.

In the weaving of this species of the draw loom, the lay is so suspended that when it is put back to allow the shuttle to pass, all the warp lies on the race rod; and when the lashes are drawn, the warp which is to form the pattern is raised to the upper part of the long eyes of the heddles; so that when the weaver presses down the treadles, the alternate threads of the ground warp are raised to produce plain texture, and every eighth thread of the flower or pattern warp is sunk to make the tweel, as in the common damask.

CROSS ZEBRAS

are also a kind of double damask, which have their patterns running in stripes across the cloth. The spotting is sometimes flushed between the figures, and sometimes incorporated with the warp.

ANGOLAS.

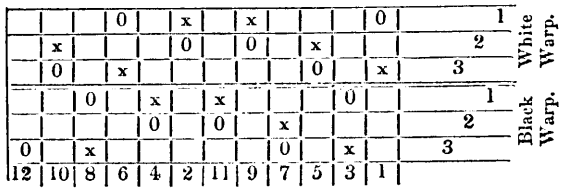
Those which are woven in the draw loom, are double damasks with a four-leafed tweel, of which No. 1 is a draught

and cording. In weaving these, a shot of each of the two wefts is thrown in on the same foot, but the one is thrown in on the fore lash, and the other on the back one.

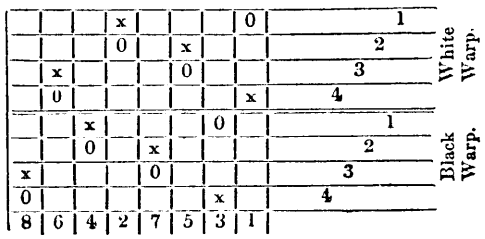
DOUBLE CLOTH HARNESS.

Having already explained the principle on which double cloth is woven, it only remains here to show how it is extended to the draw loom. Suppose we take a shawl for example, the pattern of which is black, and the ground white: then the warp would be composed of a white and a black thread alternately, and four of these threads, two of each kind, would be drawn through each mail of the harness. Were the texture to be that of a three-leafed tweel; six front leaves, three for the white, and three for the black warps would be necessary; and twelve treadles would be requisite to make the treading alternate. A four-leafed tweel, however, would require eight leaves and only eight treadles. The following plans will show the draughts and cordings of these mountings.

No. 12. THREE-LEAFED TWEEL.



No. 13. FOUR-LEAFED TWEEL.



In weaving these shawls, two shots of white and two of black weft are thrown in alternately; the two former on the fore lash, and the two latter on the back one. By inspecting No. 10, it will appear, that when any part of the warp is raised by the harness, the treadle marked 1 sinks one white leaf and raises another; and, consequently, forms the first white shed perfectly clear of the black; the pattern part of which is above the shuttle, and of the ground, below it. The same is to be observed of the treadle marked 2. The back lash reverses the harness shed, by raising the ground and sinking the pattern. The treadles 3 and 4, therefore open the two black sheds, by raising each one leaf and sinking another. The four-leafed tweel operates exactly in the same manner.

Carpets were formerly woven on the principle here explained; but are now generally woven with a machine invented or improved by a Mr. Morton of Kilmarnock, which entirely supersedes the use of a draw-boy. This machine consists of a large cylinder placed above the loom, with the lifts of the harness, agreeably to the pattern, formed on its cylindric surface, by means of nobs and staples made of wire, after the manner that a tune is pricked on the barrel of an organ. These staples act on levers, which throw the simples, or rather tail cords, on each of which there is a knot, into the teeth of two combs, one for each warp, alternately; and the sheds are opened directly by the harness, by means of the treadles.

The double cloth harness is also employed in weaving Marseille bed-covers; which, as it is merely an extension of those mountings explained under the head Double Cloth, will require no farther consideration.

IMITATIONS.

The second kind of presser harnesses mentioned in the beginning of this section, are chiefly employed in weaving

imitation shawls, trimmings, scarfs, plaids and zebras, They have sometimes two, three, or four threads in the mail, and commonly the same number of shots on the lash, respectively. The grounds are woven with a four-leafed tweel; though the pattern has sometimes one of four, sometimes one of eight, and sometimes even one of twelve. The following plans will show the principal tweels which are woven on these fabrics.

No. 14.

			x	x	0	0	x	1		x			x	x	x	0	1
		x		0	0	x	x	2			x		0	x	x	x	2
	x			0	x	x	0	3				x	x	0	x	x	3
x				x	x	0	0	4	x				x	x	0	x	4
4	3	2	1	4	3	2	1		4	3	2	1	4	3	2	1	5

No. 15.

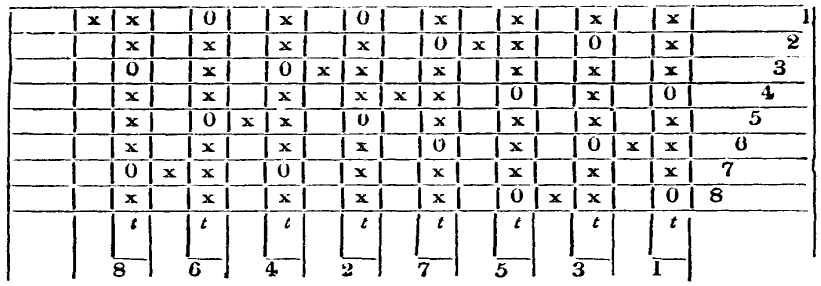
No. 16.

					x		x	x	0	0	x		1
			x			x			0	0	x	x	2
	x			x					0	x	x	0	3
		x					x		x	x	0	0	4
		t		t		t		t					
		4		3		2		1	4	3	2	1	

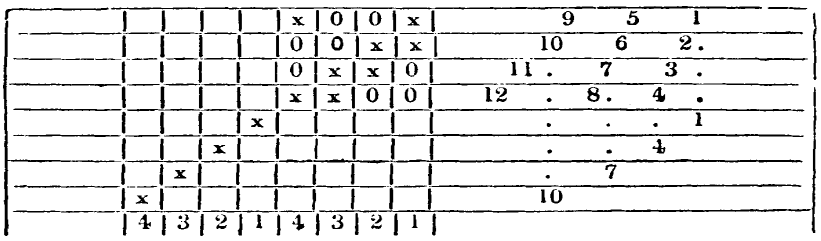
No. 17.

		x		0		x		0		0	x	x		0		x	1
		0		x		0	x	x		0		x		0		x	2
		0		x		0		x	x	x		0		x		0	3
		x		0	x	x		0		x		0		x		0	4
		x		0		x		0		0		x		0	x	x	5
		0	x	x		0		x		0		x		0		x	6
		0		x		0		x		x		0	x	x		0	7
	x	x		0		x		0		x		0		x		0	8
		t		t		t		t		t		t		t		t	
		8		6		4		2		7		5		3		1	

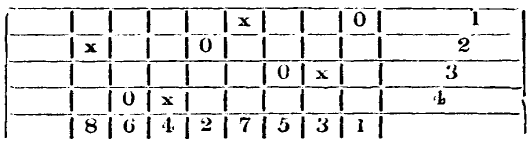
No. 18.



No. 19.



No. 20.



The purposes to which these cordings are applied, are as follow:—

No. 14 is for cotton, silk or worsted; the ground equal on both sides.

No. 15 is for a silk warp with cotton weft, the weft

thrown to the wrong side of the cloth, that the silk warp may appear to more advantage on the right.

No. 16 has the tongues marked *t* attached to the spotting treadles, for the purpose of throwing in silk or worsted on the back lash, while the ground weft is cotton. When the spotting is thrown in, the treadle only is sunk, but when the back lash is drawn, the weaver shifts forward his foot, and presses down both tongue and treadle.

No. 17 is an eight-leafed tweel for spotting a plaid or shawl, while the ground is a tweel of only four leaves. When the ground shot is thrown in, the weaver sinks both the tongue and treadle; but for the spotting, the treadle only is sunk.

No. 18 is a tweel of the same kind as No 17, but throws the weft to the wrong side, that a silk warp may appear on the right.

No. 19 is a plan of a four-leafed tweel for the ground, and a twelve-leafed tweel or flush for the spotting. Each of the threads, 1, 4, 7, 10, is drawn through two heddles, which are marked on their respective leaves in the plan.

No. 20 is for weaving two shots of ground, and two of spotting, alternately.

Sometimes imitation shawls, trimmings, scarfs, and plaids, are woven without pressing; in which case the spotting is thrown into the shed opened directly by the harness; and wherever the spotting would be too far flushed, it is catched by the harness, as pointed out by the design, in the manner exhibited in Fig. 9, Plate 12.

THE COMMON HARNESS

operates on the same principle as the common spot, explained in chap. 8. The right hand thread of each splitful of warp is drawn into a mail, or rather an eye of the harness, and the other is taken through on the left side of it; and

both threads are again drawn through a set of heddles with long eyes in the front, for weaving the ground. The spotting sheds are, therefore, opened directly by the harness; and there are two shots of the ground, which is generally the plain texture, thrown in for one of spotting. This harness was formerly much used for spotted lawns, but it is now chiefly employed in weaving patterns which are formed with cotton rove.

THE PAPER HARNESS

is also an extension of the paper spots. It is therefore evident, that the paper harness will be double of that described above; or, in other words, it will consist of two such harnesses, the one being placed in front of the other; and the first thread of a split is drawn through the eye of the back harness, and the other through the eye of the fore harness, alternately. It has also a set of plain leaves with long-eyed heddles in the front, for weaving the ground. But this harness has now given way to what is usually termed

THE FULL HARNESS.

This harness is, in effect, the same as the preceding, only the threads of warp, instead of being drawn alternately on the back and fore parts, are here drawn straight over the harness, in the manner of an over and over tweel. It is employed in various branches of weaving, wherever much delicacy of pattern is required.

THE GAUZE HARNESS,

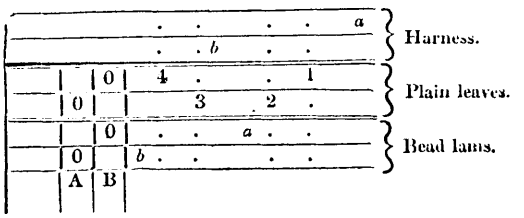
like that of the common spot, contains only one-half of the warp, the other half being taken through between the eyes. In front is a set of gauze mounting for weaving the ground, and having two back standards; as explained in spot weaving.

After the warp is taken through the harness, that is to say, one thread through an eye and the other past it on the left, the whole is taken through the front mounting as formerly described; that thread which passes through the eye of the harness being taken into the upper doup, and the other into the under one. Hence, in forming the spotting sheds by the harness, a treadle must be pressed down, which will raise the back standard, through the under part of which the threads of warp pass, and also the backmost leaf of the back set, which has also the same threads through below its clasps; the others being all sunk, as explained in spot weaving. In working these patterns, in general, one shot of ground and one of spotting are thrown in alternately; although in some patterns there are two shots of the ground for one of the spotting.

TURKEY GAUZE HARNESS.

There have been various methods invented, at different times by ingenious tradesmen, for facilitating the process of weaving Turkey gauze in the draw loom, and improving the quality of the cloth. The three following plans, however, are selected, as having been found to answer fully these important ends, leaving to the intelligent tradesman to judge of their respective merits. The first is quoted from the Renfrewshire Chronicle of April 7th, 1825, under the title of, "Improvement in Turkey Gauze Weaving," and which is given in the writer's own words.

No. 21. PLAN OF THE MOUNTING.

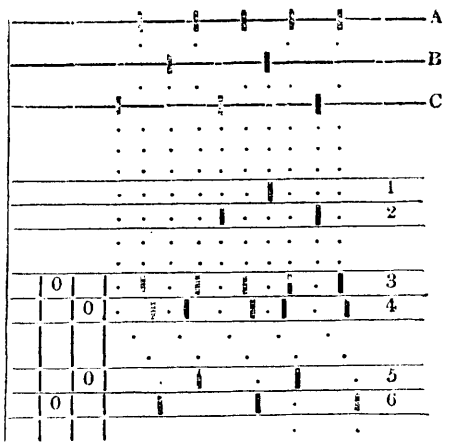


The figures, 1, 2, 3, 4, in the foregoing scheme, show the order in which the ground warp is drawn on the plain leaves. The letters *a*, *b*, on the upper spaces, show where the first two threads of whip are drawn through the harness; and the same letters on the lower spaces, show where these threads are taken through the bead lams. The thread *a*, crossing under the ground threads 1, 2, and the thread *b*, under the threads 3, 4. It is scarcely necessary to add, that these crossings take place after having passed the plain leaves. The harness, it will be observed, is divided into two parts, and the whip drawn alternately on each. When the treadle A is pressed down, part of the whip passing through the back harness is drawn up to form gauze; and when B is pressed, part of that in the fore harness is drawn up for the same purpose. Were the whole of the harness drawn alternately, as A or B is pressed, the whole fabric would be gauze; and, when the treadles are used without the harness, the whole is plain cloth.

Perhaps some further improvement may be made; but it appears, that in every previous attempt to produce the desired effect, so many obstacles presented themselves, that all the plans were soon thrown aside. One thing is certain, that Robert M'Gown, Weaver, Back Sneddon Street, who introduced the above, has produced a considerable quantity of cloth by his method, and that, too, from materials which several operatives declare incapable of being woven on the old plan.

The second method was mounted and woven in Paisley, in the year 1800, by Mr. Charles Allardyce, now foreman in Glasgow. The plan of his mounting is as follows:—

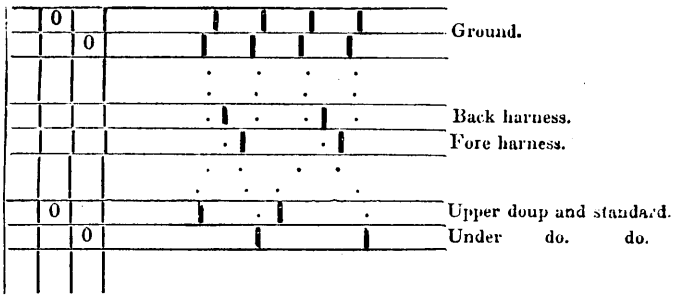
No. 22.



In this plan, the three lines marked A, B, C, represent three rolls; A, the ground roll, B, the back whip roll, and C the fore whip roll. The spaces 1, 2, are the back and fore harnesses respectively; 3, 4, two ground leaves, and 5, 6, two under doups and standards, the same as explained in cross weaving. When the harness is raised it makes gauze, and those parts which are not raised by the harness, are plain texture. When the doup and standard 5 are raised, the doup 6 is slack, and when the doup and standard 6 are raised, the doup of 5 is slack. All this will be easily understood by referring to the process of weaving common gauze, by omitting the upper doup and standard. It is necessary, however, to notice, that the harness is mounted so low, that the whip lies on the race rod when not raised by the harness or standards.

The third method was invented about the same time as the preceding, by Mr. William Kyle, now in Glasgow, of which the following is his plan:—

No. 23.



What is raised by the back harness makes plain cloth, and what is raised by the fore harness, produces gauze. To make the whole gauze, sink the back, and raise the fore harness. The harness is drawn every second shot, when the left treadle is sunk.

SEEDING HARNESS.

When the harness was first applied to seeding, it was so much encumbered with small bobbins for the seeding warp, one for each thread, that patterns of great extent were almost impracticable. This, however, is now obviated by beaming such parts of the seeding warp as work nearly equal, on one roll, and the other parts on others, and suspending a piece of lead to each thread between the mounting and the yarn roll; the slack parts being drawn in at the face of the cloth, when necessary, at the end of a piece. The leads thus suspended are regulated by a hole-board, placed below the loom.

Thus, for example, in a shawl pattern, the seeding warp of the side borders is beamed on one roll, that part which forms the bosom sprigs on another, and the part in the plain spaces between the sprigs, which is cut away when the cross borders are finished, on a third. The principal care, therefore, which is necessary in designing these patterns, is to have them regularly covered, without hurting the figures, that the seeding warp may be wrought up as equally as possible.

The harness, in this species of weaving, is placed before the ground leaves; and as the seeding threads pass through the harness above the clasp, neither eyes nor mails are necessary.

BROCADE HARNESS.

The most common kind of brocades were explained under the article Paper Spots. There is another kind of brocading in the cotton manufacture, however, which is a species of spotting woven in a full harness, that rises above the ground in such a manner, as very much to resemble that kind of needle-work called satin stitch. Patterns of this description are so designed, that the harness raises only a few threads round the edge of the figures when they are small, or divides them into separate members when large; and therefore, all the spotting, which is commonly cotton rove, is thrown to the right side of the cloth.

These patterns are generally woven with an apparatus called circles, from the pirns or bobbins which contain the spotting weft moving in a circular direction, so that each spot, which has its own spotting thread, is bounded with a neat selvage.

SARCENET FLUSH.

Fig. 14 is the pattern of a silk flush, or spotted sarcenet, which is a combination of flushing, tweeling, and plain texture. Fig. 15, shows how the same is put on design paper. It requires a full harness, and the tweeling of the ground, as well as the shading of the figure, must be represented on the design paper. If therefore, the warp of this web be supposed white, and the weft purple, the ground, which is that of a regular tweel, will be chiefly white, the two large buds which are dark shaded, will be purple, and are formed by flushing the weft over the warp: the four buds on the top are woven by reversing the tweel of the ground; the intermediate space, which is cross shaded, is plain cloth, and the centre, which is white, is flushed by raising that portion of the warp.

Having explained the general principles of weaving, both as performed by leaves and the draw loom, agreeably to the practice of this country, I shall conclude this chapter with an extract from Mr. Moorecroft's Letters from India, on the Shawl Trade.

"The shawl merchants admire the ingenuity of the English artists in imitating Cashmere shawls, but condemn the cloth on account of its harshness, which may consist in a difference in the twisting of the yarn. In the shawl country, there are three coloured wools, white, light brown, and dark brown. The two last are from Thibet, the other from Bholkera. The light brown will receive four colours, viz. black, blue, green, and brown. The dark brown will receive only black, brown, and blue. The shawl merchants state that the colours in the English shawls are fugitive. The colours now used do not exceed fifty in the most elaborate productions of the Cashmere loom. Formerly it

was said that three hundred and forty shades of colour were used.

"The embroidery is not worked with the needle, but woven in the cloth. The patterns are read off from a book, and not from a drawing. There is an embroidery language or cipher, by which the colours, number, division, distribution, and manipulations of the threads, and the forms and size of the flowers and foliage, &c. are symbolically designated. The looseness of twist in the web is owing to being done by the hand."

New method of Figuring Shaded Silks.—A new method of figuring shaded silks has just (January, 1827) been introduced from France, which is likely to give a pleasing diversity to this branch of manufacture. The figure is produced by a peculiar construction of the reed, and a vertical motion given it by the weaver's feet. The reed is made in alternate spaces, varying in fineness from one rib to the other; for example, from a 1000 to a 2000 reed; but those spaces which are of the fineness of a 1000 reed, in one side or rib, are of the fineness of a 2000 reed, in the other side or rib; the splits or dents standing obliquely, as represented at Fig. 10. plate 13. The machine in which these reeds are made is so constructed, that two turns of the wooping are taken round the rib between the splits in the coarser spaces, and only one turn where they are finer. The reed is about seven inches deep between the ribs; and, as already observed, has a vertical motion given to it in the lay, by means of a rack or other adequate apparatus, communicating with the treadles by cords; and consequently, where the finer parts of the reed come in contact with the face of the cloth, the warp becomes condensed, and shows much deeper in colour: and the effect is the reverse, where the coarser parts of the reed strike the cloth. In other words, when the centre of the reed *a a*, Fig. 10. plate 13, strikes the cloth, the fabric will be uniform; but when it is raised till the line *c c*, for example, comes in contact with the cloth, the spaces marked 2000 will be finer in proportion as the line *c c* approaches the under rib, and those marked 1000 so much coarser than the medium sett; and when the reed is sunk till the line *b b* strikes the cloth, the effect will be the reverse; so that by gradually raising and sinking the reed alternately, the threads of warp will assume the waved appearance represented in Fig. 11. plate 13. It is evident, however, that this figure is woven by a uniform motion of the reed up and down in the lay; but were the motion of the reed varied, which might be effected by a rack and spring shifted by the weaver's hand, as in weaving lappets, a proportionate diversity of patterns would be produced; and probably an apparatus similar to the lappet wheel might be applied with advantage.

CHENEILLE SHAWLS.

This beautiful specimen of our shawl manufacture is the invention of Mr Alexander Buchanan, foreman in Paisley, who has likewise contributed to enrich our manufactures with several other useful improvements. So much did the novel appearance of these shawls attract the notice of his townsmen, that, by a respectable recommendation to the Board of Trustees in Edinburgh, they awarded him the sum of twenty guineas for his ingenuity.

These shawls, which have also been denominated Kamschatkas, derive their beauty and lustre from the peculiar mode of preparing the weft, and the ingenious manner in which the colours are afterwards arranged: in so much, that a pattern which would require a large harness as an imitation shawl, can be woven without any other apparatus than the ground mounting and two treadle feet. The weft, which is called Cheneille, is prepared as follows:—A Turkey gauze warp, of net yarn, is woven in a 1200 reed, with a twist or splitful in every fifth interval, the weft being either silk, cotton, or worsted, according to the kind of shawls to be manufactured. When this fabric comes from the loom, it is cut up by a machine, in the centre between the splitfuls of warp; and, after receiving a little twist, to throw the ends of the cut weft into a spiral direction, it is ready for the weaver. The warp of the shawl is likewise a Turkey gauze, the same as that which is the foundation of the weft; so that, when a sufficient quantity of Cheneille has been produced from a warp, it is customary to make shawls of the remainder.

In weaving these shawls, one shot of the Cheneille is thrown in, and three of common weft, whether silk, cotton, or worsted; and the fibres of the Cheneille, projecting in all directions, gives the fabric the appearance of a fine glossy shag, showing the pattern, when figured, alike on both sides.

When the shawls are to be of one uniform colour, only one kind of weft is necessary; but when they are to be figured, different colours are employed; and these are woven in spaces adapted to the different parts of the design. The pattern is first painted on design paper, and coloured as for an imitation harness. Each space of the design, or that which corresponds to a ground lash with its different covers, is again painted on a separate slip of design paper, but two spaces are here covered to make them better seen by the weaver, leaving a blank space on each side. These slips are all numbered to prevent confusion. Sup-

pose, then, a web of trimmings were to be woven, with eight repeats in the breadth of a yard; for the first shot of Cheneille we take the slip of paper, No. 1, and find that, by reading it as for a sample, there are 2 spaces yellow, 1 white, 4 red, 2 yellow, 1 black, 2 white &c. the weaver works a space of each of these colours on the warp, agreeably to its respective size on the slip of design paper; which, when finished, must be exactly the breadth of the trimming. For a guide to the weaver, the slip of paper passes through the reed, and fastened at each end to a piece of tape by a bit of rosin, the one behind the mounting hanging over the warp roll and kept tight by a small weight, and the other fastened at the face of the cloth. The weaver then has only to change his shuttles by shifting the boxes of the lay at the end of each coloured space, as pointed out by the design. The slip marked No 2, is next put into the reed for the second shot, and the colours woven in the same manner, but in the reverse order of the first, as the one is thrown in from the right hand and the other from the left; and so on till the weft for the whole pattern is finished. The weft is cut in lengths of eight yards, being the quantity usually wound on one pirn; and this will make eight shots of a yard wide web, and the pirns are taken in succession, agreeably to the numbers of the slips of design paper, and the colours are placed in the manner formerly done in setting the weft of clouding. This species of weaving is likewise well adapted to the rug and carpet manufacture.

As every exertion has been made, in the course of this work, to trace the late improvements in weaving to their genuine source, it is but doing justice to Mr Robert Paterson, in the employ of Mr William Wylie, manufacturer, Paisley, to state, from authentic authority, that he was the first who produced the new method of weaving shaded silks by a moveable reed in Paisley, described in page 396, and that they were manufactured by Mr Wylie in the month of August, 1826.

The Binder will place this leaf before Chap. XII.

CHAP. XII.

WEAVING BY POWER.

As weaving by power has of late been carried to a great extent, not only in Britain, but on the continents of Europe and America, and forms, at present, a very prominent feature in the cotton manufacture, some account of the processes by which it is conducted will not, it is presumed, be found inconsistent with the general plan of this work.

In a power loom factory, the first process is winding the warp on bobbins from the cope. This is done by a winding machine, as in other manufactories, with this exception only, that the one is driven by power, and the other by the winder's foot. The warp is next prepared for the dressing machine, of which there are two kinds in common use; one, in which the brushes are wrought by cranks, and the other, in which they are circular. The warp is prepared for the crank machine, by winding it from the bobbins on reels, and is commonly divided into five parts; which five parts united form half of the warp; the other half being wound on another reel, and placed at the opposite end of the machine: when, after they are dressed, they are united in the yarn roll in the centre.

The warp for the machine with circular brushes, is wound from the bobbins on four rolls, one-fourth on each; and these rolls are placed in the machine at 1, 1, 1, 1, Fig. 5 So that, when the warp is dressed, the whole is united on the warp roll of the loom at *x*. These rolls contain, com

monly, the length of 24 webs, of eight pieces each: and as the pieces are about 25 yards in length, there will be $24 \times 8 \times 25 = 4{,}800$ yards of warp wound on each roll at one time. The rolls have flanges at the selvages to prevent the warp from spreading.

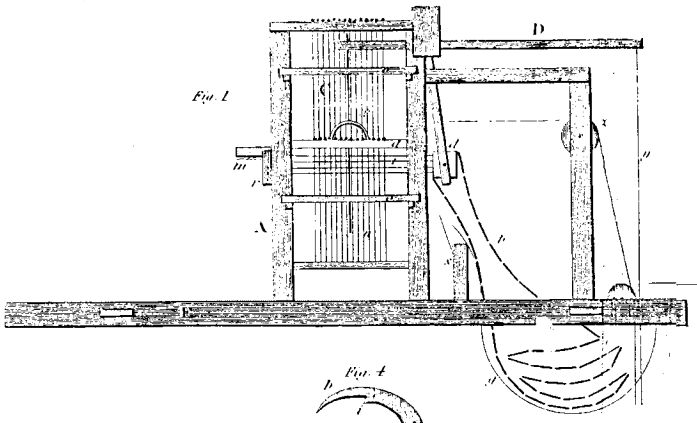
Fig. 5, plate 14, is a front view of a dressing machine with circular brushes:—1, 1, 1, 1, are the four warp rolls, which are kept in a proper state of tension by the weight *w*: —2, 2, 2, 2, 2, 2, are reeds, and 3, 3, 3, 3, are rods for separating the warp threads in the process of dressing:— *a*, *a*, *a*, *a*, are the circular brushes, and *z*, *z*, *z*, *z*, are other brushes for clearing off the dressing and loose fibres brushed from the warp:—*o*, *o*, are fans, and *u* is a stove, which are employed occasionally for drying the warp:—*x* is the yarn roll of the loom, which receives the warp as it is dressed. Above the rollers *i*, *i*, are others which press upon them and regulate the quantity of dressing necessary for the process. On the frame *b* is a set of plain heddles for forming a lease; and at *d*, a reed for clearing the warp as it proceeds to the roll.

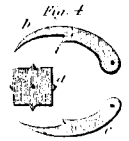
The motion is communicated to the machine by means of the fast and loose pulleys *m*, on the opposite side of the machine, which are fixed on the axle of the bevel wheel *n*; and this wheel gives motion to the shaft *p*, on which there is a triple speed for adapting the motion to the yarn roll *x*, as its diameter is increased by the warp. The shaft *p*, likewise drives the circular brushes *a*, *a*, *a*, *a*, as represented in the Fig. The fans *o*, *o*, for drying the warp, have pulleys on the opposite ends of their axles, communicating with the fast and loose pulleys, by which they are put in motion.

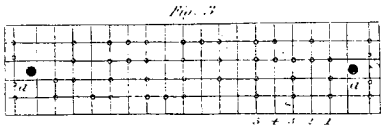
When the fans, however, are not sufficiently powerful, a quantity of steam is introduced into the stove *u*, by means of a stop cock.

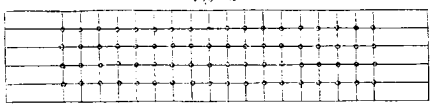
Fig. 6, plate 14, is a front elevation, and Fig. 7, a profile of a power loom. In Fig. 6, A is the cloth, B the

FRENCH DRAW LOOM

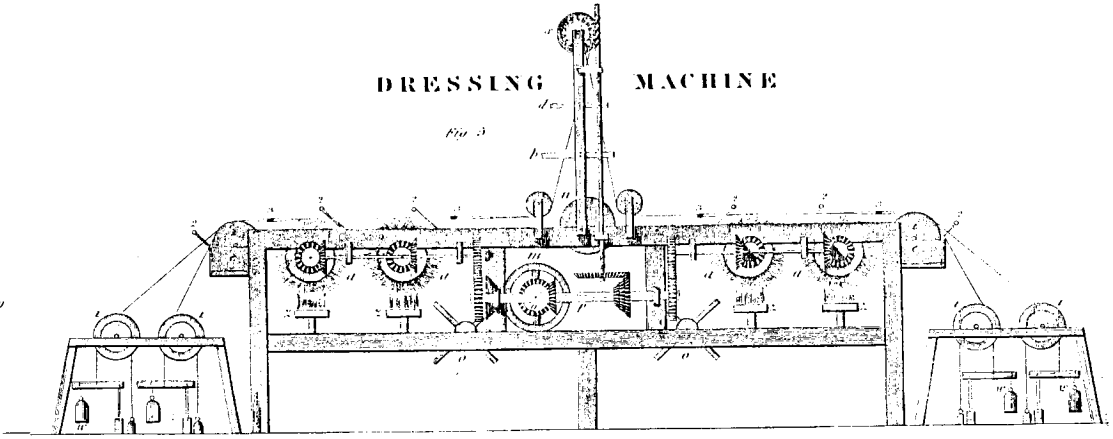




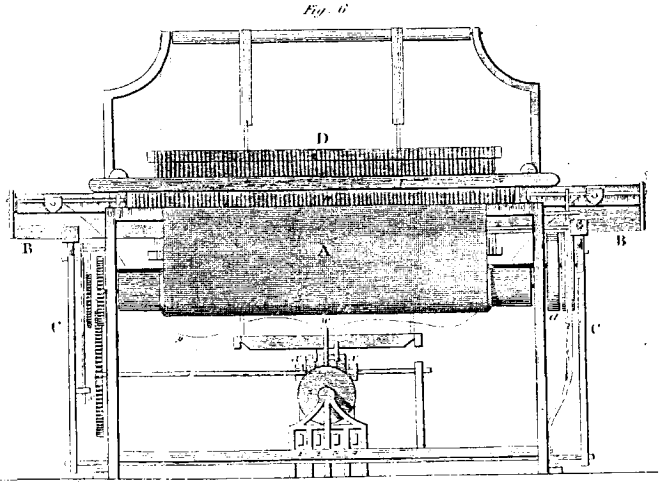


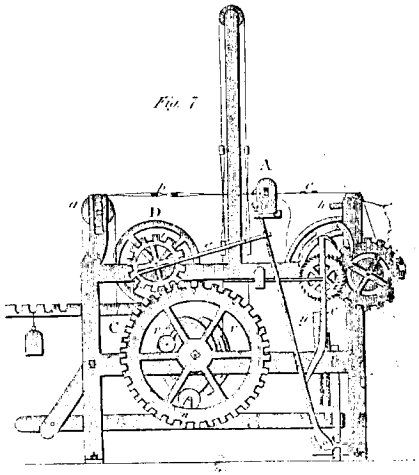


DRESSING MACHINE



POWER LOOM





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boxes of the lay, *o o* the drivers, *c* the swords of the lay, D the heddles, *n* the reed, *a* the fast and loose pulleys, and *i* the spring, for putting on and taking off the power:—1, 2, 3, 4, are the ends of four treadles, two for opening the sheds, and two for driving the shuttle:——*w*, the driving pin attached to the pulley *z*, over which there is a belt, the cords of which are attached to the two outward treadles 1 and 4:—*x*, *x*, are the wipers, and *y* the driving cord. In Fig. 7, *a* is the yarn or warp roll, *b* the rods for preserving the lease, A the box of the lay, *c* two pair of temples for keeping the cloth stretched, B a spur wheel on the axle of the cloth roll, and which assists in winding up the cloth. D are the fast and loose pulleys, represented at *a*, Fig. 6, on the axle of which is the spur wheel *i*. The reciprocating motion of the lay A, is given by means of the rod *e*, which connects it to the rim of this wheel. There is a similar rod on the opposite side of the loom attached to a crank. The wheel *C* is driven by the wheel *i*, which, by its revolutions, drives the wipers *v*, *v*, fixed on its axles. These wipers act by their circumferences on the treadles 2, 3; and, as they are circular at their greatest distance from the centres, the motion of the heddles is thereby suspended while the shuttle is passing through the warp. On the outside of each wiper is fixed a circular knob, moveable on its axis, and on the shuttle treadles, 1, 4, are fixed the friction rollers *n*. When, therefore, these knobs strike the friction rollers, they give motion to the shuttle by means of the driving stick *w*, and cord *y*, Fig. 6. It must be observed, however, that the knobs are so fixed to their respective wipers, that the sheds may be fully opened before the shuttle receives its impulse. This is done by shifting them backward or forward in grooves cut in the wipers for this purpose. B and *j* are the wheels for winding up the cloth. The spur wheel B, is driven by a pinion on the axle of the ratchet wheel *j*, and this last wheel is

turned round by a catch attached to the top of the lever *x*. This lever has a reciprocating motion given by a stud in the sword of the lay at *s*, Fig. 6. As this catch is moved by every stroke of the lay, it cannot command a tooth of the ratchet wheel at each shot, but reciprocates over one tooth till as much cloth is woven as allow it to take hold of another; the other two catches, represented in the Fig. taking hold of other teeth alternately.

The apparatus which stops the loom when the shuttle meets with any obstruction, is next to be considered. Along the back of the lay A, Fig. 7, runs an iron rod, connected to a spring *g* at each end. This rod is also connected to two circular pieces of wood, one in each box of the lay; so that when the shuttle goes into the box, this piece of wood is driven back, and acts upon the rod so as to raise a small plate of iron which covers a circular hole in the centre of the lay. When, therefore, the lay and shuttle are in operation, the iron plate is raised at each shot, and permits the stud *h* to pass through without obstruction. But when the shuttle flies out of the shed, the iron plate covers the hole and strikes with force against the stud *h*, which is connected with the disengaging rod, and throws the belt off the fast to the loose pulley, which stops the loom.

CHAP. XIII.

CALCULATIONS AND TABLES

CONNECTED WITH THE ART OF WEAVING.

SECT. I. OF GRISTING OR SORTING YARN, &c.

THE most common substances from which cloths, in general, are manufactured in this country, are flax, cotton, wool and silk. Hemp, which in its nature has a very close analogy to flax, is also manufactured into cloth. It is only the finer kinds, however, which are employed for this purpose, the coarser sorts being chiefly appropriated to the making of cordage. Hair is also spun and woven into cloth; but when it is introduced as weft, in the unspun state, along with flaxen or linen warp, it forms a cloth which is extensively employed for covering the seats of chairs, sofas, &c. There is a breed of goats in the neighbourhood of Angora, a town of Natolia, in Asiatic Turkey, whose hair, which is almost as soft as silk, is also spun and woven into cloth. The finest kind is retained for the use of the Grand Seignor, the remainder being exported

into Holland, France, and England, where it is manufactured into camblets and other fine stuffs. The true oriental camblets, however, are only made purely of this material; the European camblets having it mixed with wool or silk, and sometimes with both.

LINEN YARN.

The yarn spun from flax, usually denominated linen yarn, is, by Act of Parliament, to be reeled on a ten quarter, or 90 inch reel, and tied up into cuts of 120 threads or rounds of the reel; and 48 of these cuts to make a spyndle. By this enactment, the eleven and twelve quarter reels, though formerly much used in Scotland, are now entirely laid aside. The spyndle of linen yarn, however, admits of other subdivisions than the preceding, which, with the quantity contained in each, are exhibited in the following

TABLE.

2½ yards	=	1 split, one ell, or 45 inches long.					
50	=	20	=	1 porter or heer.			
300	=	120	=	6	=	1 cut.	
600	=	240	=	12	=	2	= 1 heer.
3600	=	1440	=	72	=	12	= 6 = 1 slip or hank.
7200	=	2880	=	144	=	24	= 12 = 2 = 1 hesp.
14400	=	5760	=	288	=	48	= 24 = 4 = 2 = 1 spyndle.

The grist or fineness of linen yarn is commonly estimated by the weight of a spyndle, hesp, or hank; sometimes by the number of heers in the Avoirdupois pound; in some places of Scotland, by the number of heers in the Tron pound; and sometimes its grist is vaguely expressed by the number of hanks in the Avoirdupois pound; as five hank yarn, six hank yarn, &c.

When yarn is gristed by the number of heers in the pound Avoirdupois, it may be reduced to the weight of the spyndle, by the following proportion: As the heers in one pound: to the heers in one spyndle, viz. 24:: so the ounces in one pound, viz. 16: to the ounces in one spyndle. But 24 and 16, which are the mean terms of the proportion, are both constant quantities; their product, therefore, which is 384, divided by the heers in a pound, gives the weight of a spyndle; or divided by the weight of a spyndle, gives the heers in a pound.

Example 1. What is the weight of a spyndle of yarn, of which there are 46 heers in the pound?

here 46)384(8 oz. $5\frac{1}{2}$ drs. answer.
368

16
16 drs.

96
16

46)256(5
230

$\frac{26}{46}=\frac{1}{2}\frac{3}{3}$ or $\frac{1}{2}$ nearly.

2. If a spyndle of yarn weigh 6 oz. how many heers in the pound?

6)384

64 heers, Answer.

3. What is the weight of a spyndle of 6 hank yarn?

In 6 hanks there are 36 heers,

therefore, $36)384(10\frac{2}{3}$ oz.

$$\begin{array}{r} 36 \\ \hline 24 \end{array}$$

$\frac{24}{36}=\frac{2}{3}$.

When linen yarn is gristed by the number of heers in the Tron pound, the number of ounces customary in the place referred to must be known, and substituted for 16 in these examples, which will give the answers required.

Table 1. shows, by inspection, the weight of a spyndle corresponding to any number of heers in the pound Avoirdupois, to drams and tenth parts. For example, on a line with 65 heers in the left hand column there is 5 oz. 14.5 drs. or 5 oz. $14\frac{1}{2}$ drams; and in the third column will be found 2 spyndles and 17 heers in the pound.

TABLE I.

OF LINEN YARN. NO. 1 and 2.

Hrs.	Weight of a Spyndle.		Spyndles & Heers in a lb.		Hrs.	Weight of a Spyndle.		Spyndles & Heers in a lb.	
	oz.	drs.				oz.	drs.		
6	64		0	6	38	10	1.7	1	14
6½	59	1.2	0	6½	39	9	13.5	1	15
7	54	13.7	0	7	40	9	9.6	1	16
7½	51	3.2	0	7½	41	9	5.9	1	17
8	48	0.	0	8	42	9	2.3	1	18
8½	45	2.8	0	8½	43	8	14.9	1	19
9	42	10.6	0	9	44	8	11.6	1	20
9½	40	6.7	0	9½	45	8	8.5	1	21
10	38	6.4	0	10	46	8	5.5	1	22
10½	36	9.1	0	10½	47	8	2.7	1	23
11	34	14.5	0	11	48	8	0.	2	0
11½	33	6.2	0	11½	49	7	13.4	2	1
12	32	0.	0	12	50	7	10.8	2	2
13	29	8.6	0	13	51	7	8.4	2	3
14	27	6.8	0	14	52	7	6.1	2	4
15	25	9.3	0	15	53	7	3.9	2	5
16	24	0.	0	16	54	7	1.8	2	6
17	22	9.4	0	17	55	6	15.7	2	7
18	21	5.3	0	18	56	6	13.7	2	8
19	20	3.3	0	19	57	6	11.8	2	9
20	19	3.2	0	20	58	6	9.9	2	10
21	18	4.6	0	21	59	6	8.1	2	11
22	17	7.3	0	22	60	6	6.4	2	12
23	16	11.1	0	23	61	6	4.7	2	13
24	16	0.	1	0	62	6	3.1	2	14
25	15	5.8	1	1	63	6	1.5	2	15
26	14	12.3	1	2	64	6	0.	2	16
27	14	3.5	1	3	65	5	14.5	2	17
28	13	11.4	1	4	66	5	13.	2	18
29	13	3.9	1	5	67	5	11.7	2	19
30	12	12.1	1	6	68	5	10.3	2	20
31	12	6.2	1	7	69	5	9.	2	21
32	12	0.	1	8	70	5	7.8	2	22
33	11	10.1	1	9	71	5	6.5	2	23
34	11	5.1	1	10	72	5	5.3	3	0
35	10	15.5	1	11	73	5	4.1	3	1
36	10	10.6	1	12	74	5	3.	3	2
37	10	6.	1	13	75	5	2.	3	3

TABLE 1ST CONTINUED.

Hrs.	Weight of a Spyndle.		Spyndles & Heers in a lb.		Hrs	Weight of a Spyndle.		Spyndles & Heers in a lb.	
	oz.	drs.				oz.	drs.		
76	5	0.8	3	4	114	3	5.9	4	18
77	4	15.6	3	5	115	3	5.4	4	19
78	4	14.8	3	6	116	3	5.	4	20
79	4	13.7	3	7	117	3	4.5	4	21
80	4	12.8	3	8	118	3	4.	4	22
81	4	11.8	3	9	119	3	3.6	4	23
82	4	10.9	3	10	120	3	3.1	5	0
83	4	10.	3	11	121	3	2.8	5	1
84	4	9.1	3	12	122	3	2.3	5	2
85	4	8.3	3	13	123	3	2.0	5	3
86	4	7.4	3	14	124	3	1.6	5	4
87	4	6.6	3	15	125	3	1.1	5	5
88	4	5.8	3	16	126	3	0.7	5	6
89	4	0.	3	17	127	3	0.3	5	7
90	4	4.2	3	18	128	3	0.	5	8
91	4	3.5	3	19	129	2	15.6	5	9
92	4	2.8	3	20	130	2	15.2	5	10
93	4	2.1	3	21	131	2	14.9	5	11
94	4	1.3	3	22	132	2	14.0	5	12
95	4	0.6	3	23	133	2	14.1	5	13
96	4	0.	4	0	134	2	13.8	5	14
97	3	15.3	4	1	135	2	13.5	5	15
98	3	14.7	4	2	136	2	13.1	5	16
99	3	14.	4	3	137	2	12.8	5	17
100	3	13.4	4	4	138	2	12.5	5	18
101	3	12.8	4	5	139	2	12.1	5	19
102	3	12.2	4	6	140	2	11.8	5	20
103	3	11.6	4	7	141	2	11.5	5	21
104	3	11.	4	8	142	2	11.2	5	22
105	3	10.5	4	9	143	2	10.9	5	23
106	3	10.	4	10	144	2	10.6	6	0
107	3	9.4	4	11	145	2	10.4	6	1
108	3	8.9	4	12	146	2	10.1	6	2
109	3	8.6	4	13	147	2	9.8	6	3
110	3	7.8	4	14	148	2	9.5	6	4
111	3	7.3	4	15	149	2	9.2	6	5
112	3	6.8	4	16	150	2	8.9	6	6
113	3	6.3	4	17	151	2	8.6	6	7

COTTON YARN.

There is no Act of the Legislature which fixes the quantity of yarn in a spyndle of cotton; but the following standard has been universally adopted by the cotton spinners in England, Scotland, and Ireland: The reel is 54 inches round, 80 threads or rounds of which make a skein, ley, or rap; 7 skeins make a number or hank, generally contracted No.; and 18 of these Nos. make one spyndle. Cotton yarn, however, is commonly sold by the pound weight, avoirdupois; and this takes place, whether the yarn be reeled or in cops; the number of hanks or Nos. in a pound indicating its fineness.

The length of the several subdivisions of the spyndle of cotton yarn will be found by the following

TABLE.

1½ yard	=					1 thread or round of the cotton reel.
120	=	80	=			1 skein or ley.
840	=	560	=	7	=	1 No. or hank.
15120	=	10080	=	126	=	18 = 1 spyndle.

By comparing the lengths of the spyndles of cotton and linen together, it will appear, that the former exceeds the latter by 720 yards, which, in the calculation of warps, makes a difference of 14 porters and 8 splits. This difference added to 288, the porters in a spyndle of linen, gives 302 porters and 8 splits for the spyndle of cotton yarn; which is an advantage of 5 per cent. For 20 : 21 :: 288 : 302.4.

The weight of a spyndle of cotton yarn may be found from its Nos., and the contrary, by a process similar to that given under linen yarn. Thus, the proportion will be, as the weight of a spyndle: 16 :: 18: to the Nos. in a pound. But 16 and 18 are constant quantities, and also

the mean terms of the proportion; their product, therefore, which is 288, divided by either extreme, will give the other

Example 1. What is the weight of a spyndle of No. 86?

Here 86)288(3 oz. $5\frac{1}{2}$ drs. nearly.
258

30
16

86)480(5.5
430

500
430

50

Example 2. If a spyndle of cotton yarn weigh $2\frac{1}{2}$ oz., what is its No.?

No.
2.5)288.0(115
25

38
25

130
125

5

Or thus, $2\frac{1}{2}$ 288
2 2

5) 576

$115\frac{1}{2}$

The number of spyndles in any bundle of cotton yarn will be found by the following rule:—

Multiply the Nos. of the yarn by the number of pounds in the bundle, and divide by 18.

Example 3. How many spyndles are in a 5 lib. bundle of No. 72?

72
5
---
18)360(20 spyndles.
36

0

These calculations may be found by inspection in Table II. agreeably to the titles on the top of the columns.

The Nos. of cotton yarn in copes are found by reeling a few hanks, commonly a spyndle, and weighing them on an instrument called a quadrant; then looking in a Table, such as the following one, for the weight of a spyndle, and the corresponding Nos. will be found in the left hand columns. This instrument consists of á brazen quadrantal rim, sometimes attached to a standard, but more frequently fixed to some convenient place in the warehouse. On the rim are engraven the ounces, drams, and decimal divisions of a dram; and when the reeled yarn is put into a scale which is appended, an index is turned round which points to the weight of the yarn. The Nos. of Merino worsteds, silk, &c. used in the shawl and plaid manufactures, and which have hitherto been regulated by no fixed standard, may be found in the same manner.

TABLE II.

COTTON YARN.

No.	Weight of a Spyndle.		Spyndles & Nos. in 5 lib.		No.	Weight of a Spyndle.		Spyndles & Nos. in 5 lib.	
	oz.	drs.	sp.	no.		oz.	drs.	sp.	no.
4	72	0.	1	2	46	6	4.2	12	14
4½	64	0.	1	4½	48	6	0.	13	6
5	57	9.6	1	7	50	5	12.1	13	16
5½	52	5.8	1	9½	52	5	8.6	14	8
6	48	0.	1	12	54	5	5.3	15	0
6½	44	4.9	1	14½	56	5	2.3	15	10
7	41	2.3	1	17	58	4	15.4	16	2
7½	38	6.4	2	1½	60	4	12.8	16	12
8	36	0.	2	4	62	4	10.3	17	4
9	32	0.	2	9	64	4	8.	17	14
10	28	12.8	2	14	66	4	5.8	18	6
11	26	3.	3	6	68	4	3.6	18	16
12	24	0.	3	6	70	4	1.8	19	8
13	22	2.4	3	11	72	4	0.	20	0
14	20	9.1	3	16	74	3	14.2	20	10
15	19	3.2	4	3	76	3	12.6	21	2
16	18	0.	4	8	78	3	11.	21	12
17	16	15.	4	13	80	3	9.6	22	4
18	16	0.	5	0	82	3	8.2	22	14
19	15	2.5	5	5	84	3	6.8	23	6
20	14	6.4	5	10	86	3	5.5	23	16
22	13	11.4	6	2	88	3	4.3	24	8
24	12	0.	6	12	90	3	3.2	25	0
26	11	1.2	7	4	92	3	2.1	25	10
28	10	4.5	7	14	94	3	1.	26	2
30	9	9.6	8	6	96	3	0.	26	12
32	9	0.	8	16	98	2	15.	27	4
34	8	7.5	9	8	100	2	14.	27	14
36	8	0.	10	0	102	2	13.1	28	6
38	7	9.2	10	10	104	2	12.2	28	16
40	7	3.2	11	2	106	2	11.4	29	8
42	6	13.7	11	12	108	2	10.6	30	0
44	6	8.7	12	4	110	2	9.9	30	10

TABLE II. CONTINUED.

No.	Weight of a Spyndle.		Spyndles & Nos. in 5 lib.		No.	Weight of a Spyndle.		Spyndles & Nos in 5 lib.	
	oz.	drs.	sp.	no.		oz.	drs.	sp.	no.
112	2	9.1	31	2	178	1	9.8	49	8
114	2	8.4	31	12	180	1	9.6	50	0
116	2	7.7	32	4	182	1	9.3	50	10
118	2	7.	32	14	184	1	9.	51	2
120	2	6.4	33	8	186	1	8.7	51	12
122	2	5.7	33	16	188	1	8.5	52	4
124	2	5.1	34	8	190	1	8.2	52	14
126	2	4.5	35	0	192	1	8.	53	6
128	2	4.	35	10	194	1	7.7	53	16
130	2	3.	36	2	196	1	7.5	54	8
132	2	2.9	36	12	198	1	7.3	55	0
134	2	2.3	37	4	200	1	7.0	55	10
136	2	1.8	37	14	202	1	6.7	56	2
138	2	1.3	38	6	204	1	6.5	56	12
140	2	0.9	38	16	206	1	6.3	57	4
142	2	0.4	39	8	208	1	6.1	57	14
144	2	0.	40	0	210	1	5.9	58	6
146	1	15.5	40	10	212	1	5.7	58	16
148	1	15.1	41	2	214	1	5.6	59	8
150	1	14.7	41	12	216	1	5.3	60	0
152	1	14.3	42	4	218	1	5.1	60	10
154	1	13.9	42	14	220	1	4.9	61	2
156	1	13.5	43	6	222	1	4.7	61	12
158	1	13.1	43	16	224	1	4.3	62	4
160	1	12.8	44	8	226	1	4.1	62	14
162	1	12.4	45	0	228	1	3.8	63	6
164	1	12.1	45	10	230	1	3.6	63	16
166	1	11.7	46	2	232	1	3.4	64	8
168	1	11.4	46	12	234	1	3.1	65	0
170	1	11.	47	4	236	1	2.8	65	10
172	1	10.8	47	14	238	1	2.6	66	2
174	1	10.4	48	0	240	1	2.4	66	12
176	1	10.1	48	16	242	1	2.9	67	4

When the quantity of yarn is less or more than a spyndle, to find its No. the proportion will be, as the weight of the quantity, to the ounces in a lib. viz. 16: so the numbers or hanks in the quantity, to the No. of the yarn.

Example 4. If 14 hanks weigh 2 oz., 3 drs., what is the fineness of the yarn?

Reduce the 2 oz., 3 drs. to drs., which are 35; the drs. in a pound are 256—then,

35 : 256 : : 14
14

1024
256 No.

35)3584(102 Answer.
35

84
70

14

Example 5. In a web which weighs 5 lbs. 10 oz. there are 30 spyndles of warp; required the No. of the yarn?

First, as there are 90 oz. in the web, and 540 hanks in 30 spyndles; then we have

90 : 16 : : 540
16

3240
540

9.0)864.0

96 the No. of the warp, which after deducting 5 per cent. for waste, will be about No. 91.

Or secondly, find the weight of one spyndle, which is 3 oz.; then by the first rule,

3)288

96 as above.

To find the number of spyndles in any quantity of copes of a given fineness, the proportion will be; as 16, the oz. in a lib.: to the No. of the yarn :: so the ounces in the quantity: to the number of spyndles.

Example 6. In 2 lib. 10 oz. of copes, No. 72, how many spyndles?

Here 16 : 72 :: 42 the ozs. in the quantity.

42

144
288

16)3024(189 hks.
16

142
128

144
144

0

Here we have 189 hanks, which, divided by 18, gives 10 spyndles and 9 hanks.

Table 3 will be found useful to those who make use of yarn in the cope, either for warp or weft. When the Nos. exceed those on the top of the table, any two may be added together, which will answer the purpose.

TABLE III.

	No. 40.			No. 42.			No. 44.			No. 46.		
lbs.	oz.	sp.	hks.	pts.	sp.	hks.	pts.	sp.	hks.	pts.	sp	hks.	pts.
	1		2	8		2	10		2	12		2	14
	2		5	0		5	4		5	8		5	12
	3		7	8		7	14		8	4		8	10
	4		10	0		10	8		11	0		11	8
	5		12	8		13	2		13	12		14	6
	6		15	0		15	12		16	8		17	4
	7		17	8	1	0	6	1	1	4	1	2	2
	8	1	2	0	1	3	0	1	4	0	1	5	0
	9	1	4	8	1	5	10	1	6	12	1	7	14
	10	1	7	0	1	8	4	1	9	8	1	10	12
	11	1	9	8	1	10	14	1	12	4	1	13	10
	12	1	12	0	1	13	8	1	15	0	1	16	8
	13	1	14	8	1	16	2	1	17	12	2	1	6
	14	1	17	0	2	0	12	2	2	8	2	4	4
	15	2	1	8	2	3	6	2	5	4	2	7	2
1		2	4		2	6		2	8		2	10	
2		4	8		4	12		4	16		5	2	
3		6	12		7	0		7	6		7	12	
4		8	16		9	6		9	14		10	4	
5		11	2		11	12		12	4		12	14	
6		13	6		14	0		14	12		15	6	
7		15	10		16	6		17	2		17	16	
8		17	14		18	12		19	10		20	8	
9		20	0		21	0		22	0		23	0	
10		22	4		23	6		24	8		25	10	
11		24	8		25	12		26	16		28	2	
12		26	12		28	0		29	6		30	12	
13		28	16		30	6		31	14		33	4	
14		31	2		32	12		34	4		35	14	
15		33	6		35	0		36	12		38	6	

TABLE III. CONTINUED.

	No. 48.			No. 50.			No. 52.			No. 54.		
lbs.	oz.	sp.	hks.	pts.	sp.	hks.	pts.	sp.	hks.	pts.	sp	hks.	pts.
	1		3			3	2		3	4		3	6
	2		6			6	4		6	8		6	12
	3		9			9	6		9	12		10	2
	4		12			12	8		13	0		13	8
	5		15			15	10		16	4		16	14
	6	1	0		1	0	12	1	1	8	1	2	4
	7	1	3		1	3	14	1	4	12	1	5	10
	8	1	6		1	7	0	1	8	0	1	9	0
	9	1	9		1	10	2	1	11	4	1	12	6
	10	1	12		1	13	4	1	14	8	1	15	12
	11	1	15		1	16	6	1	17	12	2	1	2
	12	2	0		2	1	8	2	3	0	2	4	8
	13	2	3		2	4	10	2	6	4	2	7	14
	14	2	6		2	7	12	2	9	8	2	11	4
	15	2	9		2	10	14	2	12	12	2	14	10
1		2	12		2	14		2	16		3		
2		5	6		5	10		5	14		6		
3		8	0		8	6		8	12		9		
4		10	12		11	2		11	10		12		
5		13	6		13	16		14	8		15		
6		16	0		16	12		17	6		18		
7		18	12		19	8		20	4		21		
8		21	6		22	4		23	2		24		
9		24	0		25	0		26	0		27		
10		26	12		27	14		28	16		30		
11		29	6		30	10		31	14		33		
12		32	0		33	6		34	12		36		
13		34	12		36	2		37	10		39		
14		37	6		38	16		40	8		42		
15		40	0		41	12		43	6		45		

TABLE III. CONTINUED.

	No. 56.			No. 58.			No. 60.			No. 62.		
lbs.	oz.	sp.	hks.	pts.	sp.	hks.	pts.	sp.	hks.	pts.	sp.	hks.	pts.
	1		3	8		3	10		3	12		3	14
	2		7	0		7	4		7	8		7	12
	3		10	8		10	14		11	4		11	10
	4		14	0		14	8		15	0		15	8
	5		17	8	1	0	2	1	0	12	1	1	6
	6	1	3	0	1	3	12	1	4	8	1	5	4
	7	1	6	8	1	7	6	1	8	4	1	9	2
	8	1	10	0	1	11	0	1	12	0	1	13	0
	9	1	13	8	1	14	10	1	15	12	1	16	14
	10	1	17	0	2	0	4	2	1	8	2	2	12
	11	2	2	8	2	3	14	2	5	4	2	6	10
	12	2	6	0	2	7	8	2	9	0	2	10	8
	13	2	9	8	2	11	2	2	12	12	2	14	6
	14	2	13	0	2	14	12	2	16	8	3	0	4
	15	2	16	8	3	0	6	3	2	4	3	4	2
1		3	2		3	4		3	6		3	8	
2		6	4		6	8		6	12		6	16	
3		9	6		9	12		10	0		10	6	
4		12	8		12	16		13	6		13	14	
5		15	10		16	2		16	12		17	4	
6		18	12		19	6		20	0		20	12	
7		21	14		22	10		23	6		24	2	
8		24	16		25	14		26	12		27	10	
9		28	0		29	0		30	0		31	0	
10		31	2		32	4		33	6		34	8	
11		34	4		35	8		36	12		37	16	
12		37	6		38	12		40	0		41	6	
13		40	8		41	16		43	6		44	14	
14		43	10		45	2		46	12		48	4	
15		46	12		48	6		50	0		51	12	

TABLE III. CONTINUED.

	No. 64.			No. 66.			No. 68.			No. 70.		
lbs.	oz.	sp.	hks.	pts.	sp.	hks.	pts.	sp.	hks.	pts.	sp.	hks.	pts.
	1		4			4	2		4	4		4	6
	2		8			8	4		8	8		8	12
	3		12			12	6		12	12		13	2
	4		16			16	8		17	0		17	8
	5	1	2		1	2	10	1	3	4	1	3	14
	6	1	6		1	6	12	1	7	8	1	8	4
	7	1	10		1	10	14	1	11	12	1	12	10
	8	1	14		1	15	0	1	16	0	1	17	0
	9	2	0		2	1	2	2	2	4	2	3	6
	10	2	4		2	5	4	2	6	8	2	7	12
	11	2	8		2	9	6	2	10	12	2	12	2
	12	2	12		2	13	8	2	15	0	2	16	8
	13	2	16		2	17	10	3	1	4	3	2	14
	14	3	2		3	3	12	3	5	8	3	7	4
	15	3	6		3	7	14	3	9	12	3	11	10
1		3	10		3	12		3	14		3	16	
2		7	2		7	6		7	10		7	14	
3		10	12		11	0		11	6		11	12	
4		14	4		14	12		15	2		15	10	
5		17	14		18	6		18	16		19	8	
6		21	6		22	0		22	12		23	6	
7		24	16		25	12		26	8		27	4	
8		28	8		29	6		30	4		31	2	
9		32	0		33	0		34	0		35	0	
10		35	10		36	12		37	14		38	16	
11		39	2		40	6		41	10		42	14	
12		42	12		44	0		45	6		46	12	
13		46	4		47	12		49	2		50	10	
14		49	14		51	6		52	16		54	8	
15		53	6		55	0		56	12		58	6	

TABLE III. CONTINUED.

	No. 72.			No. 74.			No. 76.			No. 78.		
lbs.	oz.	sp.	hks.	pts	sp.	hks.	pts.	sp.	hks.	pts.	sp.	hks.	pts.
	1		4	8		4	10		4	12		4	14
	2		9	0		9	4		9	8		9	12
	3		13	8		13	14		14	4		14	10
	4	1	0	0	1	0	8	1	1	0	1	1	8
	5	1	4	8	1	5	2	1	5	12	1	6	6
	6	1	9	0	1	9	12	1	10	8	1	11	4
	7	1	13	8	1	14	6	1	15	4	1	16	2
	8	2	0	0	2	1	0	2	2	0	2	3	0
	9	2	4	8	2	5	10	2	6	12	2	7	14
	10	2	9	0	2	10	4	2	11	8	2	12	12
	11	2	13	8	2	14	14	2	16	4	2	17	10
	12	3	0	0	3	1	8	3	3	0	3	4	8
	13	3	4	8	3	6	2	3	7	12	3	9	6
	14	3	9	0	3	10	12	3	12	8	3	14	4
	15	3	13	8	3	15	6	3	17	4	4	1	2
1		4			4	2		4	4		4	6	
2		8			8	4		8	8		8	12	
3		12			12	6		12	12		13	0	
4		16			16	8		16	16		17	6	
5		20			20	10		21	2		21	12	
6		24			24	12		25	6		26	0	
7		28			28	14		29	10		30	6	
8		32			32	16		33	14		34	12	
9		36			37	0		38	0		39	0	
10		40			41	2		42	4		43	6	
11		44			45	4		46	8		47	12	
12		48			49	6		50	12		52	0	
13		52			53	8		54	16		56	6	
14		56			57	10		59	2		60	12	
15		60			61	12		63	6		65	0	

SECT. II. REEDS.

THE reed is the scale by which, independent of its being employed for striking up the woof, the manufacturer determines the fineness of his cloth, being so constructed that a certain number of warp threads may always be contained in a given breadth of the web.

For the principal manufactures of Scotland and Ireland, the scale of reeds is regulated by the number of splits contained in the Scotch ell of 37 inches. The splits in this space are divided into hundreds, the number of which, in any reed, indicates its sett, and each hundred is again divided into five parts, called porters, which consequently contain twenty splits. Reeds made for Hollands and cambrics, which were, till of late, very common in Scotland, had scales peculiar to themselves, the hundreds or sett of the former being counted on 40 inches, and of the latter on 34, which corresponded to the breadths of their respective fabrics.

In England the scales of reeds are different from any of the preceding. Those denominated the Manchester and Bolton reeds, take their designation from the number of dents (splits) in $24\frac{1}{4}$ inches, and are divided into beers, (porters) which contain sometimes 19, but more frequently 20 dents. The sett or fineness of the Stockport reeds is known by the number of ends or threads of warp in an inch; and as two ends are equivalent to one dent, the fineness or sett of the reed is expressed by the number of dents in two inches. Thus, a 40 reed has 20 dents in an inch, a 50, 25 dents, &c. In Manchester they generally make use of the Stockport count for muslins only, and the Bolton, for quiltings, dimities, ginghams, muslins, corduroys, &c. There are several kinds of goods, however, such as calicoes, checks and handkerchiefs, which are woven in reeds constructed on 36 inches; and, indeed, each of these