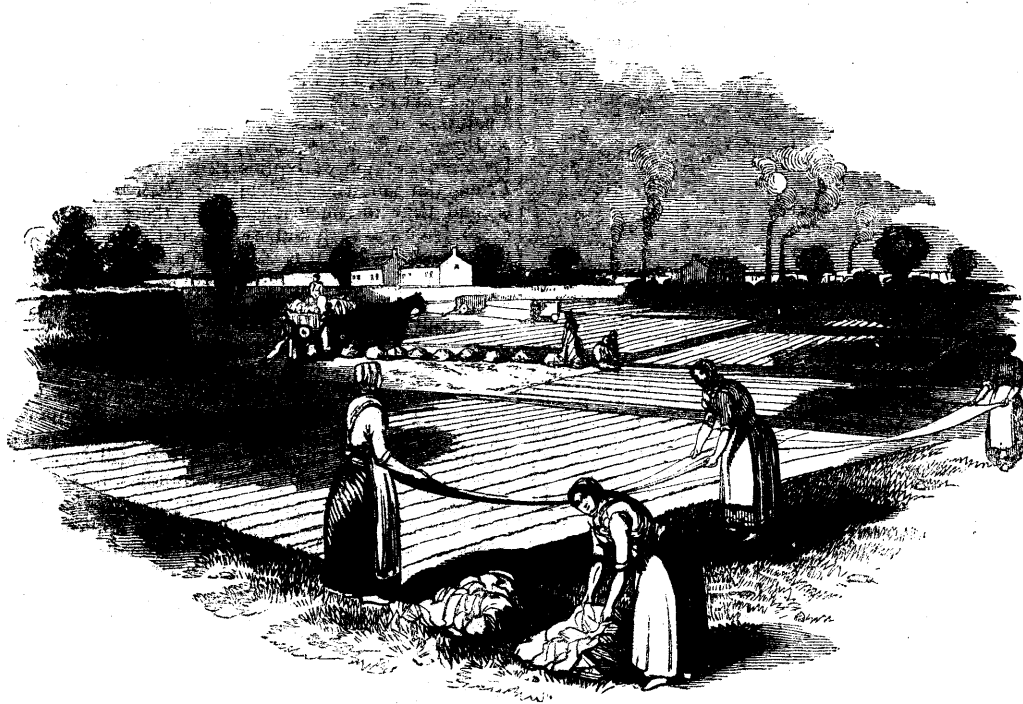


A DAY AT THE BARROWFIELD DYE-WORKS, GLASGOW.



[Bleaching-Ground—Monteth's Dye-Works, Glasgow.]

WERE it not that the subject of calico-printing has already occupied our attention in the 'Supplement' for June, 1843, the fine establishment of Messrs. Monteth, at Glasgow, would afford ample opportunity for illustrating many varieties of that beautiful process; but as the differences observable in such establishments, although very marked in the eyes of a manufacturer, are of no moment to those who wish merely to gain a slight insight into the general processes, we shall dispense with any further notice of calico-printing in general. There are, however, two beautiful processes which stand out somewhat distinctly from calico-printing in general, and for which the Barrowfield Works of the above-named firm have acquired a very wide celebrity, viz. *Turkey-red Dyeing* and *Bandana Handkerchief* work: these processes, through the courtesy of the proprietors, we have been allowed to witness; and it is the object of the present article to describe them, as well as the general arrangement of the Works wherein they are conducted.

The Barrowfield Works occupy a very large area of ground at the eastern margin of Glasgow, bordered by the Clyde on one side, and by the excellent "Green" of Glasgow on another. The Londoners might well envy the Glasgow folks the possession of such a Green, for it is an invaluable agent in maintaining the health of the city. It consists of a large park or green, comprising one hundred and forty acres, having the river flowing along one margin, a series of houses along the opposite margin, Hutcheson Bridge at one end, and

Rutherglen Bridge at the other. The inhabitants, aided zealously by Dr. Cleland, have successfully resisted all attempts to have this Green built upon; and there it remains, the property of all, with a few clusters of trees here and there, seats for the wearied, gravel walks for the rambles, and a soft green carpet of sward on which the bare-legged damsels lay out their washed linen to dry,—for it is also a drying-ground open to all the laundresses who choose to avail themselves of it. Amid the smoke and bustle of iron-works, chemical-works, dye-works, cotton-mills, and engine-factories, it is no trifling advantage to have such an open spot.

Having walked across this "Green," then, to its eastern end (and it is a good thing that many of the workmen have to cross this Green on their way to work), we arrive at the gates of the Works, within which is large area of ground occupied partly by buildings, partly by yards and drying-grounds, and partly by green sward as a bleaching-ground. The buildings are in detached groups, and many of them are very large; some being used for dyeing cotton-cloth, some for Turkey-red yarn-dyeing, and others for bandana-work, printing, stoving, and a variety of other processes. The drying-grounds have ranges of poles on which yarn is hung to dry; while the extensive bleach-field requires nothing but a smooth, clean, grassy surface. It may be well at once to remark that this bleach-ground is appropriated wholly to certain stages of the Turkey-red dyeing; and does not relate to

bleaching as commonly understood,—chloride of lime having wholly subverted the ancient mode of conducting such bleaching. Those portions of the establishment which are connected with the general processes of printing on calico we shall pass over for reasons just stated, and shall proceed at once to

Turkey-red Dyeing.—Most persons are familiar with the tint of red known as ‘Turkey-red;’ but few would imagine how many have been the experiments as to the best mode of producing it, or the multiplicity of the distinct processes involved in the production. The vegetable substance called *madder* produces a red which is much employed under the name of ‘common madder red;’ but the ‘*Turkey-red,*’ although produced likewise from madder, is infinitely more brilliant and beautiful, and requires great complexity of operations. The production of this fine colour was first known in India, from whence it travelled to the western part of Asia, and thence to Greece and Turkey. Just about a century ago, two French manufacturers brought some Greek dyers into France, and with their aid established Turkey-red Dye-Works at Rouen and in Languedoc. Mr. Wilson of Ainsworth, near Manchester, endeavoured, about the year 1770, to introduce this mode of dyeing into England; but for some reason or other it does not appear to have succeeded at that time. Some years afterwards a French gentleman, M. Papillon, joined Mr. Mackintosh in the establishment of a Turkey-red Dye-Work at Glasgow. There was an agreement entered into between these gentlemen and the Commissioners and Trustees for Manufactures in Scotland, to the effect that the Turkey-red dye process, at that time a secret in few hands, was to be published for the benefit of the public at the end of a certain term of years. This period expired in 1803; and the trustees then laid a minute account of the different processes before the public. Glasgow, however, having been the first to witness the successful prosecution of the process, continued to maintain its supremacy in that matter, and has ever since been the head-quarters in Britain for this art. Dr. Thomson has observed that “different individuals, possessed of both chemical skill and considerable sagacity, have studied the different parts of this very complicated method of dyeing. The effects of each individual operation have been carefully investigated, and the whole has been somewhat shortened and simplified, though it still constitutes the most complicated process in the whole art of dyeing.” The red dye was at first given only to the spun yarn; but among the subsequent improvements was that of dyeing the woven cotton itself. We may here remark, that M. Papillon, when he introduced the practice of this art at Glasgow, occupied that part of the Barrowfield Works now appropriated to the yarn-dyeing.

Let us suppose that a quantity of cotton-cloth reaches the Works just in the state that it leaves the loom; that is, technically speaking, ‘in the grey.’ The first process it undergoes is to plunge it in what is termed a *rot-steep*; this is a very hot alkaline liquor, the continued action of which on the cloth for many hours removes the ‘dressing’ of paste or size which the yarn had received before weaving, and which, if not removed, would prevent the fibres from imbibing the dye. The cloth having by this process become saturated with alkaline liquor, which must likewise be removed, it is conveyed to a long washing-house containing a large number of ‘dash-wheels,’ similar to those which were sketched and described in the ‘Supplement’ before alluded to. Into these dash-wheels the cloth is introduced, and there rotated with water till cleansed from the alkaline liquor and the dressing. But as the fibres have become saturated with water

during this washing, and as this water must be removed, the cloth is exposed to the action of a powerful Bramah press, by which a force of five hundred tons is brought to bear upon it, so as to press out the water.

Then ensues a remarkable series of processes, in which almost every one operation is repeated a great number of times, adding considerably to the complexity of the routine. The cloth is put into what is termed a ‘vomiting-boiler,’ that is, a boiler so constructed that the water is made to vomit upwards from a pipe, and then to fall down on the cloth in the boiler, so as to act equally on the whole. The boiler contains a solution of soap and soda, which is allowed to act on the cloth for some hours, so as to prepare the fibres for the reception of liquids afterwards to be applied. From the vomiting-boilers the cloth is conveyed a second time to the wash-wheels, there to be washed clean from the soap and soda, and then a second time to the press, where it is squeezed almost dry. This repeated transfer of the cloth from one vessel to another, and from one part of the building to another, gives employment to a great number of men, who are running to and fro in all directions, wheeling barrows or hand-trucks containing the cloth.

After the second washing and squeezing, the cloth is taken to a drying-stove, a room heated to a temperature of about 140°, and provided with bars and pegs on which the cloth is hung by the selvage till dry. Then, being made up into convenient bundles, it is taken by the hand-carts to a building where that series of processes is conducted which forms, perhaps, the most distinguishing feature in Turkey-red dyeing, and on which the beauty of the dye mainly depends. A vessel is supplied with a solution containing Gallipoli oil and some alkalies, which form a kind of soap, together with a third substance, more useful than agreeable, to give an ‘animalizing’ power to the action of the solution. It is well known that silk and wool (both animal fibres) receive in general much more brilliant dyes than cotton or linen (vegetable fibres); and the present process is to impart to the cotton fibres a quality somewhat analogous to that of wool and silk. Two rollers dip into the trough containing this solution, and the cloth is drawn through the solution between the rollers, by which it becomes saturated.

Then ensues that part of the process wherein the bleach-field is brought into requisition. The cloth, which has acquired a yellowish tinge from the solution, is wheeled from the building to the open air, where it is consigned to the care of a number of women. The cloth is in pieces of 28 yards each, and these pieces are laid down flat on the grass, side by side. If the weather be favourable, an exposure for two or three hours to the action of air produces the effect desired, which seems to be a kind of oxidation. All is bustle in the bleach-field when rain threatens: the women, with handkerchiefs on their heads, but nothing on the feet, hasten to gather up the cloth; and even if the weather be fine there is constant employment for them, since one batch of cloth is laid down as soon as another is removed. Sometimes as much as five thousand pieces, or a hundred and forty thousand yards, are lying on the field at one time.

The cloth is subjected a second time to the solution; then a second time spread out on the grass, in the same way as before. A different solution is next employed, containing only the oil and alkali; and this is applied three or four times in the same way as before, the cloth being ‘grassed’ after each application, and stoved-dried after each immersion in liquor and after each grassing; so that the transfers to and fro become very numerous, and show how much time and assiduity are

bestowed upon those processes. When the last of this recurring series is completed, the cloth is steeped for some hours in an alkali bath; and then, after being washed in the dash-wheel and squeezed in the press, it is drawn between rollers in a tub containing a solution of sumach (a substance much used in tanning thin leather, and in other processes where a binding quality is required). After being dried, it is passed through a solution of alum; so that by this time the cloth has been exposed to the action of oil, alkali, sumach, and alum, all of which contribute to the permanence and beauty of the dye afterwards to be applied.

The dye-house is a long building, containing a range of dye-vats, with horizontal shafts or frames worked by steam-power. The cloth is placed over these frames, and allowed to hang down into the dye-liquor, so that by rotating the frame, every part of the cloth becomes exposed equally to the action of the dye. The principal ingredients in the dye are madder and bullock's blood, mixed in such proportions, and heated to such a temperature, as are found best suited to the object in view. The alum, previously applied, causes the dye to adhere to the cloth, and the depth of tint greatly depends on the amount of alum combined; while the other preparatory ingredients aid in giving brilliancy to the dye. When the cloth has imbibed sufficient of the dye, it is washed in the dash-wheels, and then boiled for eight or ten hours in an alkaline liquor, by which the colour is greatly heightened, or 'cleared.' Another washing, another boiling, a third washing, and a final 'clearing' in a solution of chlorine, terminate this very long and complex series of operations.

Most of the processes here noted (except perhaps the grassing) are analogous to others that occur in dyeing generally; but it is the great number of them, and the nicety required in their management, which constitute the remarkable features in Turkey-red dyeing.

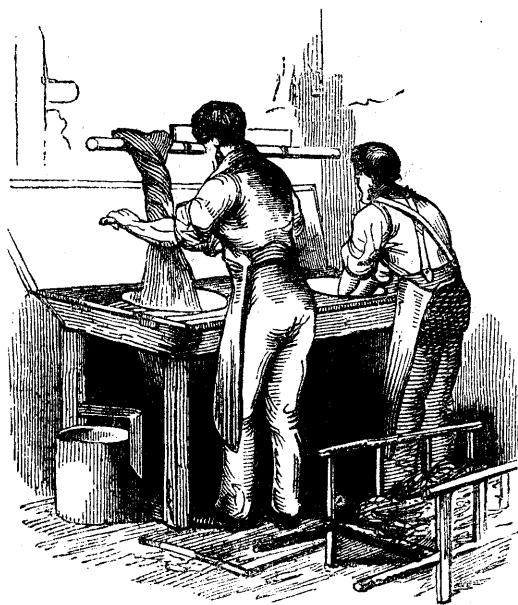
The cloth, when thus dyed, is ready for any further process, either to be printed for dresses, shawls, or handkerchiefs, or to go through that peculiar train of processes which constitutes bandana-work. But besides the cloth thus dyed, a vast quantity of cotton yarn is similarly dyed, to be employed afterwards by

the weavers in this country, or for exportation to foreign parts. The general train of processes is similar in the two cases, with some minor exceptions, and the annexed cut shows the mode of effecting a process which is many times repeated in the course of the dyeing, viz. wringing the hanks of yarn after being immersed in liquids. The yarn-dyeing is carried on wholly in a separate set of buildings, with boilers, vats, troughs, &c. independent of those employed for the cloth dyeing; and instead of laying the hanks of yarn down upon the grass, they are hung upon short tin tubes, which tubes are rested on bars in the drying-ground.

Bandana Handkerchiefs.—Most persons probably know that particular style of pocket-handkerchief which obtains the name of *bandana* or *bandanna*. The term is an Indian one, and was applied by the natives of India, who first produced this kind of pattern, though in a manner very different from that followed in this country. The characteristics of a bandana handkerchief are these:—a uniformly dyed ground of red, blue, or purple; with groups of yellow or white spots. The durability of the colours was the quality which brought those handkerchiefs into favour; and for many years the British manufacturers failed in producing a good imitation. The Indians are said to adopt the following very rude and simple mode of procedure:—After having dyed the cloth, they tie up with bits of thread those small parts which are to remain white or yellow; while the rest of the surface is freely exposed to the operation of the dye. Whether this is or is not a correct description of the Indian process, it is certain that the first British 'bandanas' were a poor imitation of those from the East. The first mode of accomplishing this was by the ordinary process of calico-printing upon white cloth. But in this mode it was rarely if ever in the power of the manufacturer to render the colours sufficiently durable, especially the red; and therefore the home-made article was never held in estimation by purchasers, most of whom consisted of that class of persons to whom durability was a great requisite. There was also a tax which at that time pressed heavily on printed cottons. These two circumstances led to the adoption of a felicitously conceived plan for producing the effect by totally different means. It was, we believe, M. Kœchlin, of Mülhausen, who, in 1810, discovered a mode of effecting this by the use of the chloride of lime; and in a few years afterwards, the 'Bandana-gallery' at Messrs. Monteith's Works became one of the most celebrated manufacturing apartments in the kingdom, in reference to the use of this powerful chemical agent in the production of handkerchiefs, which now far excel their Indian prototypes.

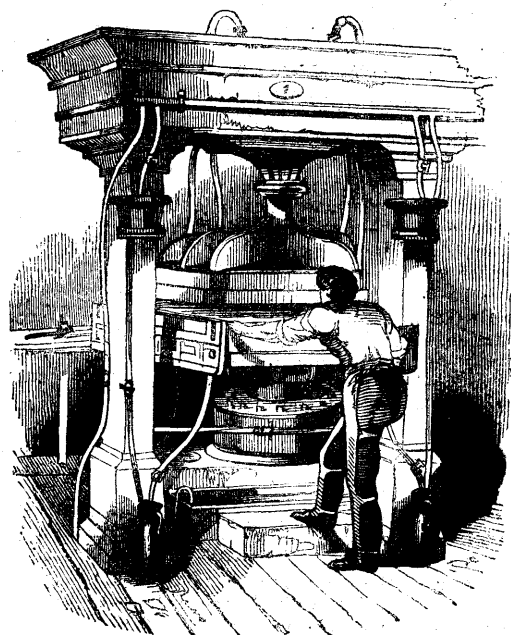
To understand the mode of proceeding, it will be well to premise that the handkerchief, shawl, or piece of cloth, is dyed uniformly of one colour in every part, both surfaces being equally impregnated with the colour; and that the white spots have the colour completely removed from them by the action of chloride of lime. The operations therefore resolve themselves into two parts—the dyeing of the cloth, and the discharging of the colour. Generally speaking these bandana-handkerchiefs are either red or blue: if the former, they are prepared by the Turkey-red dye processes just described; if blue, they are dyed with indigo in the usual manner. We will therefore suppose the dyeing to be completed, and the subsequent processes about to commence.

The Bandana-gallery at the Barrowfield Works is a room about one hundred feet in length, exhibiting through its centre a range of sixteen discharging-presses, where the chemical action of the chloride of lime is exerted. These presses are about six or seven



[Yarn-wringing.]

feet high, by four or five square; and have behind each of them a roller on which the dyed cloth is wound, and in front another which receives the cloth after the discharge. At one end of the gallery there is kind of clock or dial, having a moveable index or hand, and certain figures round the edge. An inquiry into the object of this dial affords us the means of seeing with what admirable simplicity mechanical power is brought to the aid of chemical power in these operations. Each of the presses, such as the one here sketched, is a



[Bandana Press.]

hydraulic press, in which a bed-plate is forced upwards with a power all but irresistible. The man who attends each press can turn on or off this power with the utmost ease, by placing his machine into or out of connection with the hydraulic engine where the force is generated. All the presses are alike connected with this engine, which is outside the gallery; and the dial indicates the force of pressure at any particular moment, by which the workmen are guided in their proceedings.

We will suppose that several pieces of red cloth for handkerchiefs are to have groups of circular white spots, such as are so frequently exhibited by banana-handkerchiefs. Fourteen pieces are laid flat and smooth one on another, as even and regular as possible. This compound piece is wound on the roller at the back of one of the presses; and a portion about a yard square, being unwound, is laid flat on a horizontal slab or bed in the machine. Then the workman, by turning a handle, brings the pressure to act from the hydraulic machine, and we see the bed-plate rise slowly till the cloth comes into contact with an upper horizontal plate; and such is the power of the machine that the cloth is pressed between the two plates with a pressure of, we believe, from two to three hundred tons. Then the workman pours some liquor into a cell or trough above the upper plate; and after allowing it to remain a short time, first draws off the liquor by a small cock, and then removes the pressure, whereby the lower plate is made to sink. On now removing the cloth from the press we see—and a stranger can scarcely see it without astonishment—that the red sur-

face of the cloth is diversified with groups of white spots; nay more, that every one of the fourteen pieces is similarly affected, whether lying at the top, the bottom, or the middle of the heap. The red-dye that would have withstood all the wear and tear of ordinary usage and washing, is seen to be completely removed from the spots, leaving them quite white.

We naturally look to the horizontal plates, to see how the liquid is enabled to act upon the cloth. Both plates are made of lead, about half an inch in thickness, and both are perforated exactly in the same way, and with holes of the same size as the spots to be produced on the cloth. The fourteen thicknesses of cloth have thus a perforated plate above them and another below, so that any liquid which may be poured on the upper plate can percolate through the holes, then through the fourteen thicknesses of cloth, and lastly through the holes in the lower plate. But it is easy to conceive that unless the cloth were pressed very tightly between the plates, some of the liquid would spread laterally beyond the margins of the holes; and it is to prevent this that the immense pressure is exerted. The liquid, which is a solution of 'bleaching-powder,' or chloride of lime, being poured on the upper surface of the upper plate, is allowed to remain there a few minutes, during which time it acts on the fourteen thicknesses of cloth at the places where the holes in the plates occur; but the intense pressure prevents it from spreading laterally to other parts of the cloth. Chloride of lime has the property of removing colours; and this it does so speedily, that in about ten or fifteen minutes all the fourteen thicknesses of cloth are acted on. When one portion of the compound piece of cloth is thus finished, it is wound on the front roller, and another equal portion is unwound from the back roller, to be treated in a similar manner. All the presses have equal power, so that in twelve hours the whole series can discharge an enormous length of cloth, by the aid of four or five men only; for while one press is remaining still and in work, the man who attends it can go and supply other presses with their working materials.

Sometimes the spots on a blue or red bandana handkerchief are yellow, instead of white. In this case the chloride of lime is still the active agent by which the ground-colour is removed, but other arrangements are made whereby a chemical production of colour results. Two liquids are, in such an instance, poured on the upper plate: the one being a solution of chloride of lime, to abstract the ground-colour from the cloth; and the other some chemical agent which shall give a yellow colour to the white spots thus produced: or perhaps it may be that the white spots are not actually produced at all; that the ground-colour, the colouring-agent, and the chloride, all act simultaneously in the production of yellow spots at the part of the cloth not protected by the plates.

In other instances, again, there are both white and yellow spots combined in the same piece of cloth. This arrangement requires the use of very ingeniously constructed plates. There is, in the first place, in each plate, one series of holes for white spots and another series for the yellow, and then an adjustment so that there shall be no channels of communication whatever between the one series and the other. By certain little ridges and dividing edges, all the holes of one series are brought into connection with a cell into which one kind of liquid is poured, while those of the other series are similarly placed in communication with another cell. Into one cell is poured the simple solution which is to produce the white spots; into the other the combined liquid for producing the yellow spots: and the two liquids percolate through the cloth

independent of each other, each one working its own effect in its own peculiar way. In like manner the lower plate is so partitioned off as to afford separate egress to the two kinds of liquid.

The preparation of these plates is an important point in the series of operations. In one part of the Works is an apartment where the plates are wrought. The lead, cast for the purpose, is brought to as flat and smooth a surface as possible, and on each piece is drawn or sketched the positions of the various holes, correspondent to the spots in the pattern. With appropriate tools, fitted for working in lead, the holes are then cut out completely through the lead; and various little channels are made in that one which is to be the lower plate, as a means of carrying off the liquid when it has effected its work. The holes in the upper plate are made to correspond strictly to those in the lower, whether the pattern is simply a group of spots, or whether it has a border. The nature of the process, it is easy to see, is inconsistent with the production of any fine or delicate lines in the pattern; and therefore very little more is attempted than the production of spots and lines or bold scrolls. The stock of plates forms both a ponderous and expensive item in the Works; for each pair—that is, the two for each pattern—weigh about six hundred pounds; and as every new pattern requires a new pair of plates, there is a constant addition being made to these very weighty working materials, especially as the old ones are not melted up so long as there is a chance of using them again.

Many of the handkerchief and shawl pieces are treated in a mode somewhat midway between the usual process of calico-printing and that of bandana-work, or indeed combining something of the two. For instance, a piece of cloth being dyed some uniform colour, and then printed in certain parts with a chemical agent, is dipped into a vat of bleaching-liquid, which either instantly discharges the colour from the printed parts, or gives to them a wholly new colour, in either case imparting a pattern. This process is well calculated to surprise a spectator, for the printed part is almost wholly invisible until dipped into the discharging-vat; and hence what appears to be a piece of plain red or blue cloth comes out of the vat with a beautiful white or yellow pattern upon it. The writer has now before him a small piece of Turkey-red dyed cotton which he saw go through the following processes in the course of a few minutes:—A pattern was printed on one part with tartaric acid and nitrate of lead; another pattern was printed on another part with tartaric acid alone; a third pattern was printed on a third part with tartaric acid and Prussian blue: the cloth was then dipped into a chloride solution, by which the first printed portion became white; and then into a solution of bi-chromate of potash, by which the other printed portions became yellow and blue respectively:—thus exhibiting a very remarkable series of chemical actions among the substances employed.

As regards the patterns of handkerchiefs and similar articles of cotton, a glance round the warehouses of such an establishment as the one we have been describing will afford us some curious items of information. At the warehouses of Messrs. Monteith, in the heart of Glasgow, the first thing which strikes the eye is a very blaze of Turkey-red (if we may use such a term): on every side shelves, presses, and counters, in long ranges of rooms, are loaded with cotton goods, principally handkerchiefs and shawls, and all more or less exhibiting Turkey-red as the chief colour; for though all colours are employed, yet this one is the characteristic of the place, and gives a hue to the whole assemblage of goods. A little closer glance

shows that the goods about to be exported to any particular country have a character about them different from those destined to other countries. This is a very curious point, and is exemplified on a large scale at this warehouse. The patterns for the home-market are generally unmeaning, representing objects which never have existed and never will; curves, zig-zags, stripes, spots, all imaginable shapes, are combined together into patterns, which are pleasing, perhaps, to the eye, but have no definite meaning. The Chinese market, on the other hand, requires patterns in which natural objects, such as birds and flowers, are depicted. The South American States demand the most gorgeous mixture of colours which the dyer and the printer can give; large masses of bright red, blue, and yellow—without any particular reference to the pattern—are called for. For the German market, pictorial subjects are prepared, without much reference to brilliancy of colours: copies from celebrated works of art by Overbeek, Cornelius, and other artists; and from pictures in the gallery of the Pinacothek at Munich, together with representations of cathedrals, abbeys, castles, and public buildings generally—were among the subjects which we saw represented on large bales of handkerchiefs for the German market.—In this way a sixpenny pocket-handkerchief may, if we choose to study it rightly, be made the means of giving us a little insight into national character and taste.

This will be a fitting opportunity to group together a few facts relating to the finishing, or what we may perhaps term the decorative departments of the cotton manufacture: first, in respect to the dyeing and printing in other countries; and secondly, in respect to the embroidering, or decoration by means of the needle.

The Hindoos had the skill of imparting bright colours and a glossy surface to their cottons in times when we knew very little even of the substance itself. Whether colours were given or not to the exquisitely fine muslins of India, or were confined to goods of coarser texture, it is certain that both the fineness and the beauty of colour were in early times regarded with mingled astonishment and admiration. Tavernier, when speaking of the calicuts or calicocs made at Calicut in India (whence they were named), said—"The white calicuts are woven in several places in Bengal and Mogulistan, and are carried to Raioxsary and Baroché to be whitened, because of the large meadows and plenty of lemons that grow thereabouts, for they are never so white as they should be till they are dipped in lemon-water. Some calicuts are made so fine, you can hardly feel them in your hand, and the thread when spun is scarcely discernible." He also says that some of the calico is so fine that when a man puts on a garment made of it, "his skin shall appear as plainly through it as if he was quite naked." Various other modes were adopted, and have been adopted by later writers, to express the exquisite fineness of the Hindoc muslin. One states that "twenty-five ells of it put into a turban will not weigh four ounces." Mr. Ward says, "Muslins are made so exceedingly fine that four months are required to weave one piece, which sells at four or five hundred rupees. When this muslin is laid on the grass, and the dew has fallen on it, it is no longer discernible." Sir Joseph Banks described some Hindoo home-spun cotton yarn, of which one pound measured a hundred and fifteen miles in length. The late Mr. Mill thus accounted for the extraordinary skill of the Hindoos in these matters:—"It is

a sedentary occupation, and thus in harmony with his predominant inclination. It requires patience, of which he has an inexhaustible fund. It requires little bodily exertion, of which he is always exceedingly sparing; and the finer the production the more slender the force which he is called upon to apply. But this is not all. The weak and delicate frame of the Hindoo is accompanied with an acuteness of external sense, particularly of touch, which is altogether unrivalled; and the flexibility of his fingers is equally remarkable."

The dyeing and beautifying of the woven cottons were equally objects of attention with the Hindoos. One of the early Portuguese adventurers speaks with admiration of the "painted" cottons produced by the Hindoos; and there are other writers who speak similarly of *painted* colours, the true character of which was not at that time understood. Thus, a Venetian merchant who travelled in India about 1560, speaks of the cotton-cloth "painted, which is a rare thing, because this kind of cloths shew us they were gilded with divers colours, and the more they be washed the livelier the colour will show." There was also a species of chintz then made, and extensively purchased in Europe; for in a pamphlet published in 1678, called 'The ancient Trades decayed and repaired again,' is the following complaint on the part of the woollen manufacturers:—"This trade is very much hindered by our own people, who do wear many foreign commodities instead of our own, as may be instanced in many particulars, viz. instead of green say, that was wont to be used for children's frocks, is now used *painted* and *Indian-stained* and striped calico; and instead of a perpetuana or shalloon to lyne men's coats with, is used sometimes a glazed calico." Defoe, too, said that "the general fanzie of the people runs upon East India goods to that degree, that the *chintz* and painted *calicoes*, which before were only made use of for carpets, quilts, &c., and to clothe children and ordinary people, became now the dress of our ladies."

But the most curious account of the dyeing processes adopted by the Hindoos was that given by Father Cœurdoux, a missionary at Pondicherry. From this account it appears that the Indian cotton-cloths, when brought from the loom, were worn next to the skin by the dyer and his family, during a space of eight or ten days; after which they underwent several soakings in water with goats' dung, accompanied with frequent intermediate beatings, washings, and drying in the sunshine. They were next soaked for some time in a liquid formed of curdled buffalo's milk, and the astringent fruit of the yellow *myrobalans*. When the cloth was thoroughly impregnated with this mixture, it was taken out, squeezed, dried by exposure to the sunshine, rubbed and pressed. Then ensued a process of painting, by drawing devices on the cloth with a pencil. The liquors used for this purpose were not colours or pigments, but mordants. The first was a mordant of acetate of iron mixed with sour palm-wine, and thickened with rice-water. The mordant was applied to the figures or spots intended to become black. Then an aluminous mordant was applied to those parts which were to be red; it consisted of alum-water, coloured with powdered sappan-wood and thickened with gum. When these processes were finished, the cloth was exposed to the hottest sunshine, to dry the parts where the mordants had been applied; and then it was thoroughly soaked in large pots of water, to cleanse it from the loose or superfluous part of the mordants. A dye-vat was then prepared, consisting of certain roots boiled in water; and in this dye the cloth was boiled for a long period. The parts which had received the alum mordant were made red; those to which the iron

mordant had been applied became black; and the remainder, after being washed and bleached in the sun, became white.

In China the use of silk is much more prevalent than that of cotton; but still it is stated by Staunton that blue-dyed cottons are worn very extensively among the humbler classes in China. That the Chinese are acquainted with the art of dyeing brilliant colours is too well known to need remark; but there has been an erroneous opinion prevalent as to the production of the tint exhibited by *nankeen* cotton, once so great a favourite in this country. Doubt has often been expressed whether this tint was imparted to the woven cotton by a process of dyeing, or whether the fibres of the cotton had this tint in the first instance. Mr. Baines, who has devoted much attention to the history of the various departments of the cotton manufacture in different countries, has collected the following passages from different writers to show that *nankeen* cotton is in reality not dyed at all:—"Sir George Staunton, who travelled with Lord Macartney's embassy through the province of Kiangnan, to which province the *nankeen* cotton is peculiar, distinctly states that the cotton is naturally "of the same yellow tinge which it preserves when spun and woven into cloth." He also says that "the *nankeen* cotton degenerates when transplanted to any other province." Mr. Baines then quotes the following statements from other authorities:—"Sir G. T. Staunton (the son) has translated an extract from a Chinese herbal on the culture and uses of the cotton-plant, in which one of the varieties is described as a "dusky yellow cotton of very fine quality." Van Braam, who travelled in China with a Dutch embassy at the close of the last century, was commissioned by some European merchants to ascertain whether a deeper dye could not be made in China; but he reported that it was not dyed at all, the cotton itself being the same colour as the *nankeen*. The narrator of the voyage of the ship *Amherst* says, "Each family at *Woosung* appears to cultivate a small portion of ground with cotton, which I here saw of a light red colour. The *nankeen* cloth made from that requires no dye."

A nation on the borders of the Caspian were described by one of the classic writers as being in the habit of painting figures of animals on their garments with a vegetable dye:—"They have trees whose leaves possess a most singular property: they beat them to powder, and then steep them in water: this forms a dye, with which they paint on their garments figures of animals. The impression is so very strong, that it cannot be washed out; it appears to be interwoven in the cloth, and wears as long as the garment." Pliny, too, in speaking of the Egyptians, describes a process evidently analogous to a rude kind of printing: "Garments are painted in Egypt in a wonderful manner, the white cloths being first smeared, not with colours, but with drugs, which absorb colour. These applications do not appear upon the cloths, but when the cloths are immersed in a cauldron of hot dyeing liquor, they are taken out a moment after painted. It is wonderful that, although the dyeing liquor is only of one colour, the garment is dyed by it of several colours, according to the different properties of the drugs which had been applied to different parts. Nor can this dye be washed out. Thus the vat, which would doubtless have confused all the colours if the cloths had been immersed in a painted state, produces a diversity of colours out of one, and at the same time fixes them immoveably."

The Indian colours, or perhaps the mordants to fix the colours, seem to be laid on in India by a kind of pencil or reed; but Mr. Buckingham, while speaking

of Mesopotamia, says that the natives *print* devices by means of small blocks four or six inches square. Other nations of the East were known to have done the same before the art was practised in England.

If we transfer our attention to the Western world, we find in like manner that the art of imparting showy colours to their woven goods was understood by the Americans when the Spaniards first saw them, although there is no evidence to show that the *printing* of cottons was practised by them. Clavigero says that among the presents sent by Cortes to Charles V. were "cotton mantles, some all white, others mixed with white and black, or red, green, yellow, and blue; waist-coats, handkerchiefs, counterpanes, tapestry, and carpets of cotton;" and he also states that the colours of the cotton were extremely fine, as the Mexicans had both indigo and cochineal among their native dyes.

With regard to the state of these arts at the present day, it will be sufficient to remark that all rude nations, with some rare exceptions, possess a knowledge of the means to impart dyed colour to their garments; that in many parts of Asia there are still practised various modes of producing coloured devices on cloth, either by actual painting or by a rude kind of printing; that in the southern and eastern parts of Europe dyeing is carried on, but scarcely aught that can be called calico-printing; that in the United States this is almost a new branch of industry, carried on to but a very limited extent; and that the countries which are alone distinguished for this beautiful art are Britain, France, Switzerland, Belgium, and some parts of Germany.

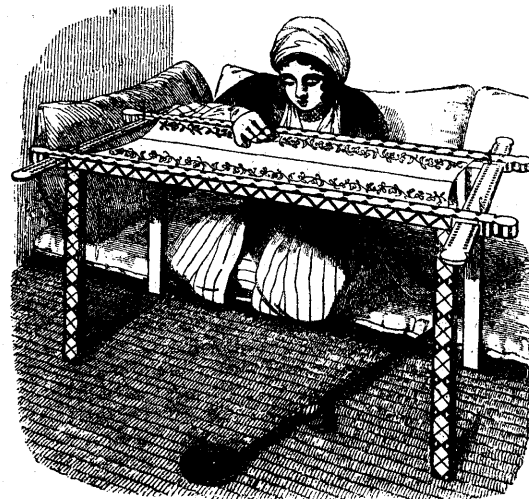
The other department of finishing processes, to which we alluded as offering fitting subjects to be briefly touched on here, is the *tambouring* or *embroidery*, which is effected by means of white or coloured threads. This presents a marked difference when brought into comparison either with the printing or the weaving methods of decoration: the one relating to the application of colouring substances to the cloth; the other to the intermixture of differently coloured threads in the cloth; whereas *tambouring* relates to the tracing of a pattern by means of a line of thread after the cloth is woven.

Muslin is the chief kind of cotton goods to which this sort of decoration is applied; and the term 'tambouring,' by which the process is generally designated, seems to have been derived from the French name for a drum; the instrument or frame employed by the *tambourers* being formed something like a drum. In the simplest mode of conducting this process, the arrangements are as follows:—There are two circular hoops or drums, the outer one of which fits closely around the inner one. The muslin to be *tamboured* is stretched over the inner hoop, and is kept in its place by the outer hoop being applied to it, a layer of cloth or flannel being so adjusted as to make the two hoops cling tightly one to another. The apparatus, thus adjusted, is in a fit condition for the *embroidress* to work an ornamental pattern on the surface. In the most simple form of working, this apparatus is held merely between the knee and the chin of the workwoman; but a more convenient and less clumsy arrangement is to support the *tambour* on some kind of pedestal or stand, so as to leave the worker greater freedom of movement.

Such has been the common form where *tambouring* is carried on simply as a domestic employment. But then it became a branch of trade—that is, when the manufacturers of muslin made *tamboured* muslin one of the articles on sale in their warehouses—a more convenient and expeditious plan was adopted. It was found advantageous, where a piece of muslin or cloth was broad, and the pattern close and tedious, to employ

a number of hands upon the same piece, in order that it might be quickly finished and brought to market; and hence the common *tambour-frame* was adopted. This frame is a very simple piece of apparatus, consisting merely of two parallel rollers placed horizontally in a wooden stand, and furnished with ratchet-wheels and catches to stretch the cloth. The piece of cloth is wound, one end over or around one roller, and the other end round the other; leaving a portion tightly stretched in a horizontal position between the two. According to the size of the portion thus stretched horizontally, three, four, or six persons can work at it simultaneously, each one confining her attention to one particular spot until finished, and a new portion being then unwound from one of the rollers.

The general arrangement here described corresponds almost exactly with that of the 'lace-running frame,' represented at page 113 of our last year's volume, in the Supplement relating to the Nottingham Lace Manufacture: in both cases the object being to stretch out a piece of cloth or of net, so that the hand of the workwoman can be placed either above or below it. Indeed, if we compare the following cut with the one just alluded to, we shall see that the Eastern ladies adopt the use of an *embroidering-frame* bearing a very near resemblance to the English *tambouring-frame*.



[Men'seg, or Egyptian Embroidery-frame.]

This is a sketch which Mr. Lane gives in his 'Manners and Customs of the Modern Egyptians,' of the *men'seg*, or embroidery-frame employed by the Egyptian ladies in their private apartments. While speaking of the occupations of the upper grades of female society in Cairo, he says:—"Their leisure hours are mostly spent in working with the needle; particularly in *embroidering* handkerchiefs, head-veils, &c., upon a frame called *men'seg*, with coloured silks and gold. Many women, even in the houses of the wealthy, replenish their private purses by ornamenting handkerchiefs and other things in this manner, and employing a *della'leh* (or female broker) to take them to the market, or to other *hhareems*, for sale."

The *tambouring* of muslin in private society has been practised for many centuries, or at least an analogous process on woven tissues of some kind or other; but the establishment of this as a regular branch of trade dates about the latter end of the last century. Glasgow has been and still is one of the head-quarters of the muslin manufacture; and the female population for many miles around that centre began to find

employment in embroidering or tambouring the muslin, or some of it, there made. It has been computed that the tambouring of muslin, when at its greatest extension, employed, wholly or partially, at least twenty thousand females in the western parts of Scotland. Of these females many lived in the vicinity of Glasgow, while others were scattered through various parts of the country, and were supplied with work and money by agents in the employ of extensive manufacturers.

A curious change has been effected in this manner within the last few years. Although the Glasgow manufacturers still supply tamboured muslin in large quantity, yet it is in Ireland that a considerable portion of this muslin is tamboured, thus illustrating the remarkable interchanges which occur when industry is allowed to seek out its own market. Mr. Hall, while describing one of the northern counties of Ireland, as he found it two or three years ago, says, "Through the whole of this district, the barony of Ards and that of Castlereagh, a large proportion of the peasantry are employed in what is technically termed 'flowering,' embroidering muslin, chiefly for the Glasgow manufacturers, who supply the unwrought material, and pay fixed sums for the workmanship. The workers earn generally about three shillings a week" (about as much as the lace-runners of Nottingham), "a small sum, but as the majority of the inmates of a cottage are similarly employed, sufficient is obtained to procure the necessaries of life, and, indeed, some of its luxuries, for the interior of many of the cabins presented an aspect of cheerfulness and comfort. We found, upon inquiry from the sources best informed upon the subject, that the number of girls occupied upon this branch of industry may be thus stated:—Between two and three thousand girls, from five to twelve years of age, employed at veining, at weekly wages averaging from 1s. 6d. to 2s. 6d.; sewers employed at needlework for Belfast houses, between two and three thousand, at weekly wages averaging 3s.; about ten thousand employed as needleworkers for Glasgow houses, at weekly wages averaging 4s. Thus upwards of 9000 are paid weekly in the north of Ireland for the manufacture of needlework. Nearly the whole of the work sent from Glasgow to London, and other parts of England, is produced in this district. It is bleached in Scotland, and sold as 'Scotch work.' The manufacture is chiefly of collars, cuffs, &c."

It is scarcely necessary to describe here the particular nature of the tambouring or embroidering process. It consists simply in drawing the loop of a thread successively through other loops, in such a manner as to allow the thread to stand out prominently on the muslin, to form a pattern, and yet to adhere durably to it. About forty years ago, the idea occurred to Mr. Duncan, of Glasgow, to contrive a machine which should effect this tambouring in a very expeditious manner. He gave rather a melancholy picture of the condition of the muslin-tambourers of Glasgow at that time, and seemed to think that the employment of a machine would place the occupation on a more healthy footing. He accordingly invented a machine full of highly ingenious arrangements, which he afterwards described in Brewster's 'Edinburgh Cyclopædia.' Many difficulties occurred in bringing this machine into use; and although it was so comprehensive that forty tambouring needles could be superintended by one girl, yet from various causes it has never competed successfully with the common process of tambouring by hand. Mr.

Duncan made a few remarks as to the probable reason why this kind of machine should not succeed to any eminent degree; and as these, if correct, apply to other cases equally with this one, we quote them:—"Upon the whole, experience has very clearly evinced that large sums cannot be prudently expended upon machinery calculated for articles of mere fashion, and that the exercise of mechanical genius will always be better directed to provide for the actual wants and conveniences, than to gratify the whims and caprices of mankind. In a refined state of society, ornamental arts must always exist; but the establishments for producing these ought ever to be calculated to meet those frequent stagnations of demand to which they are peculiarly exposed. The power to drive this machine being very small, and even that capable of great reduction by judicious alterations, an expensive establishment of mill-work, moved by power, is not by any means inherently necessary for the business. The regularity of motion produced by machinery is indeed desirable; but the attendant expense is more than equivalent to any advantage gained by its use."

More recently, a hand-worked machine (if we may use the term) of very beautiful construction has been introduced; for the purpose of working ornaments on the surface of woven fabrics, on the principle of the pantograph or of the profile-machine. It is true, that this machine is applied chiefly to the embroidery of silk goods; but the principle is equally available to cottons, if ever and whenever circumstances shall seem to render such a method desirable. The mode of proceeding is nearly as follows:—The machine consists of an upright frame, on the top of which is a moveable rod attached to one arm of a lever. The material which is to be embroidered passes over this rod to a roller beneath. On each side of this frame are carriages having a horizontal motion backwards and forwards; and these carriages are supplied with a system of clippers or pincers, and also of needles having eyes in the middle. The needles are threaded with the various coloured threads which are to be embroidered on the suspended piece of cloth. A workwoman, called a 'tenter' (a very general name in factories for those who attend on any particular machines), sitting at one end of the machine, moves the long arm of the lever to a point marked in a copy of the pattern; and by this movement the other arm of the lever, from which the cloth is suspended, is made to give a corresponding motion. When this motion has taken place, one of the carriages moves forwards, and drives its needles into the suspended cloth; and these needles are immediately seized by the clippers in the carriage at the other side. Then, by a slight adjustment on the part of the 'tenter,' an analogous but reverse movement takes place: the 'tenter' marks another point on the pattern; the suspended cloth makes another slight lateral movement; the back carriage thrusts the needles through the cloth; the front carriage seizes all these needles; and thus a second stage in the proceedings is completed. According to the number of needles employed, so is the number of repetitions of the pattern produced in the same piece at the same time. By passing each needle to and fro repeatedly through the cloth, a pattern is produced of any desired degree of complexity; yet so simple and regular is the action of the machine, that three females suffice for its management, one guiding the lever to the points marked on the pattern, and the other two directing the motion of the carriages.