1967/4

CIBA REVIEW

Japanese resist-dyeing techniques

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Japanese Resist-dyeing Techniques

Cover and feature

The dyeing of kimono fabrics in a Japanese dyeshop: before the fabrics are put in the dyebath, selected sections are tied to produce shibori effects; the craftsman on the right is colouring a 'yuzen' print. Woodcut from a series of 24 made by Yoshinobu Kano (1552–1640) to show Japanese craftsmen at work. By courtesy of R. Buner, Basle.

In old Japan, dyeing was a time-honoured art which had been influenced by numerous techniques and artistic styles in the course of its history. Conventional methods were improved or abandoned in favour of others until craftsmanship finally attained perfection in resist-dyeing techniques.

The 'kasuri', 'shibori' and resist-paste methods were employed to produce on yarns and fabrics of bast, cotton or silk, highly characteristic motifs which frequently had symbolic import. All these designs were the product of painstaking work and bear evidence of a real feeling for artistic expression.

The manufacture and dyeing of fabrics is closely tied up with Japanese history. Hence traditional techniques have not only survived the advent of industrialization but are still being used today in many dyeshops.

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"The evolution of mills and factories"

History and fabrics in Japan

Indigenous culture and foreign influence

Japan is a chain of islands lying like a string of beads off the eastern coast of Asia. Its indigenous culture is the product of the peoples who, coming from the mainland and the south, took possession of these islands, assimilating almost all the aboriginal Ainu. For a long time the people of Japan had no contact with other lands, not even with bronze age China.

When it finally developed, traffic with the mainland gradually changed the islanders' way of life. And change brought several hundred years of civil war. Not until the 17th century was there ushered in a period of political and social peace and stability which was to endure for two centuries. In these 200 years the Japanese again lived in a vacuum without contact with other countries. However, it was this isolation which gave birth to the customs and habits which are characteristically Japanese, and which enabled weavers and dyers to evolve fabrics and patterns of an equally characteristic beauty.

But isolation was not complete; through the port of Nagasaki there seeped into Japan the elements of European civilization, bringing with them new knowledge and science. Then, a little more than a century ago, internal and external pressures compelled Japan's rulers to open wide her doors to foreigners. From then on there swept over the Japanese wave after wave of European ideas, initiating remarkable changes in almost every walk of life. This process has not yet come to an end.

In the course of Japan's long history, China and Europe have exerted the most far-reaching influences on national culture. But the Japanese have always adapted to their own tastes and environment those aspects of a foreign culture they found attractive. In art they have always loved that which is mild serene and natural; they have avoided strident colours and tormented shapes.

China, Korea and Japan are neighbours, yet there are characteristic differences in their art. That of China, it is said, is massive and strong; that of Korea tranquil and aloof; and that of Japan gentle and clear. It is this gentleness and clarity which also finds expression in everyday life, in the national character, and in the traditional hand-woven and hand-dyed fabrics of Japan.

Jōmon period

Pottery made about 200 B.C. is distinguished by indented 'jōmon' or 'rope-mark' patterns. The stone age hunters and fishers who made it presumably first wore leaves and furs, then used elm bast fibres, and finally wove rough cloth from nettle fibres, hemp and ramie. The utilization of bark fibres seems to have originated mainly in the north, that of stalk fibres in the south; both types have left their traces on pottery. In time, the use of bark fibres became typical of the remoter regions and the Ainu in Hokkaido; stalk fibres were processed throughout the whole country. Weaving techniques were handed down from one generation to the next.

Archaeological excavation has brought to light Jōmon period clay images of men and women attired in fabrics ornamented with patterns based on bold, curving lines. Although these figurines give no proper picture of the clothing of the age, they do convey an idea of the strength of the designs used. Similar patterns are still favoured by the Ainu.

1. Japan, excluding the Ryūkyūs: locations of the most important textile centres.

1

2. In rural areas, peasant women still spin silk floss by hand, using a spindle with a stone or baked-clay whorl.

Yayoi period

Rice came to Japan from the mainland in about 200 B.C. and was soon being cultivated on all the islands. It became the staple food and led to an agricultural economy with settled communities.

Pottery was finer than that of the Jōmon period and had a distinctive shape. The first specimens were found in 1884 at Yayoi chō (Tokyo), the site thus providing a name, 'Yayoi', for the period which ended about 250 A.D.

Fabrics for everyday use were woven from twisted yarns of bark and stalk fibre. Rough and stiff bark-fibre 'tafu' fabric was used for work clothes, thin stalk-fibre 'sayomi' fabrics went into the apparel worn at home. Because both types of fibre were long virtually the only material from which textiles were made, their very names became synonymous for 'cloth' and retained this meaning even after cotton and silk had come into general use.

Tumulus period

The new, rice-growing agricultural economy was based on the ownership of land. Thus the owners of large estates acquired political power, and the beginnings of a state emerged.

Contemporary pottery shows traces of change, but truly typical of the period 250–550 A.D. were the great burial mounds of the wealthy dead. Hence the name: Tumulus period. Ornaments, swords and clay images ('haniwa') found in such graves show that customs and crafts had progressed since the Yayoi period.

Buddhism came to Japan via Korea in 552 A.D. and soon found many adherents among the ruling class. It significantly influenced architecture, sculpture, and the higher arts and

3. Banana fibre being spun with the aid of a spindle turned by a hand-cranked wheel. This probably came into general use when cotton was introduced into Japan in the 16th century.

3

crafts. Waves of emigrants from the mainland and Korea arriving about this time brought with them advanced techniques for manufacturing jewelry, arrows and pottery, for spinning, weaving, dyeing and sewing cloth, and for making fine, soft silks. This led to changes in Japanese dress.

The new dyes and dyeing techniques resulted in more colorful clothing. Patterns were obtained by the 'kasuri', batik and other resist-dyeing methods. But colour very soon became a sign of rank and use of the new textiles an exclusive prerogative of the court nobility and priests. Taxes were levied in kind: men paid with game, women with home-woven fabrics.

Heian period

In 794 A.D. the imperial court moved from Nara to Heian Kyō (now Kyoto), and the Heian period began. It lasted 400 years (until 1192 A.D.), during which the nobility furthered refined taste in literature, architecture, arts and crafts.

As taxes were still paid in kind, hempen and silk fabrics came to be valued as currency. Hence the techniques for their manufacture were improved and production increased until they were on sale in every town and country market. The customs of the nobility began to influence life in general, but the common people continued to dress in the bast fibre fabrics they had always worn.

Power struggles between rulers, nobles and provincial clans which broke out in the latter half of the Heian period plunged the country into five centuries of civil war. The might of the court nobility declined and its privileges, fabrics and colours became available to all—but the poverty stricken people of war-torn Japan had more pressing wants than an interest in elegant clothing.

Kamakura, Muromachi and Azuchi-Momoyama periods

At the close of the 12th century the 'samurai' or warrior class finally united the country and set up a shogunate, a military government, in Kamakura.

The 'shoguns' or hereditary commanders-in-chief levied taxes in rice and encouraged austerity, particularly in dress. Decrees limited the maximum width of a woven fabric to 37 cm; the manufacture of double-widths was prohibited. Thus the clothes of both the upper and the reasonably well-to-do classes became

4. Characteristic design on the bast fibre 'attosh' dress of the Ainu. The basic, recurring motif is thought to be a stylized bear's head (i.e. face) and a bear cult symbol.

plainer. For instance, the 'kosode' or 'small sleeves' underwear of the former nobility came to be worn as an outer garment.

Following the close of the 14th century, dyeing and weaving flourished for about 250 years together with arts such as the tea ceremony and the religiously inspired nô-dramas. Extensive foreign trade and cultural contacts introduced new ideas from China and India. This progress was due in large degree to warrior-politician Toyotomi Hideyoshi (1536–1598), the initiator of the brilliant Momoyama period in art and a patron of all the crafts including dyeing.
In 1512, so the legend says, a Portuguese brought cotton seeds to Japan. Soon this textile fibre was being planted, spun, and woven by almost every housewife in the country. Production increased rapidly and cotton fabrics appeared in the markets. The utility, warmth and strength of cotton changed Japanese dress and habits, particularly those of the common people.

Edo period

In 1615 the Togugawa clan set up their shogunate in Edo (now Tokyo). All traffic with other countries was forbidden soon afterwards, and Japan's Middle Ages began. In the following 250 years there emerged a firmly established government and a feudal class society of warriors, farmers, craftsmen, and merchants. The common people gradually gained economic power and attained a higher standard of living.
Clothing grew less and less austere, and the quality and supply of cotton, hempen and silk fabrics improved greatly. Forbidden to wear silk in public, commoners donned these fabrics in the seclusion of their homes. By the latter half of the Edo period taste had become so refined that 48 shades of brown and 100 shades of grey were distinguished, and competitive exhibitions of dyed fabrics were regular events.

The 'daimyo' or barons encouraged the spinning and weaving of cotton, and so production of such fabrics increased enormously. Osaka became the centre of the cotton trade. Indigo grew so popular that there was at least one indigo dyer in every village and town in Japan. Every family assembled a 'shimacho' album of fabric swatches, a weaving manual which passed from mother to daughter (Fig. 9).
The faults of feudalism were also evident in the Edo period. A harsh poll-tax was levied in Okinawa and women everywhere were long obliged to weave large quantities of fabric conforming to very strictly enforced standards. However, the system gave home weavers a very thorough training in the textile arts and thus bequeathed to posterity weaving and dyeing techniques which produce fabrics of unparalleled beauty.

Meiji period and 20th century

The Meiji Restauration of 1867 brought political and social reforms, foreign trade, and contact with the West. Imported textile machines and synthetic dyes initiated changes which did not, however, become noticeable until conversion to a capitalist economy was completed in the early 1900s.

Until then, traditional craftsmanship burgeoned and spread with the rapidly growing population. New natural mordants and dyes were introduced and silk, now available to all, was woven and dyed with new techniques and patterns.

But industrialization and its mills came at last, and home weavers' and dyers' standards deteriorated visibly. From about 1900 onwards, most 'shimacho' albums contained only swatches of poor quality fabric badly coloured with synthetic dyes and in the end ceased to be of any importance.

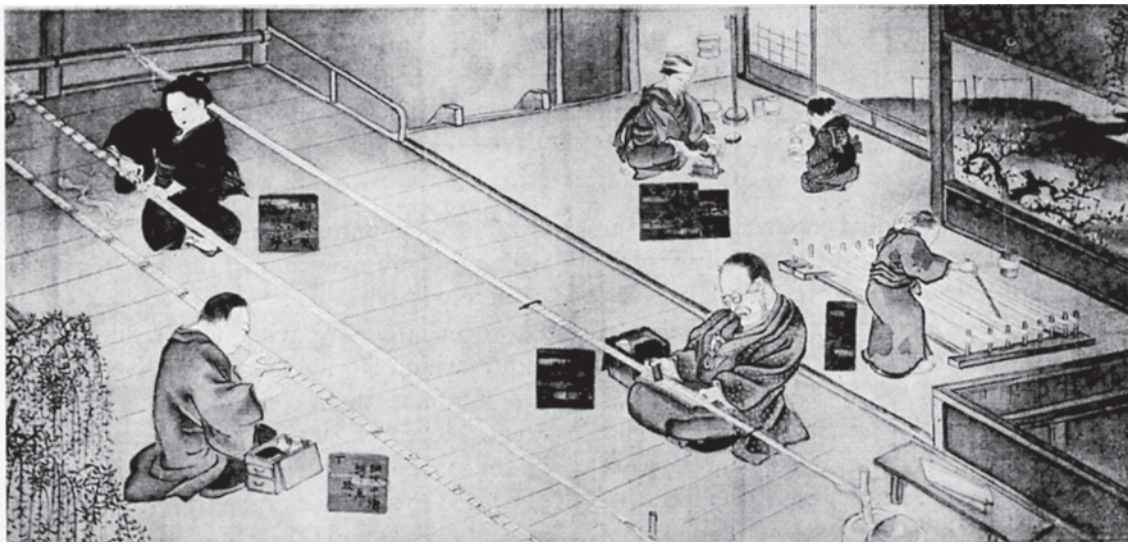
However, those weaving and dyeing techniques which did not lend themselves to mass production methods continued in use in many areas. Moreover, in the last 30 years the Folk Crafts movement started by the late Dr. Yanagi has led to a revival of the traditional textile arts all over Japan.

5–8. The dyeing and weaving of fine hempen 'kasuri' fabrics in Echigo province, as depicted by Kizan Ungai (1885) in a series of brush drawings now in the Akashi shrine at Ojiya, Miigata Prefecture. By courtesy of J. Langewis.

5. Weft yarns (foreground) and warp yarns (background) are bleached separately in the snow, the warps previously having been boiled in lye.

6. Bleached weft yarn is first arranged on a frame (right) and then stretched out to its full length, after which carefully selected sections are marked and tightly tied with bast ribbon.

5



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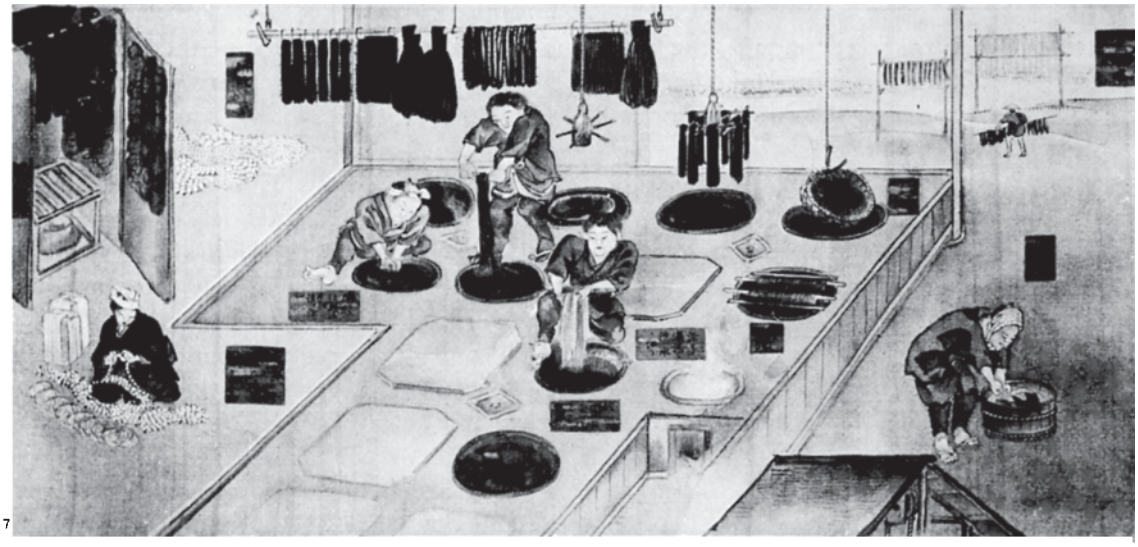
7. Skeins of tied weft yarns being dyed with indigo. On the left a woman is loosening up the untied sections of yarns to ensure good dye penetration, on the right the dyed yarns are being washed off, and in the background the skeins are being hung up to dry.

8. The tie-dyed weft and the warp yarns being woven into 'kasuri' fabrics on floor-level backstrap looms ('jibata'). The weaver in the foreground is using the characteristic shuttle to insert the weft in the shed.



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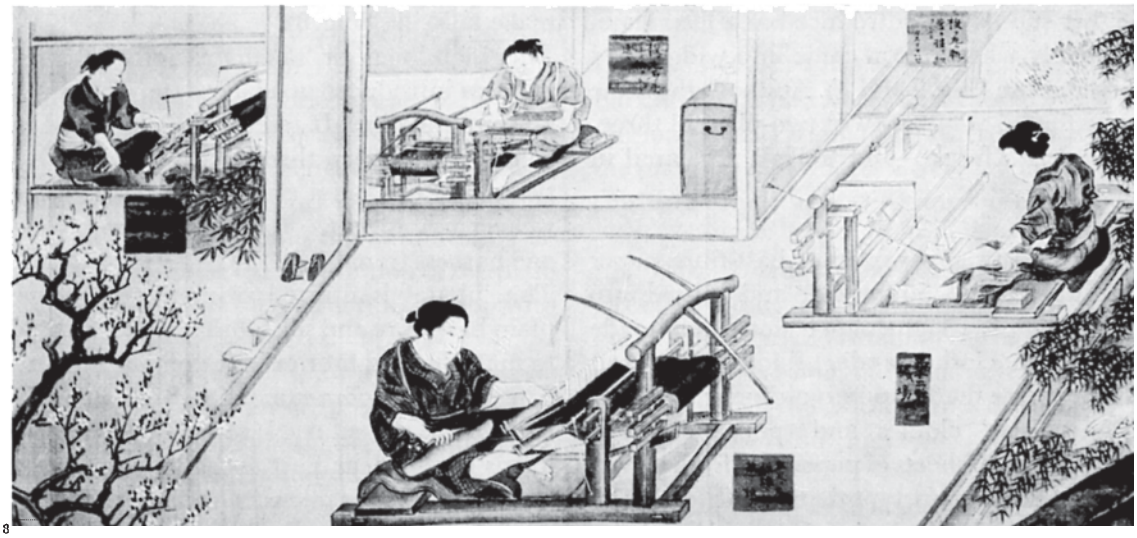

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Spinning and weaving

Yarns

Jōmon period yarns were made by the 'umu' method: bast fibres were joined together at the ends with a twist or a weaver's knot. Contemporary pottery bears the marks both of two-ply yarns and of fabric woven of yarns without twist. The latter still forms the weft in the 'attosh' made by the Ainu, in some hempen fabrics, and in the banana fibre fabrics of Okinawa. Raw silk reeled off the cocoon was also used without twist. As 'umu' yarns generally have little tensile strength and give fabrics a rough handle, twisting and spinning eventually were resorted to as a means of eliminating these drawbacks.

In the Yayoi period, spinners used a spindle set in a doughnut shaped stone or ceramic whorl, working just as do hand-spinners of wool in some parts of Europe today. A hand-cranked wheel which turns the spindle at higher speeds was introduced at a later date, probably when cotton came into widespread popular use (Fig. 2 and 3). At about the same time the first double-twist two-ply and three-ply yarns ('futako' and 'miko') appeared in fabrics.

Fabrics were also woven of bast-fibre paper cut into strips 4–5 mm wide and twisted into yarn. Thick, rough 'paper cloth' was made into work clothes and cushions; thin, soft fabrics were made up into ordinary clothing. 'Paper-wear' clothes and 'paper curtains' were cut from sheets of paper, not from woven fabric. Polynesian type bark cloth or 'tapa' was never made in Japan.

Looms

The earliest weavers used neither frames nor looms; a weaver tied the warp yarns to a tree or stake and to her body, squatting on the ground and inching toward the tree as she introduced the weft. This 'backstrap loom' technique requires a great deal of elbow room and is generally practised out-of-doors, where inclement weather may easily interfere with the work. The Ainu still use this method.

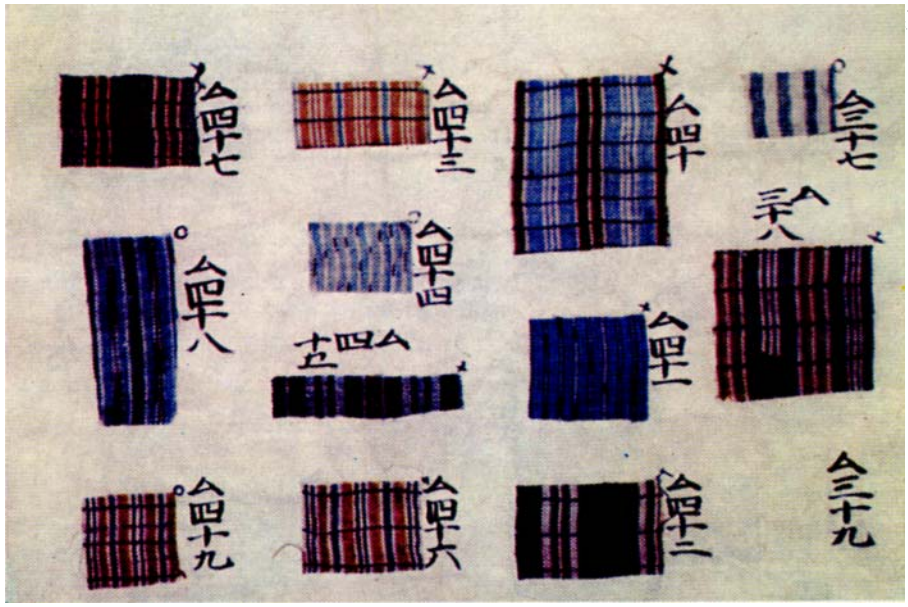
Two kinds of horizontal loom subsequently came into use. The older of these is the backstrap 'low loom' or 'jibata' (also known as the 'izaribata' or 'fusebata'). On it the warp threads are fastened to a warp beam and stretched with a belt around the weaver's body, the shed being opened with a single foot-operated harness frame. The 'jibata' takes up little space, can be set up indoors, and produces plain and fine weaves. It is still used today at Echigo, Etchū, Noto and Omi to weave high quality hempen fabrics, and at Hachijojima and Yuki and in Okinawa to make fine silks (Fig. 8).

The 'high loom' or 'takahata' with its raised seat was introduced at a later date, very probably from China. It resembles looms used in Europe. The warp threads are stretched between a warp and a cloth beam, leaving the weaver free to move and operate more than one harness frame (Fig. 12).

The 'jibata' is utilized primarily to weave plain bast-fibre and silk fabrics, the 'takahata' to make figured fabrics of cotton and silk.

The 'tatebata' loom came in with carpet weaving in the 16th century. It resembles the carpet looms of the Near East and China; a seated weaver inserts the pile weft and knots in warp yarns held in an upright frame.

9. Fabric samples in a 'shimacho' album. Once such 'shimacho' with swatches illustrating weaves and motifs were assembled by every family and handed down from mother to daughter for generations.



Weaves

All early Japanese fabrics were made with plain weave, possibly because it is simple and assures the tight interlacing of warp and weft which is desirable for work clothes. A growing desire for perfection and more interesting effects subsequently led to variation of the plain weave technique and to experimentation with innumerable other weaves.

As everywhere else in the world, the weaves employed in Japan were modifications and combinations of the basic three: plain, twill, and satin. But it would take a dictionary to list all the special weave names and techniques.

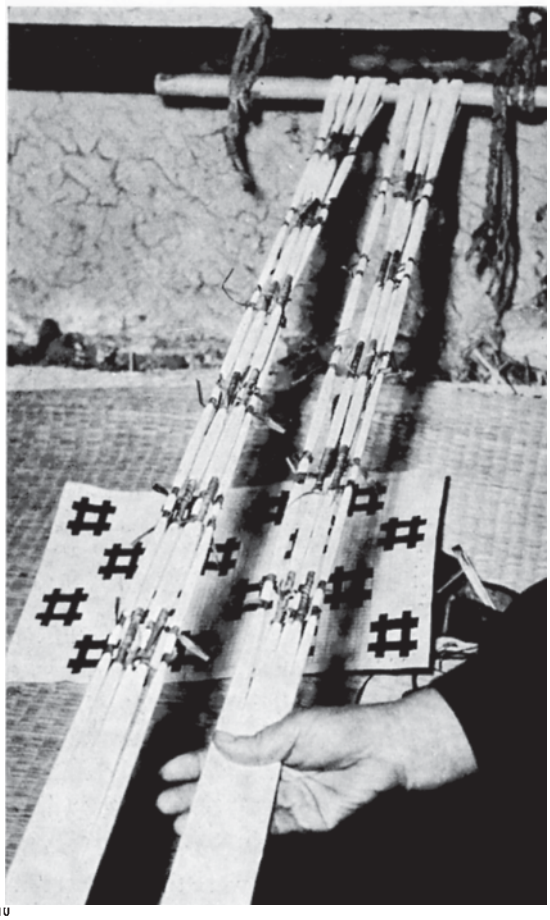
Fibres

Bark and stalk bast fibres were the earliest textile materials. Originally gathered wherever the plants grew wild, they were later carefully cultivated and the strains improved.

Bast fibres obtained from the bark of various trees are strong enough to be used without twist. In remote mountain areas they are still woven into time-honored 'tafu', a rough, thick fabric of which the oldest form is the elm-fibre 'attosh' of the Ainu (Fig. 4).

Wistaria fibres are as strong as tree-bark fibres and can be utilized for the same kind of fab-

10. Yarn tied and ready for dyeing. Underneath, the detailed paper pattern showing the required design and repeats. Photo: J. Langewis.



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rics. *Arrowroot fibres* have less tensile strength and are suitable only for weft yarns in fabrics with warp yarns of hemp, cotton or silk. In the Edo period, arrowroot fabric was widely used by ordinary people to make clothing. Because of its high lustre and fine handle it has been utilized since the Meiji Restauration to make wall hangings, cushions, bindings, etc.

Wild nettle hemp is thought to have been the very first textile fibre used in Japan. The fabric has a lustre like silk, but it never found wide application because its handle is too harsh.

Ramie was cultivated to obtain a variety of high-quality fibres. It makes a fabric which is 'cool' to the touch, and which was very popular for apparel worn during humid Japanese summers. Ramie weaving was a predominantly rural occupation. Today the most important centres are at Echigo (Niigata Ken), and on Miyako and Yaeyama in the Ryūkyūs.

Hempen fabrics were produced in large quantities by home weavers. Characteristic weaves and patterns distinguished goods made in such noted centres as Shichinohe (Aomori Ken), Echigo (Niigata Ken), the Noto peninsular (Ishikawa Ken), Omi (Shiga Ken), Echizen (Fukui Ken), and Nara (Nara Ken). Hemp was used for everyday clothing, the robes of priests, and the ceremonial dress of the samurai, for curtains, mosquito nets, and the borders of rush mats ('tatami'). Once every housewife felt justifiably proud if, in addition to her family's clothing, she managed during her working life to make one whole mosquito net, i.e. a piece of fine hempen mesh 100 metres long and 37 cm wide. It was such green mosquito nets which gave Japanese summer scenes their typical fairy-tale atmosphere.

Banana fibres from a variety of banana tree cultivated for its long leaf-bast fibres make fabrics with a refreshingly 'cool' handle. These are widely worn in Okinawa, where they are ideally suited to the humid climate and local way of life.

11. The resist-dyeing of yarns for 'kasuri' fabrics by the 'itajime-kasuri' technique. The yarn is pressed between engraved boards, the dye being unable to penetrate to the sections of yarn under pressure. Depending on the design, up to 150 boards may be used to dye a single batch of yarn. Photo: R. Sträuli. By courtesy of the Ethnological Museum, Basle.

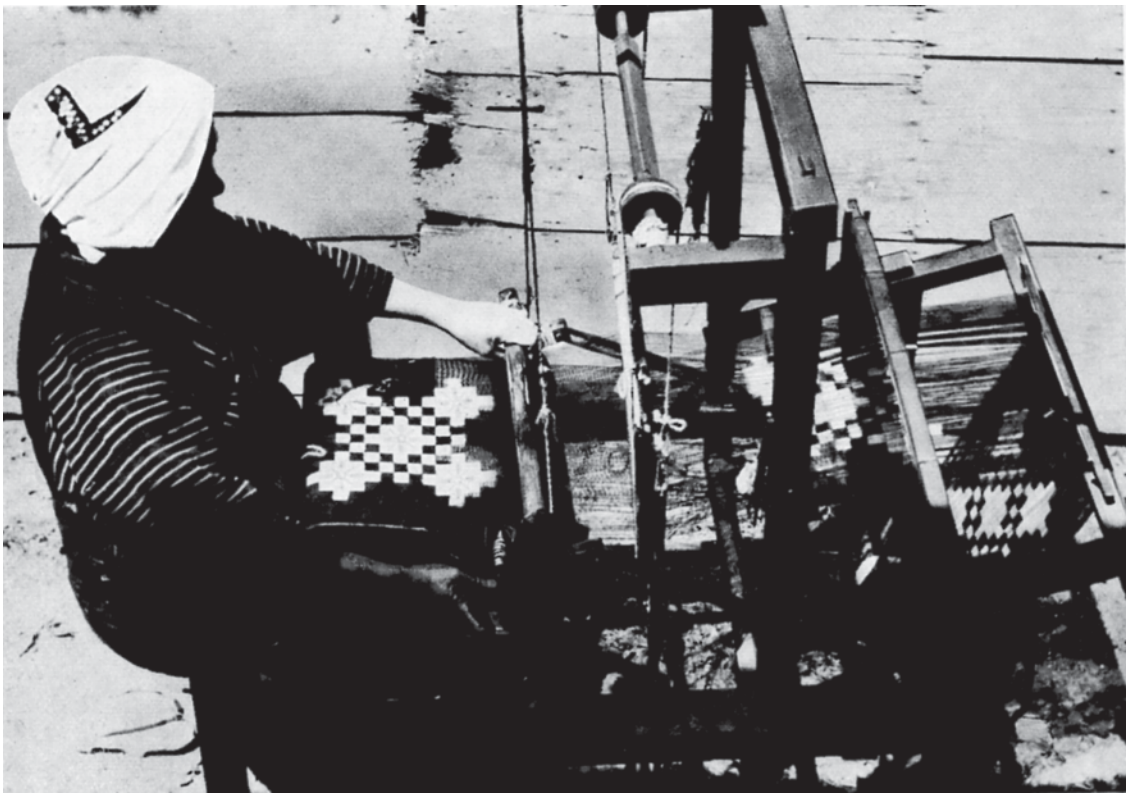
11

Flax was introduced into Japan in 1890 and first planted in Hokkaido. Although extensively cultivated today, it was never utilized in traditional fabrics.

Cotton arrived late on the Japanese scene but found the most widespread application. It was first cultivated for a short while in the 8th century, then reintroduced in the early 16th century, and became the dominant textile fibre soon afterwards. Cotton clothing could be worn both in winter and summer, and it was both tough and inexpensive. Cotton quilts were an ideal substitute for the previously used bedding of wadded straw, hemp waste, and catstails, which gave little protection in winter, was unhygienic, and reportedly sparked epidemics which cost innumerable lives every spring.

The Japanese took enthusiastically to the cultivation, spinning and weaving of cotton. Cotton clothing became a status symbol for upper

12. Weaving a 'kasuri' fabric on the 'takahata' or 'high loom'. When the weft and warp yarns have been interlaced, the undyed sections in both will combine to form a geometric design. Photo: J. Langewis. By courtesy of the Ethnological Museum, Basle.



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and lower classes alike. Cotton was made up into underwear, nightwear, bedclothes and work clothes, into summer clothing ('yukata'), wraps ('furoshiki'), towels ('tenugui'), socks ('tabi') and traditional costumes ('happi'), and used to make curtains, flags, leggings, tents, string, etc. In many districts, cotton fabrics were also made for use as barter goods by the local barons. Some cotton centres eventually acquired such fame that their names were used to designate the fabrics they produced, e.g. Moka and Kokura.

In northern Japan, where cotton cannot be grown, cotton fabrics were greatly prized and, when made up into clothing, were worn only on social occasions. Workaday clothes were made of home-grown hemp, being embroidered with cotton thread for added strength and better protection against the cold. Cotton fabric appliqué and thread embroidery are used by the Ainu to improve the wear resistance of their traditional bast-fibre robes (Fig. 4).

13. Young Japanese mother wearing a cotton kimono ornamented with white 'kasuri' motifs obtained on a blue ground by tie-dyeing both the weft and warp yarns. Photo: J. Langewis.

Silk was the only animal fibre known and used in old Japan. In the beginning, it was obtained from the cocoons of wild silkworms found in the oak and chestnut forests in mountain areas. This tussah was highly prized for its quality and lustre, Kabe (Hiroshima Ken) and Matsumoto (Nagano Ken) becoming noted for their silks. Little use was originally made of cultivated silk. Sericulture came into its own only after new techniques were introduced from China during the Yayoi period and quality and output were increased. From then on, fabrics were no longer woven from raw silk; instead the fibres were degummed, twisted, and made up into 2-ply and 3-ply yarns.

Silks were long legal attire only for nobles and priests; for the common people they were a form of currency and a means of paying taxes. They did not come into general use until the sumptuary laws were repealed after the Meiji Restauration. Many farmers then switched to sericulture and silk was soon being exported in large quantities, especially to the United States. The fibre has been at the disposal of home- weavers ever since and custom requires everyone to own at least one silk national costume. Silk is today used to make kimonos, neckbands, linings, sleeves, bedclothes and wraps.

13

Yarn resist-dyeing techniques

Over the centuries, Japanese home-weavers and dyers evolved innumerable patterns and designs based on combinations of solid colours, stripes, checks and 'kasuri' motifs.

Solid shades, stripes and checks

Long ago, when vegetable dyes were still a novelty, warp and weft were dyed one uniform shade—partly because a solid colour fabric was easier to weave and partly because some colours were thought to ward off misfortune and disease. Indigo blue found the widest application as it was a convenient shade for the clothes of peasants and labourers.

Bark and stalk bast fibres vary in colour with the part of the plant from which they are obtained. Interlaced in chance or chosen sequence, yarns spun from such differently coloured fibres will have made striped fabrics with an unusual, completely natural beauty of their own. Weavers obviously adapted, varied and improved upon this simple basic technique to obtain more complicated stripe and check effects. The introduction of dyes will have given them even greater scope.

'Shimacho'

Although designs introduced from southeast Asia in the 15th century did have a certain influence on subsequent developments, all the stripe and check patterns found in old 'shimacho' albums are of indigenous, Japanese origin. Such 'shimacho' were shown to friends, and home-weavers taught to one another the techniques they employed to obtain certain effects. In some centres experts were hired to devise new designs.

Dyed in plain colours, the more restrained small-figure designs generally appeared on male clothing. Large figures and combinations of several colours were used to ornament women's kimonos. Wrap and coverlet fabrics bore 15–30 cm square checks which rather resembled those in Scottish tartans (Fig. 9).

'Kasuri'

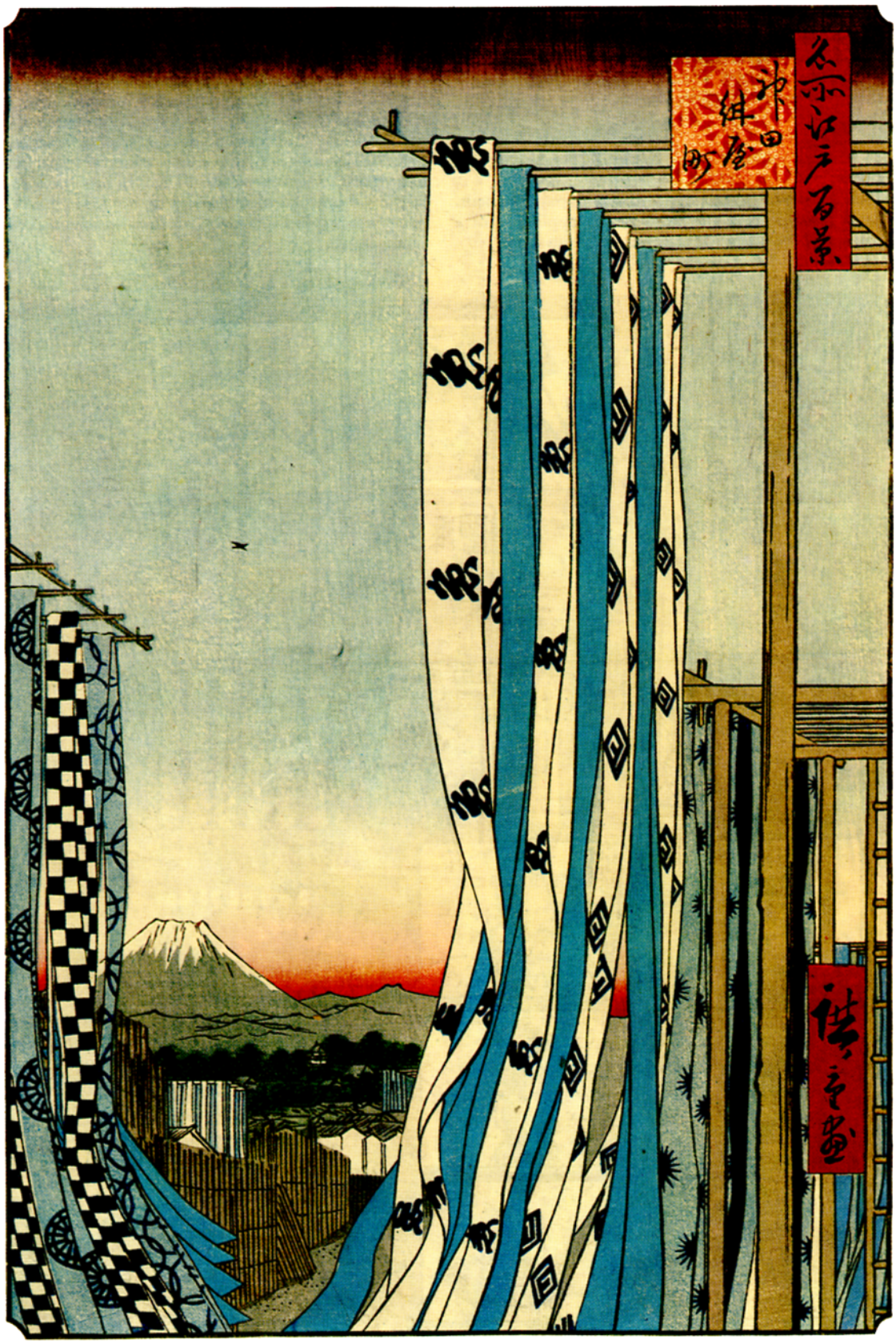
'Kasuri' is a type of patterned and figured fabric which is typically Japanese. It may be made by any one of a number of resist-dyeing techniques. The yarns are first treated at certain points to prevent absorption of dye, then dyed, and finally woven so that the undyed sections of yarn in the fabric appear and combine at previously determined points to form characteristic, traditional patterns and figures. Either warp or weft yarns, or both sets of yarns, may be partially dyed and interlaced in this fashion (Fig. 12).

Kasuri techniques

Numerous kasuri resist-dyeing methods were evolved in the course of time. The most important are the following:

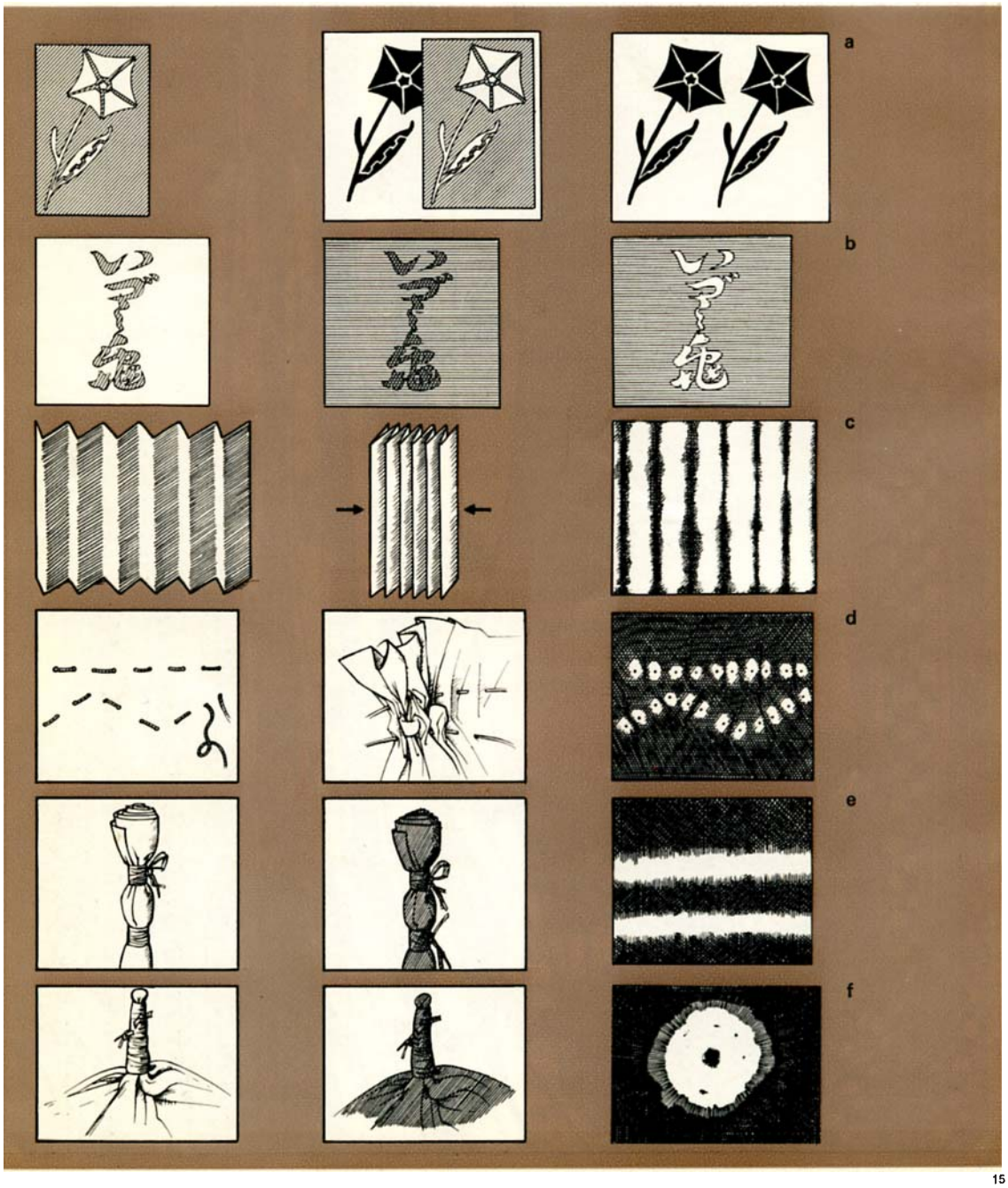
1) Thread is wound tightly around those sections of the warp and weft yarns which are to be reserved (Fig. 5–8 and 10). This technique is still widely used in Japan. In the West it is known by its Indonesian name, 'ikat', or as 'tie-dyeing' (CIBA Review No. 44).

Ikat is known the whole world over, but Japanese kasuri methods are very highly developed modifications of the basic technique. The finest kasuri fabrics are made in Okinawa by the 'kugeeigūsi' technique. Their unique beauty has long appealed to mainland Japanese and they are today in demand throughout the whole country.


名所江戸百景

14. (Page 17) Dyed lengths of cloth drying in the open air and, in the background, the street of dyers in old Kanda and the Fujiyama. Coloured woodcut from 'A Hundred Views of Yedo' by Andō Hiroshige (1797–1858). R. Buner collection, Basle.

15. Various methods employed in the resist-dyeing of fabrics.
Stencil techniques: (a) Direct printing with paper stencils. (b) A resist-paste made from rice is applied with a stencil and spatula and the fabric then dip dyed.
Shibori techniques: (c) The fabric is folded and pressed so that dye cannot penetrate to the areas under pressure. (d) The points to be left undyed are picked out with a length of strong thread on which the fabric is then drawn tightly together to form close-packed, impenetrable folds. (e) The rolled fabric is tightly wound about with bast etc. at selected points, straw rope or wooden cylinders being inserted as filling material when large figures are to be produced. (f) Knobs and sections of fabric are pinched together and tightly tied.
All photographs by courtesy of the Ethnological Museum, Basle.



15

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Dyeing	®Cibacet, ®Tectilon, Benzyl Fast and Alizarine Fast dyes, and ®Cibalan Black BGL, ®Avilon Fast Black G-W or B
Levelling	Levelling Agent PAW and ®Univadine W
Printing	Selected acid, Tectilon, Cibalan, ®Neolan, Avilon Fast or ®Chlorantine Fast dyes
Improving wet-fastness	®Cibatex PA, which may also be used for reserving whites in printing
Softening	®Sapamine OC, PA, NP

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Polyester carpet pile materials

Pre-scouring	®Ultravon JU
Dyeing	®Terasil dyes
Soil repellent and anti-static finishes	®Sapamine NP
Softening	Sapamine OC, PA, WP, and NP

16. Close-set knobs of fabric pinched and tied with the aid of mechanical devices produce the blotch pattern designs typical of 'kanoko' shibori. Photo: J. Langewis. By courtesy of the Ethnological Museum, Basle.

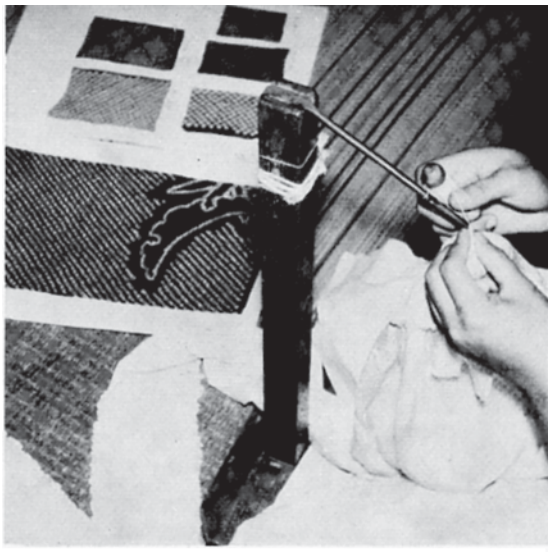
17. 'Yanagi' or 'willow-leaf' shibori design on a cotton fabric. Innumerable different effects can be obtained by combining folding, tying, resist-paste and filling material methods.

Geometrical patterns are generally used for everyday and working clothes of silk, cotton, hemp and banana fibre. Figured designs with flowers and animals decorate cotton coverlets ('futon') and door curtains ('noren').

2) The weft yarns are woven with thick cotton warps into a fabric which is dyed and then taken apart. The weft yarns, undyed where they were covered by the warps, are subsequently woven with new warps into the final fabric. This method produces the fine, dotted patterns on the silk kasuri of Amamiōshima and the ramie kasuri of Miyako. These fabrics are famous, but making them entails so much work that they are too expensive for everyday use.

3) Yarns are pressed between two boards engraved in high relief with the required design and immersed in the dyeliquor, which cannot penetrate to the points under pressure (Fig. 11). The partially dyed yarns are then woven into a fabric. This technique was introduced from China sometime in the 6th century and was originally employed to dye fabrics in the piece. In its present form it is typically Japanese and facilitates the reproduction of very fine lines. It calls for complicated equipment and is nowadays used to produce kasuri only at Omi and Echigo (hemp), Yonezawa (silk), and Yamato (cotton).

4) Dye is hand-rubbed with small, thin sticks into carefully selected sections of a long, undyed end of yarn stretched out to its full length. Known as 'kashiri' (to rub), this technique is still used at Echigo (Niigata Ken) and on Yaeyama in the Ryūkyūs.



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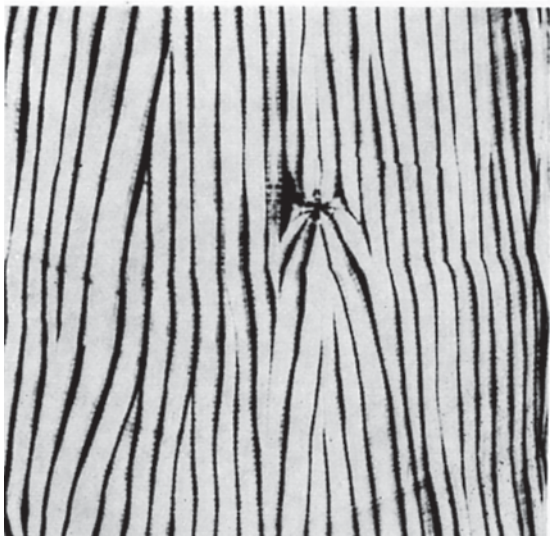

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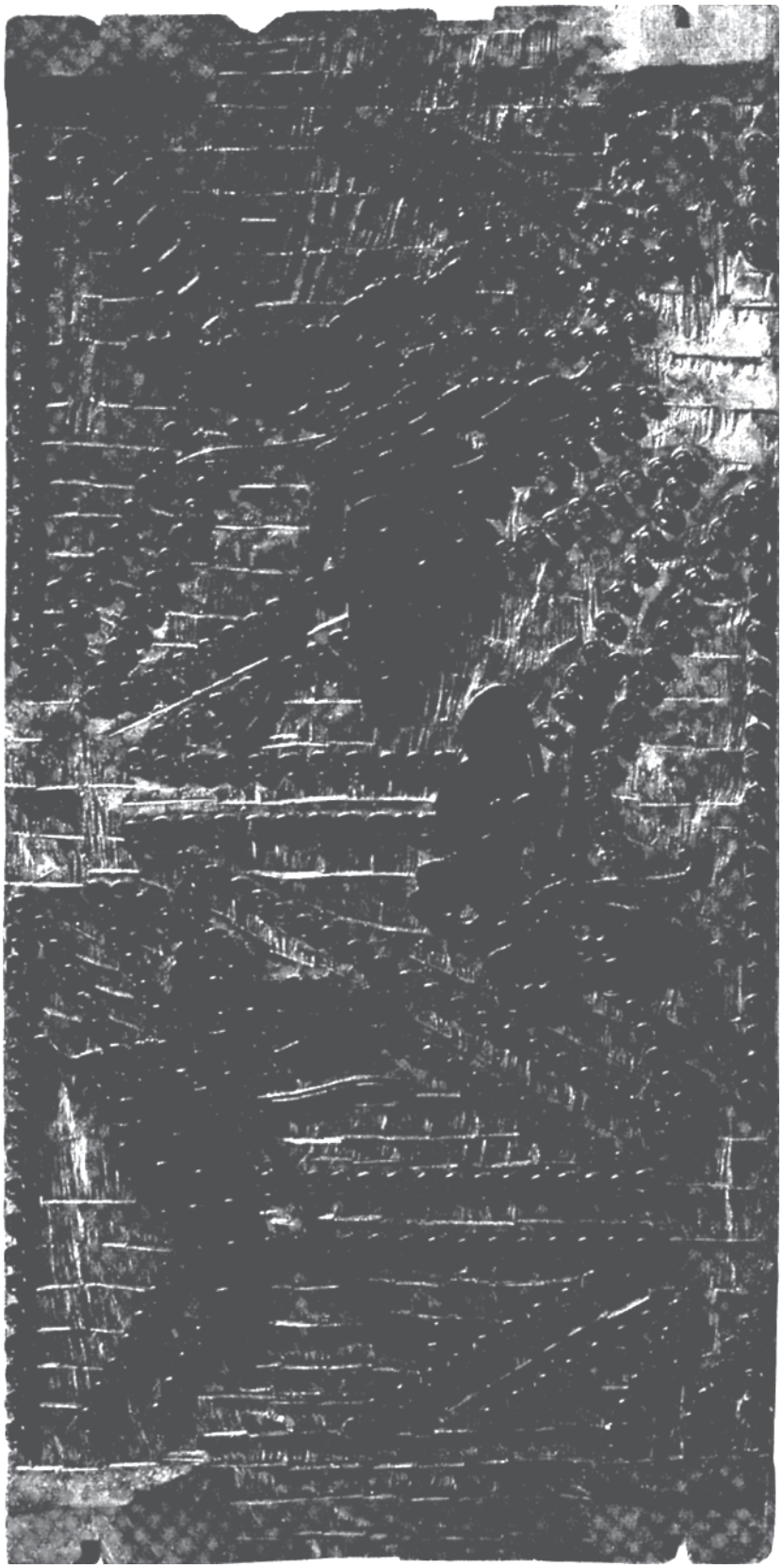

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18. A wooden board of the kind used in the resist-dyeing of fabric by the 'kyokechi' technique. Several boards are used at a time, the design being cut in mirror image high relief on both sides of each. The fabric is laid between them and pressure applied to prevent dye penetrating the areas between the raised wooden surfaces. The design appears in white on a coloured ground.
R. Buner collection, Basle.

19. An elegant 'kyo' shibori design on silk. Such craftsmanship is still a Kyōto dyeshop speciality.

5) Part of a skein of yarn is dipped in dye-liquor. Fabrics woven from such yarns have 'hazy, shifting' shades and are known as 'fukiyose' or 'drifting' kasuri. The method itself indicates the spontaneity with which some kasuri patterns originated.

6) A fabric is woven with very rough, temporary wefts and printed with a multicoloured figured design, then taken apart. Afterwards the partially dyed warps are woven with new, undyed weft yarns of the same material into the final product. Almost any multicoloured pattern or figure can be reproduced with this method, but it is not a true kasuri technique and can hardly be used by home-weavers and dyers.

7) Kasuri pattern fabrics are woven using two or more solid-colour and no partially dyed yarns. These products are known as 'ukiori' kasuri even though they are not really kasuri at all.

8) Kasuri patterns are printed on solid-colour fabrics. These fabrics are imitation kasuri.

19

The origin of the kasuri technique is obscure. Some authorities believe it came to Japan from India via southeast Asia, Okinawa and the Ryūkyūs; others claim it was invented by a woman named Inoue Den at Kurume on Kyūshū early in the 19th century. It is in any case the kind of technique a community's weavers would inevitably invent for themselves. An unevenly or only partly dyed yarn may be a faulty bit of work, but it will produce a dot-pattern effect when woven into a fabric.

Hence even dipping half a skein of yarn in dyeliquor will produce simple kasuri effects.
The basic figures in kasuri designs vary greatly in size; there may be as much as 180 repeats to a fabric width of 37 cm. Symmetrical patterns include those found on 'ka' (mosquito), 'ya' (arrow), 'jūji' (cross), 'kikkō' (tortoise shell), 'kinoji' and 'igeta' kasuri. Some of the asymmetrical designs are 'fukiyose' (drifting), 'ame' (rain), 'kasumi' (haze), and 'mizin' (fine) kasuri. Other designs are named for their colours, e.g. 'shiro' (white), 'kon' (indigo blue), 'futairo' (two-colour), and 'iro' (multicolour) kasuri.
Kasuri techniques were used to dye fabrics made of hemp, ramie and silk. Cotton dyed with indigo blue kasuri designs has always been highly popular for traditional peasant costumes (Fig. 13). In fact, the demand for cotton kasuri is still so great that it keeps busy such centres as Kurume (Fukuoka Ken), Bingo (Hiroshima Ken), and Tsuyama (Okayama Ken). High-quality hempen fabrics with kasuri designs are made at Omi (Shiga Ken), on the Noto peninsular and at Echigo (Niigata Ken), the latter centre and the Ryūkyū islands Miyako and Yaeyama also being famous for their fine ramie kasuri (Fig. 5–8). The best silk kasuri comes from Isesaki (Gunma Ken), Nagai and Shirataka (Yamagata Ken), Amamiōshima (Kagoshima Ken), and from Shuri and Kumejima in the Ryūkyūs. The iro-kasuri silks from Okinawa exhibit superior colour combinations, those from Amamiōshima are generally dyed in dark brown shades.

In the beginning, the dyeing of fabrics in the piece with simple vegetable dyes by immersion or paste application methods was a task for a household's womenfolk. Men took over after the introduction of indigo, purple and safflower necessitated the use of special equipment and techniques which made dyeing a full-time job and trade. Professional dyers finally became indispensable when stencil and freehand drawing techniques were adopted, simply because their skill and equipment gave better results. At this time indigo dyers were given their traditional name: 'kōya'.
The mainland craftsmen who in the 6th century brought advanced sericulture, new weaves and dyes to Japan apparently also introduced various resist-dyeing methods. Among these were batik, the dyeing of fabric sandwiched tightly between boards carved in high relief (Fig. 18), the shibori technique, and the rubbing of dye into fabric stretched over an engraved board. Magnificent specimens of fabrics dyed in this way have been preserved in temples and the Shosoin at Nara. However, some of these early techniques were too complicated for home dyers and were abandoned. The batik technique was revived in the 18th century, but it was never used to any great degree.

'Shibori'

'Shibori' is the Japanese name for the tie-dyeing technique more generally known by its Indonesian name as 'plangi', and employed to dye fabrics in the piece (see CIBA Review No. 104). Since this technique is particularly suitable for soft fabrics, it was first used for silk and then, from the 16th century onwards, for cotton. Variations in basic tech-

20.–21. A small wooden bucket with a tight-fitting lid is used to reserve large sections of a fabric ('okejime' shibori); the parts to be dyed are left dangling down the sides of the bucket (20). When the dyeing operation has been completed, the fabric is taken out of the bucket (21). Additional effects can be obtained by folding and tie-dyeing methods. By courtesy of the Ethnological Museum, Basle.

22. Stripes are produced by rolling the fabric around wooden cylinders, covering up the sections to be reserved with strips of paper or plastic, and tying these tightly before dip dyeing the fabric. By courtesy of the Ethnological Museum, Basle.

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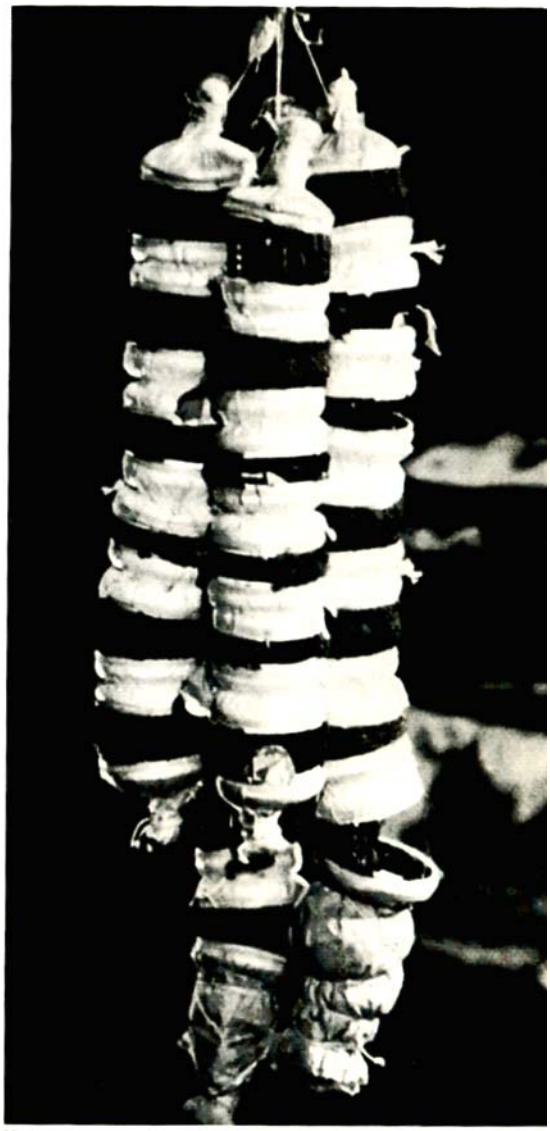

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nique produced a series of classical patterns, e.g. the simple and popular 'yanagi' (willow-leaf) and 'mame' (bean) shibori (Fig. 17).
Shibori fabrics inevitably became the speciality of certain centres such as Kyōto, Morioka (Iwate Ken), Arimatsu and Narumi (Aichi Ken), Amagi (Fukuoka Ken), Hirose (Shimane Ken), and Beppu (Ōita Ken). The 'kyō' shibori from Kyōto are famous for their elegant patterns (Fig. 19).
Kimonos made of fabrics dyed in intricate designs with a combination of tie-and-dye methods are too expensive for most people. Coverlets, wraps and men's waistbands ('obi') ornamented with simple patterns are widely used.
The shibori cottons from Arimatsu and Narumi are as famous as Kyōto's silks; they have been prized since the 16th century. The artist Andō Hiroshige (1797–1858) depicted a stall selling such fabrics at Narumi in his 'Fifty-Three Stages of the Tōkaidō' (Fig. 23). The cottons were bought as souvenirs by travellers and sold throughout the country by merchants. Generally dyed with indigo blue in large, bold patterns, they are now often made up into towels, waistbands, and apparel for children. 'Yukata' summer dresses ornamented with shibori patterns are particularly appearing to the eye.
Indigo blue shibori cottons are also produced at Amagi, Hirose and Beppu. Morioka (Iwate Ken) is known for shibori cottons dyed red-purple with gromwell root (Lithospermum officinale) extract.

Resist-paste techniques

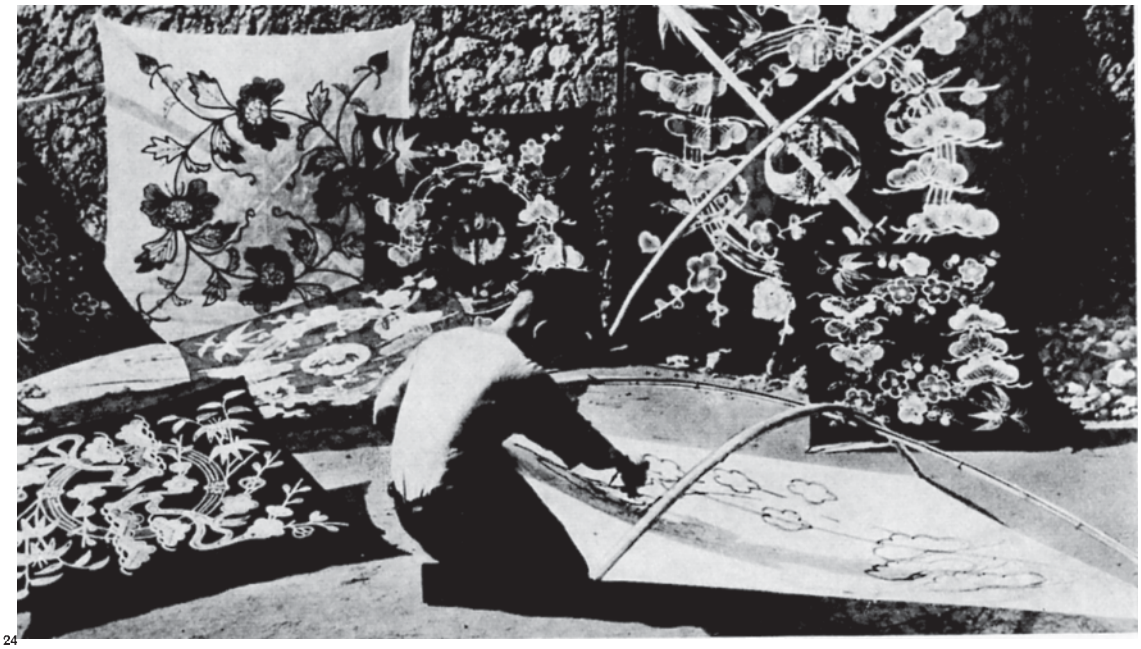
Japanese resist-paste techniques were apparently evolved from the 12th century Chinese 'in-fa-pu' method; they are widely used by home dyers. Glutinous rice and rice bran are boiled, mashed, and kneaded together to make a resist paste which is applied to the fabric by tube, stencil or pouring. The techniques work with both dyes and pigments on hemp, silk, and cotton. They are used to dye everyday and working clothes, 'yutan' furniture covers, coverlets, wraps, etc.

Freehand drawing technique
With one technique, resist paste is squeezed directly onto the fabric from a tube held rather like a crayon. Skilled craftsmen can draw designs freehand in paste on coverlets or wraps up to 160 cm square, but as a rule a rough sketch is made first. When the paste is dry, the fabric is dyed in one or more shades. Traditional designs reproduced by this method include the 'shō-chiku-bai' or 'pine-bamboo-plum blossom' motif (Fig. 24 and 25).
Resist paste applied by tube is used in the Tōhoku area of northeastern Japan to produce the charming designs seen on women's ceremonial, hempen 'katsugi' head-dresses. Elsewhere, the method is employed to dye designs incorporating large, white family crests or trademarks. In the San'in area (Shimane and Tottori Ken), a traditional centre of the craft, wraps and kimonos ornamented with hand-drawn designs still form part of a bride's dowry.
In Okinawa, ramie and banana fibre wraps and kimonos are ornamented with traditional designs by the paste drawing method. In spring, women carrying on their heads trays of offerings covered with such fabrics are a highly picturesque sight as they go in procession to the cemeteries.

23. Cloth dealer's stall in early 19th century Narumi; the designs on the fabrics and kimonos were all obtained by resist-dyeing techniques. Coloured woodcut from 'The 53 Stages of the Tōkaidō' by Andō Hiroshige (1797–1858). R. Buner collection, Basle.

23

24. Using a tube filled with resist-paste, a dyer draws traditional design on fabrics. After dyeing, the 'pine-bamboo-plum blossom' motif will appear in white on a dark ground.



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In a modification of the ordinary method, thin slivers of wood are used instead of tubes to draw designs consisting of very fine lines.

Stencil technique

With the stencil technique, the resist paste is rubbed with a spatula into those parts of a fabric not covered by a stencil (Fig. 28). When the paste is dry, the fabric is dyed in one or more shades and the paste subsequently washed off. The whole process bears about the same relation to the ordinary stencil dyeing (screen printing) technique—in which dye is transferred from the stencil to the fabric—as does a photographic negative to a print (Fig. 15a and 15b).

The stencils ('katagami') are cut from paper (Fig. 27), often from several layers between which is inserted a fine net of hairs which prevents dislocation of the stencil parts in use (see CIBA Review No. 107). At Shirako near Ise (Mie Ken), such stencils are manufactured for sale throughout Japan. The local craftsmen are so skilled that they can reproduce classical Edo and Meiji period filigree patterns for women's kimonos by punching out lines

25. A cotton coverlet ('futon') dyed in several shades by drawing the design with resist-paste squeezed from a tube.

26. Highly ornamental 'bingata' design incorporating plant motifs and produced by combining stencil and direct-printing techniques.

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26

with dots no more than 1 mm in diameter. Stencils for 'yukata' dresses and coverlets are cut in larger, bolder patterns based on arabesques, 'bird-and-flower' and 'crane-and-tortoise' motifs, etc.

'Bingata' and 'Yuzen'

Stencils can be used in innumerable combinations with other techniques. Striking ornamental effects can be obtained by employing them together with direct printing or free-hand drawing techniques. Thus 'bingata' prints are famed for the bright colours, clear lines, and unique shading-off effects which depict more than 10 animal and 30 kinds of plant and landscape motifs. Bingata prints (Fig. 26) are a wonder of rigidly stylized motif elements assembled in free compositions. They are traditional Japanese dyeing technique at its best, and may be compared only with 'yuzen' dyeings.

The name 'yuzen' designates a combination technique in which numerous printing and dyeing operations alternate with delicate free-hand insertion of detail. Stencils (screens) are first used to print motifs in one or more colours,

27. Cutting out paper stencils calls for a very steady hand, painstaking precision, and a thorough knowledge of motifs dating back to the 17th century.

28. Covering up the sections of fabric to be dyed with a stencil, a dyer applies resist-paste to the rest. A very intricate design may necessitate the use of a combination of up to 150 stencils.

29. The sections to be left undyed having been covered with resist-paste, a fabric is carefully folded and spread with springy sticks ready for dyeing.

30. The wet fabric being lifted out of the dyebath.

Photos 28–30: R. Sträuli. By courtesy of the Ethnological Museum, Basle.

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then additional colour and shades are painted in by hand, each motif is covered with resist paste, and the ground shade is thickly applied by squeegee. Finally, the fabric is steamed and washed-off. The result is a design with magnificently detailed motifs.

The exclusive use of stencils would at first glance seem to limit a dyer's scope far more than batik or 'sarasa' (see below) techniques. In practice, however, stencils produce full, sharply defined, bold and beautiful figures superior to the somewhat hazy-edged effects obtained by the two other methods. This fact explains the lasting popularity of the technique.

Stencils are also used in the 'dye pouring' technique ('chusen'). Resist paste is applied by the stencil method to a piece of fabric which is afterwards folded several times, each fold corresponding in length to the length of the stencil. Dyeliquor is then poured onto the folded fabric and penetrates all the areas not covered with resist paste. The result is a pattern in white, etc. on a dark ground.

'Sarasa'

The 'sarasa' (sarasa calico) technique owes its origin to chintz and striped cotton goods which were imported from India in the 16th century and became very popular during the Edo period. A fine cotton fabric is given two coatings of soybean juice and allowed to dry, then brushed two or three times with distilled persimmon tannin, dried out-of-doors in fine weather, and then given a thorough rub and smoothed with a piece of china. Afterwards pigments are applied with a fine brush to make what are commonly known as 'kaki sarasa' (picture calico). At Saga, on the Amakusas (Kyūshū) and at Sakai (Osaka), the pigment is applied with a stencil instead of a brush. Fabrics dyed by this method are named for their colours or designs, e.g. 'beni', 'kin', or 'ningyō-de' sarasa (red, gold, or doll sarasa) and are used to make kimonos, coverlets, etc. However, since the designs are essentially copies of alien motifs and the shades obtained are pale and not adequately fast, the sarasa technique was never widely used.

Unless otherwise identified, all illustrations reproduced on the preceding pages were supplied by the author.

Dyes and pigments

Traditional Japanese resist-dyeing techniques bear witness to the work of highly specialized craftsmen whose painstaking precision indicates that their skills were developed and refined over a very long period of time. Although the history of Japanese dyeing methods casts considerable light on these techniques, it can only be touched upon briefly in the space available here. Similarly, it is not possible to provide more than a list (below) of the most important natural dyes used by old-time colourists.

In prehistoric times, the inhabitants of Japan no doubt painted their bodies and wore clothing having the natural colour of the fibres. Later on they will have rubbed flowers, ashes, coloured earths and oxides directly into their fabrics to obtain unlevel shades fast to neither wear nor weather. Eventually mainland methods of extracting medicines from herbs probably inspired them to make dyeliquors by soaking and boiling roots, barks or leaves. A resultant mental association between herbs and dye plants may have been the origin of the

Dye plants and dye-woods of Japan

Japanese name	Botanical name	Parts used	Shades obtained
ai	Polygonum tinctorium (Polygonaceae)	stalk and leaves	blue and indigo
yamamomo	Myrica rubra (Myricaceae)	rind and leaves	yellowish-brown khaki
kurumi	Juglans Sieboldiana (Juglandaceae)	bark and leaves	yellowish-brown khaki
kuri	Castanea crenata (Fagaceae)	bark	greyish-brown khaki
kiwada	Phellodendron amurense (Rutaceae)	rind	khaki brown
sharimbai	Raphiolepis umbellata (Rosaceae)	rind	brown
binrōji	Areca catechu (Palmae)	fruit	greyish black
suwō	Caesalpinia sapan (Leguminosae)	heart-wood	red-purple
benibana	Carthamus tinctorius (Compositae)	flower	red
murasaki	Lithospermum officinale (Boraginaceae)	root	purple
akane	Rubia cordifolia (Rubiaceae)	root	red
kūrū	Diosorea rhipogonoides (Dioscoreaceae)	root	red brown
kariyasu	Miscanthus tinctorius (Gramineae)	stalk and leaves	yellow
kobunagusa	Arthraxon ciliaris (Gramineae)	stalk and leaves	yellow
asenyaku	Acacia catechu (Leguminosae)	bark	brown
madami	Machilus thunbergii (Lauraceae)	bark	brown
shii	Pasaniopsis Sieboldii (Fagaceae)	bark	greyish-brown khaki
hannoki	Alnus japonica (Betulaceae)	bark	greyish-brown khaki
yashabushi	Alnus firma (Betulaceae)	nut	khaki brown
hazenoki	Rhus succedanea (Anacardiaceae)	bark	greyish-brown khaki
tangara	Bruguiera gymnorrhiza (Rhizophoraceae)	bark	brown

31

31. (Page 31) Old Japanese stencil-printing workshop: the operations shown are scouring, printing and drying. Woodcut from a series of 24 made by Yoshinobu Kano (1552–1640) and showing Japanese craftsmen at work. R. Buner collection.

32. Sapan-wood (Caesalpinia sapan) came to Japan from India. A decoction made from the rasped heartwood and applied with metal mordants produces yellowish to bluish shades of red on wool, silk and cotton. Copper etching by G. E. Rumphius from 'Herbarium Amboinense', Amsterdam, 1743.

33. Mangrove species (Bruguiera gymnorrhiza) with a bark containing tannin and dye. Decoctions produce various shades of brown. Copper etching by G.E. Rumphius from 'Herbarium Amboinense', Amsterdam, 1743.

belief that certain dyes have protective value. For instance, the smell of indigo was thought to ward off poisonous snakes and red-purple shades obtained with gromwell root (Lithospermum officinale) were held to be a safeguard against consumption.

Later it will have been discovered, possibly by accident, that clothes wetted with lye or dropped into the iron-containing water of rice paddies exhibited better and faster shades. In any case, lye was being used both to degum silk and as a mordant in China by the 5th century, and such techniques will have been copied, directly or in principle, in Japan. Then foreign and indigenous techniques will have been combined and handed down from one generation to the next until, in the course of centuries, there became available a whole arsenal of dyes and application methods.

The earliest known pigments were iron and copper oxides, cinnabar, ochre, soot, and ash; iron oxide and cinnabar have been found on clay figures made in the Yayoi period (220 B.C.–250 A.D.). All these substances were rubbed into fabrics and the shades obtained were known as 'sabi-suri' (rust rub), 'tsuchi-suri' (soil rub), and 'hai-suri' (ash rub). With the exception of soot, none of these colours were fast to rubbing or washing.
A method of fixing pigments on fibres was eventually found in the 12th century, during the Kamakura period. They were mixed with a fine paste made by grinding down soya beans which had been soaked in water overnight. Since then, pigments have been a handy means of colouring clothing, curtain, and other fabrics.

32

Kasuri motif symbolism

33

A symbolic meaning is attached to most traditional Japanese kasuri designs, whether their motifs depict ordinary animals and plants or mythological creatures, deities, etc.

The 'futon'

An excellent example of kasuri symbolism is the 'futon', a kind of thickly padded cotton quilt still widely used in rural areas. The top of such a coverlet is made of four or more panels of cotton kasuri fabric sewn together at the selvedges. Each panel is about 33 cm wide, i.e. the standard width of fabrics woven in Japan. The length of a whole futon is about 165 cm (65 inches).

The futon was once a highly prized part of every bride's trousseau. Enveloped in a traditional 'furoshiki' wrapping cloth, it was carried by the bride's parents to the groom's house prior to the actual wedding as a ceremonial expression of their blessings. Futons thus acquired a very special value. They were, and still are, treasured for generations so that they may bring their successive owners good luck and enduring happiness.

The kasuri designs on futons usually consist of two alternating motifs, one figured and the other purely geometrical. The peasant preference is for traditional motifs reserved in white or the natural colour of the fibre on an indigo blue ground.

The season of the year and even the day of the wedding have a bearing on the choice of a design for a futon. Usually the motifs express the wish for a long and happy life and marriage. They also reveal a strong sense of tradition and are normally easy to identify and interpret. But some motifs have become stylized to such a degree that ordinary people can no longer

appreciate their symbolic import. They can be interpreted only when it proves possible to trace the figures from which they were derived.

Plant motifs

Among the designs very frequently found on futons are those based on the 'pine-bamboo-plum blossom' and the 'crane-and-tortoise' motifs (Fig. 34). The former came from the mainland and is generally known by its Chinese name: 'shō-chiku-bai'. The evergreen pine and bamboo, and the blossoms growing on the naked branches of a plum tree, are symbols of longevity, rectitude and harmony. Together, they are emblems of happiness and good fortune. In stylized form, the pine branches appear as a semi-circular figure, the bamboo as a purely geometrical shape, and the plum blossoms as a five-petalled flower.

Animal motifs

In the old days, the crane ('tsuri') was thought to live 1,000 years and the tortoise ('kame') at least 10,000. The 'crane-and-tortoise' motif thus became a very popular longevity symbol and is found in both natural and stylized form on futons.

In Japan, each year and day and hour has its own distinctive sign of the zodiac, hence year-symbols are often found as kasuri motifs on trousseau futons. An interesting example is the tiger or 'tora', the symbol for the third year of the oriental zodiac. Because the tiger never existed in Japan, it is depicted in ancient Chinese style and assumes quaint and unnatural forms. Regarded as the lord of the animal kingdom, the tiger is a symbol of power. It is frequently depicted together with the bamboo, a symbol of security. But the tiger motif rarely appears on futons. An old belief claims a tiger can make a return journey of 1,000 miles in a single day and, therefore, it may have been felt that the motif was suggestive of an all too speedy return by the bride to her parents' house (Fig. 38).

The lion or 'kara-shishi' appears quite frequently on futons. In Buddhist lore, it plays a role as the guardian of sanctuaries and a protector against evil influences. As the lion is also not an indigenous animal ('kara' = China, 'shishi' = lion), it too takes on rather strange forms in Japanese art. The lion motif sometimes appears together with the peony or 'botan', one of the plants symbolizing the four seasons and itself the emblem of summer. As a combined kasuri motif, lion and peony are a reminder that success and survival are for the most deserving (Fig. 35).

Geometrical motifs

A symbolic meaning is also to be seen in most of the purely geometrical designs found on futons. A particularly interesting figure of this kind is the '88' or 'hachi-jû-hachi' motif.

In the past, birthdays marking attainment of significantly high age were occasions for special rejoicing; the 'ga-no-iwai' or 'long-life celebration' is a tradition with roots deep in history. During the Nara period (645–793 A.D.), the 'ga-no-iwai' was celebrated on 40th, 50th, 60th, 70th and 80th birthdays, additional festivities marking the 42nd, 61st, 77th and 88th birthdays being introduced in the Muromachi period (1338–1573 A.D.).

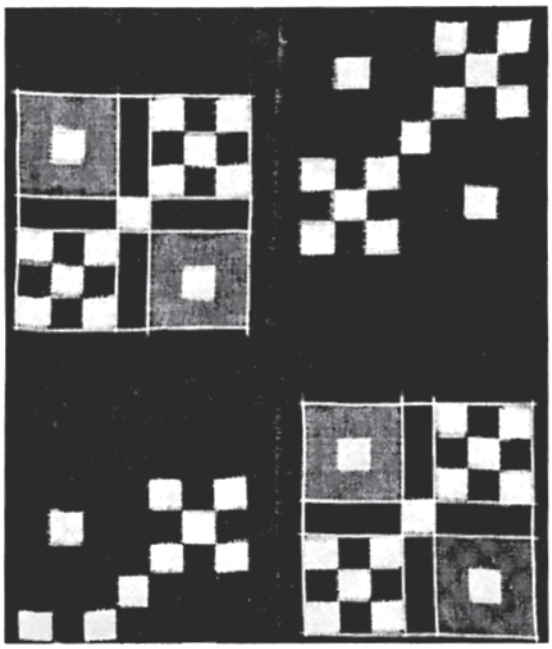
An 88th birthday is an extremely important event in Japanese family life. It is known as the 'bei-ju-no-iwai' or 'rice long-life feast' be-

34. The 'pine-bamboo-plum blossom' motif coupled with the crane and tortoise motifs symbolizes happiness and well-being. Section of figured kasuri design from a cotton coverlet ('futon').

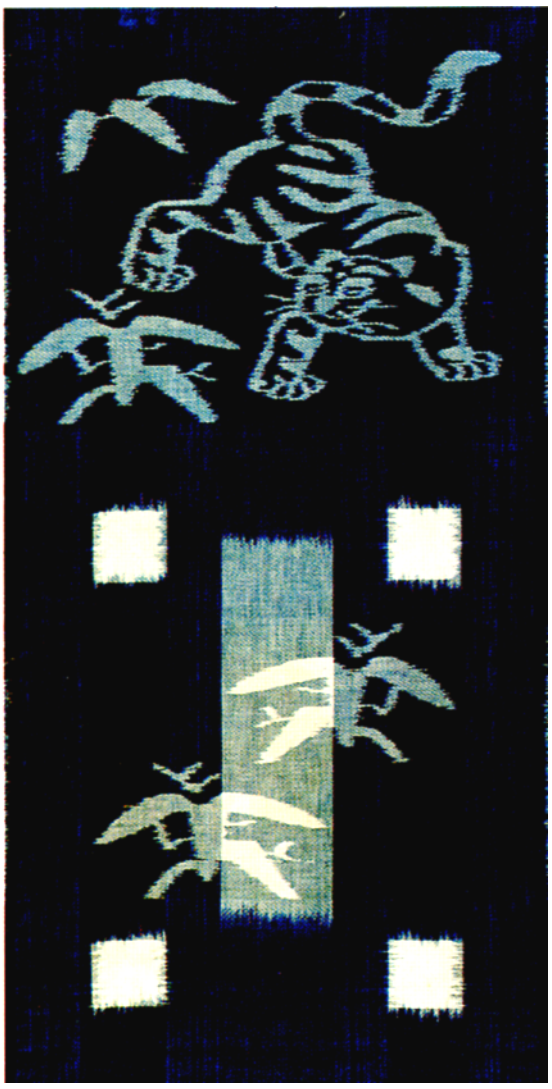
36. Geometrical kasuri design based on motifs derived from Japanese characters and produced by tie-dyeing both the warp and the weft yarns. Section of a cotton coverlet.

35. For Buddhists, the lion is a guardian of sacred sites and protector against evil influences. Combined with the peony in a kasuri design on a cotton coverlet, it makes a motif symbolizing the survival of the most deserving.

37. A 'mon' in the heraldic style. It is a good luck symbol based on the 'three-commas' motif and a written character. Weft kasuri design on a cotton coverlet.



38. Tiger and bamboo together are a symbol of security. Section of figured kasuri design from a cotton coverlet.



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cause the written characters for '88' can be grouped to resemble the ideograph for the word rice, i.e. 'kome' (or 'bei' in Sino-Japanese). In rural districts, it is still the custom on such occasions for the person celebrating his 88th birthday to make an imprint of his hands in black on a piece of paper. This is hung over the entrance to the house in such a way that the hands appear to touch the foreheads of those who come in to participate in the ceremonies.

In agriculture, the symbolic 88 appears in the form of the 'hachi-jû-hachi-ya' or '88th night', the day on which spring sowing traditionally begins. It is the 88th day from the beginning of the coldest season or 'kan', as reckoned by the lunar calendar still used by Japanese farmers.

The 'hachi-jū-hachi' motif is thus yet another longevity symbol. Known also as the rice or 'kome' motif, it appears frequently in many simple or intricate forms on futons and other traditional Japanese fabrics.

The ideograph for 'ta', meaning rice paddy, was believed to further happiness when combined with the '88' motif. Hence it was a popular geometrical pattern for futon fabrics, kimonos, etc. In fact, the 'ta' and '88' motifs may even have been the origin of the great variety of purely geometrical patterns which appeared in the second half of the Edo period (1673–1867 A.D.), the heyday of the kasuri technique (Fig. 36).

The 'mon'

A great many kasuri motifs take the form of highly stylized family crests or 'mon'. As written in China, 'mon' means 'design' or 'pat-

CIBA products for the leather and fur industries

Leather production

	Beam house—Liming
®Invadine L, ®Ultravon JL	Highly effective non-ionic wetting and scouring agents when soaking, liming and bating
Fungicide GL Paste	Bactericide in soaking
	Tanning
Fungicide GL Paste	Fungicide when vegetable tanning
	Dyeing
Invadine L, Ultravon JL, Ultravon AL	Wetting, scouring and degreasing agents
®Invaderm A, Invaderm C, Invaderm W	Levelling agents for use with anionic dyes
®Polycor, ®Neolan, ®Cibalan, Acid Leather, Chrome Leather and Basic dyes	for all tannages

39. 'Boy rescued out of the priceless vase', a design based on a Chinese legend and illustrating the narrative character of some kasuri motifs. Cotton picture kasuri fabric from Hirose.

All illustrations on pages 35–37 are reproduced by courtesy of Mr. J. Langewis.

39

tern', but in Sino-Japanese characters it means 'thread-pattern' or 'thread-writing'.

The 'mon' became popular as a design motif on clothing during the Edo period, gradually losing its original heraldic significance in the process. In the end, it became the fashion to adopt new, purely ornamental crests and to decorate with them the whole length and breadth of a garment.

Popular 'mon' of this type were derived from the shapes of plants and flowers, but geometrical figures and even ancient Chinese characters were utilized. For instance, one very popular design was the 'three-comma' motif. Set in a circle (as are most crests) together with the ideograph for the word 'kotobuki' ('jū' = longevity), it was another of the many, many symbols denoting 'luck' and 'happiness' (Fig. 37).

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The CIBA Organization

Japan

ASAHI-CIBA resin factory on-stream

CIBA ®Araldite and Dow group ®DER epoxy resins are now being produced in Japan by the new ASAHI-CIBA K.K. plant at Mizushima, Okayama Prefecture.

ASAHI-CIBA K.K. was set up in June 1966. 50% of the share capital is held by ASAHI-DOW and 25% each by ASAHI Chemical and CIBA. The plant was built on an ASAHI-DOW site in only nine months with the aid of CIBA engineers. The operating personnel have been provided by ASAHI-DOW.

The ASAHI-CIBA production program at present comprises eight types of bisphenol/epichlorohydrin resins which are of particular interest to Japanese consumers. Special epoxy resin types will be produced later on. Present capacity is 4,000 tons per annum, but can be increased to 8,000 tons as soon as the demand warrants. Sales are being handled by CIBA Products Limited, Osaka, and DOW Chemical International Ltd., Tokyo.

Japan is the world's third largest market for epoxy resins. Consumption totalled about 7,500 tons in 1966 and is expected to exceed 9,000 tons in 1967. Until ASAHI-CIBA K.K. went on-stream in mid-October 1967, epoxy resins in Japan were produced exclusively by a joint Mitsubishi-SHELL undertaking, the Mitsubishi Yuka K.K.

United Kingdom

Plug-in TV films system to be launched in Britain

A new audio-visual system which will revolutionize education and TV entertainment, and which will be to film what the long-playing record is to sound, is scheduled to make its debut in Britain in spring 1969. It is called EVR, short for Electronic Video Recording and Reproduction.

EVR is the brainchild of Dr. Peter C. Goldmark, the president of CBS Laboratories and the man who developed the long-playing record. He calls it a "marriage of optics and electronics". Much of the technology originated with research in military reconnaissance photography and moon-rocket TV systems.

An EVR unit consists essentially of a tape-recorder size portable player that connects to a domestic TV set's antenna terminals, and a plastic cartridge of film. The program in the cartridge is played through the TV screen.

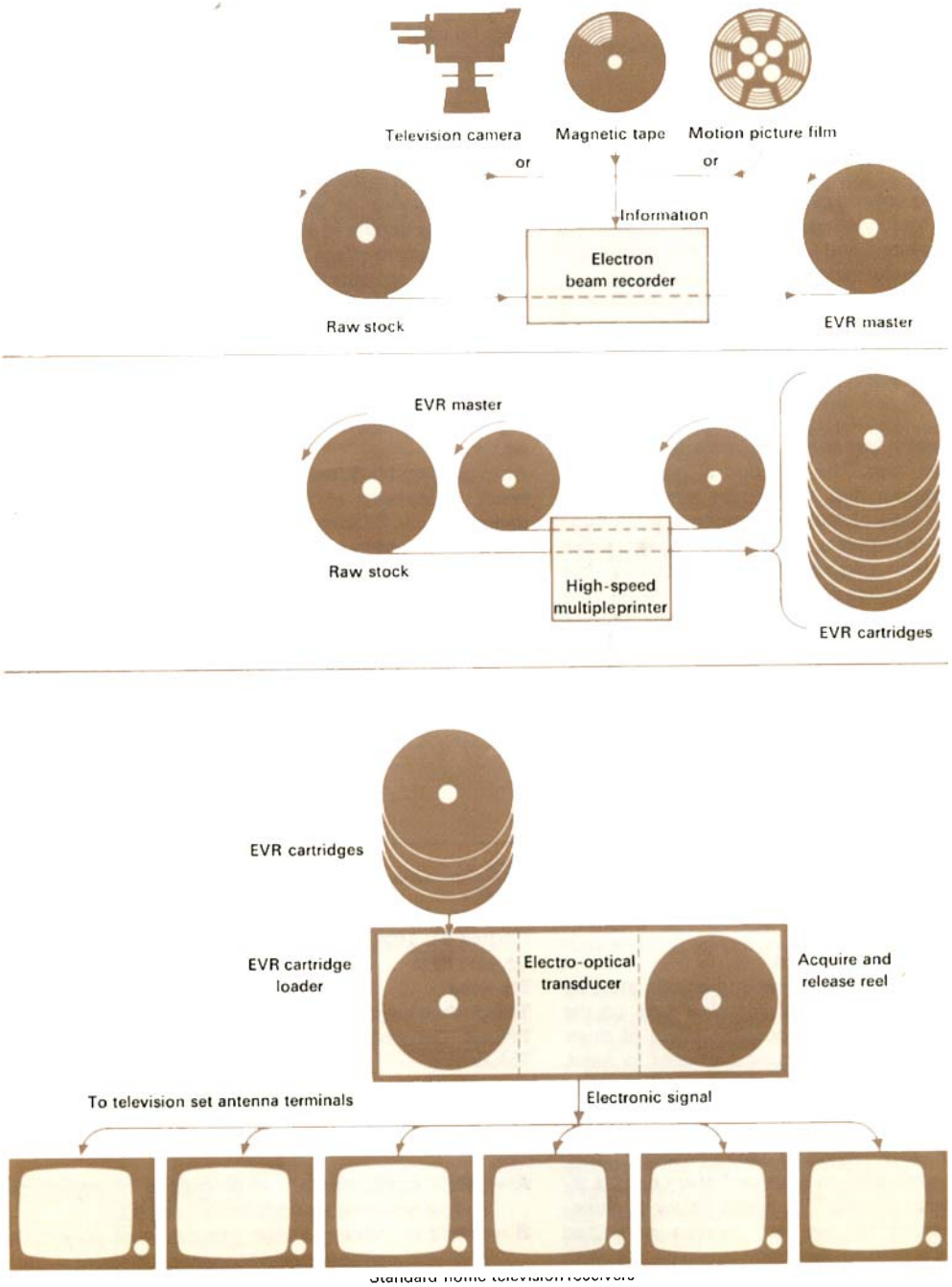
A single cartridge will run for an hour in black-and-white, or 30 minutes in colour. Although it is a disc only 7 inches in diameter and ½ inch thick, a full cartridge holds 750 feet of film. This suffices for 180,000 frames in black-and-white or 90,000 in colour. Since each frame can be stopped for detailed study, whole books could be filmed. 1½ cartridges would probably take care of all 20 volumes of the Encyclopedia Britannica.

EVR will be a boon to schools which want to use TV as a teaching aid but seek independence of educational programs put out by broadcasting services. They will be able to pick their own films, play them when and how they like, and have one man show different films to different classes at one and the same time.

Home viewers will be able to select their own TV fare of light entertainment, general interest and educational films. In the beginning, EVR will cost about £100 ($280) for the player and 50s to £5 (up to $14) for a cartridge. But lending libraries and rental schemes will probably cut these prices appreciably. Eventually, a player could probably be built into a mass-produced TV set for about £25 ($75).

The U.S.A.'s giant Columbia Broadcasting System, Britain's ICI and CIBA Limited have joined forces to develop, make and market the EVR system. Ilford Limited, the British photographic materials manufacturer owned by ICI and CIBA, will make special unperforated EVR film and cartridges at a plant now under construction. Cartridge production is expected to exceed one million per annum by 1971.

Initial full-scale application of EVR will be in Britain, where it will first be available as a teaching aid for use in schools and universities. Players and cartridges are to be marketed in spring 1969. Colour films will be introduced when the demand for colour TV increases. In the U.S.A., initial efforts to sell the system will be concentrated in the educational and audio-visual fields rather than the home entertainment market. But CBS's Columbia Record Club with its two million members is a ready-made marketing organization. By the mid-1970s, the average TV set owner should have his own private library of favourite films.


Television camera
Magnetic tape
Motion picture film
or
or
Information
Electron
beam recorder
Raw stock
EVR master
EVR master
Raw stock
High-speed
multiplepr inter
EVR cartridges
EVR cartridges
EVR cartridge
loader
Electro-optical
transducer
Acquire and
release reel
To television set antenna terminals
Electronic signal

Modern Trends in Printing, Dyeing, and Finishing

CIBA's registered trade-marks are given an ®. — Certain products named in this issue may not be available in your country for a variety of local reasons. For particulars, please inquire of the nearest Sales Office or Representative

Printing triacetate/polyamide blend fabrics

General

An ever increasing volume of triacetate/polyamide blend fabrics is going into printing. AMCEL are promoting a number of fibre blends and Courtaulds have introduced a novel triacetate/polyamide 6 bi-component fibre.

Blends of this kind are used primarily in the manufacture of ladies' apparel. The main arguments in their favour are easy-care properties and the greater durability of polyamide-reinforced triacetate.

Suitable dyes

Triacetate/polyamide blends are dyed with disperse, acid, or metal-complex dyes. The selection of disperse dyes available is adequate, but the shades obtained with most of them on the polyamide component exhibit unsatisfactory wet-fastnesses. Better fastness properties can be obtained with acid and metal-complex dyes, but these necessitate the use of more complicated printing methods and it is not easy to match certain shades, e.g. turquoise blues.

®Cibacet dyes

The standard recipe using ®Albatex BD, ®Ultravon JU, thickening and water is employed when printing with disperse dyes. The dyes are fixed by pressure steaming (15–22 psi/1–1.5 kg/cm²). If only low pressure steam is available, a swelling agent should be added to the print paste as in the case of 100% triacetate fabrics. Disperse dyes have the advantage that the shades they produce are largely unaffected by the proportions in which blend components are mixed.

Acid and metal-complex dyes

As with the ®Triacid process, swelling agents must be employed to fix acid and metal-complex dyes on the triacetate component. But the possible effect of these on the polyamide component must be borne in mind. Depending on the type and amount of swelling agent used, the type and proportion of polyamide in the blend, and the construction of the woven or knitted fabric, pronounced shrinking may occur during fixation.

A single recipe applicable in each and every case is almost impossible to devise. That given below is particularly recommended for use with woven or knitted fabrics showing a marked tendency to shrink, i.e. with those containing a high proportion of polyamide. It may also be used for fabrics containing little polyamide. The swelling agents in it are thiourea and Glyecin PFD[1]. It does not give optimum yield. A higher yield could be obtained by using more Glyecin PFD, but even a slight increase results in pronounced flushing, especially on smooth fabrics. A second recipe using phenyl "Cellosolve" instead of Glyecin PFD was therefore devised for use with blends on which the first does not produce satisfactory depths of shade. Phenyl "Cellosolve" has a greater swelling effect than Glyecin PFD and shows no tendency to promote flushing. Note, however, that both recipes are intended merely to provide guidance in devising other recipes adapted to available mill facilities.

The dye is usually fixed by steaming at 7 psi (0.5 kg/cm²), but steaming without pressure may suffice with some higher quality fabrics. Preliminary tests are recommended.

As in printing 100% polyamide fabrics, washing-off may result in staining of the grounds. To eliminate this danger, apply ®Cibatex PA in a pretreatment[2] or as a rinsing bath additive. Cibatex PA may also be employed to aftertreat prints and improve the wet-fastness on the polyamide component.

Table 1. Combination print recipes

The recipe used should be adapted to suit the construction of the fabric and the blend ratio.

		Disperse dyes	Acid and metal-complex dyes	
			A	B
Dye	g	x	x	x
Water	g	y	y	y
Ultravon JU	g	10	–	–
Albatex BD 10%	g	50	–	–
Glyecin PFD	g	50	–	50–100
Thiourea	g	–	80	50
Thiodiethylene glycol	g	–	30	–
Phenyl "Cellosolve"	g	–	50	–
Thickening[3]	g	550	550	550
		1 kg	1 kg	1 kg

A = Fabric containing a low proportion of polyamide and/or showing little tendency to shrink

B = Fabric containing a high proportion of polyamide and/or showing a marked tendency to shrink

Fixing and washing-off
Dyes are fixed by steaming for 20 minutes at atmospheric pressure or 7 psi (0.5 kg/cm²), depending on the quality of the fabric. After a cold rinse, the goods are washed off at 50–60° C with 1–2 g/l ®Ultravon AN and 2 g/l ammonia.
If there is danger of staining the white ground, 2 g/l Cibatex PA are added to the first rinsing bath (set at pH 3–3.5 with formic acid) or the goods are pretreated with 2% Cibatex PA for 30 minutes at 80° C. If the wet-fastness properties are unsatisfactory, aftertreat the goods with 2% Cibatex PA for 30 minutes at 60–70° C (pH set at 4 with formic acid).

Table 2. Suitable acid and metal-complex dyes

®Cibalan Brilliant Yellow 3GL conc. D
®Kiton Fast Yellow G
Benzyl Fast Yellow RLE
®Avilon Fast Golden Yellow 2R
Cibalan Orange RL
Cibalan Scarlet GL
®Tectilon Red 3B
Avilon Fast Red 3B
Avilon Fast Red 6B
Cibalan Red Brown RL
Avilon Fast Red Brown R-W[4]
Avilon Fast Violet B
Avilon Fast Violet 3B
Cibalan Brilliant Blue RL conc. D
Cibalan Navy Blue RL
Avilon Fast Navy Blue R
Avilon Fast Navy Blue B-W
Avilon Fast Olive G-W
Avilon Fast Black B

Table 3. Suitable Cibacet dyes

Cibacet Yellow 2GC	Md Gran.
Cibacet Orange 3RL	Md Gran.
Cibacet Orange 5RL	Md Gran.

G. Kögel
Technical Service and Development Department

[1] Registered trademark of Badische Anilin- und Sodafabrik AG, Ludwigshafen, West Germany.
[2] Patent applied for.
[3] Locust bean flour derivative.
[4] Needs an addition of 100 g/kg Glycin PFD.

Printing with ®Lanasol dyes on animal fibres

1. General

Methods and dyes which produced fast prints on cellulosic fibres were evolved comparatively early, but it took very long to develop means of obtaining comparable results on animal fibres.
On these, prints with good all-round fastnesses have been obtainable since the introduction of 1:1 and 1:2 metal-complex dyes, and with the older mordant and chrome dyes. However, none of these dyes produced shades of satisfactory brightness.
Prior to the advent of reactive dyes, bright shades could be produced only by using acid dyes. This meant lower all-round standards of fastness.
The ®Cibalan Brilliant brands were the first dyes that produced bright shades with good fastness properties on animal fibres.
The Cibalan Brilliant brands are not conventional metal-complex dyes for wool and silk; they are reactive dyes that form a chemical bond with the fibre. They were followed by the ®Cibacron brands, which are also very suitable for the printing of wool, wool unions, and silk. The latest development in this direction are the recently introduced *Lanasol dyes*.

Lanasol dyes combine the positive properties of all the dye classes previously used. Their most notable features are the production of very bright shades and very good fastness to light and wet treatments.
Lanasol dyes represent a great advance in the printing of animal fibres.
The dyes in the Lanasol range have a highly reactive group which differs in its constitution from that of previously known reactive dyes. They are suitable for dyeing wool and for printing wool and silk. Lanasol dyes have the following outstanding properties:

- High yield and bright shades
- Very good fastness to light and wet treatments, even in very pale shades
- Washing off prints involves no risk of staining white grounds

With Lanasol dyes, very deep and bright shades can be produced on both chlorinated and unchlorinated wool and on silk. Conventional acid and metal-complex dyes also produce bright shades, but these frequently fail to meet other modern requirements. In particular, they are not adequately fast to washing.

Prints obtained with Lanasol brands are fast to repeated washing, even at temperatures in excess of 80° C (175° F). This means that wool fabrics dyed to full shades can be subjected to severe household and machine laundering, providing that the fabric itself will withstand this kind of treatment. Goods made of chlorinated, i.e. shrink-resisted, wool usually have the required stability.
Lanasol shades are also very fast to perspiration.

Aftertreatment of the prints is particularly important when working with Lanasol brands as a small residue of incompletely fixed dye is still present on the fibre when printing has been completed. To produce very deep shades with optimum fastness properties, the unfixed dye must be removed by giving the goods a cold rinse and then aftertreating them at 80° C (175° F) in an ammoniacal bath to which ®Cibaphasol C has been added. The bath should on no account be heated to more than 80° C.

2. Procedure

2.1. Printing chlorinated and unchlorinated wool
Different recipes are used when printing wool and silk. For both chlorinated and unchlorinated wool, CIBA recommend adding acetic acid and Cibaphasol AS to the print paste.
Prints tend to be skittery on unchlorinated wool, but the shades produced by Lanasol dyes are remarkable: they are virtually as deep and level as those obtained on chlorinated wool.
If the dye affinity of the fibres in a woollen fabric varies greatly, it is advisable to add 15–20 g/l ®Albegal A to the print paste to ensure level shades.
In the case of unchlorinated wool, an ammoniacal aftertreatment at 80° C may lead to more or less pronounced felting, depending on the material itself and the amount of mechanical action to which it is subjected. CIBA therefore recommend, with reservations only, the printing of unchlorinated wool with Lanasol dyes.

Recipe	Print paste	Reduction paste
Lanasol dye	20 g	–
Urea	100 g	50 g
Thiodiethylene glycol	100 g	50 g
Albatex BD	10 g	5 g
Water	210–190 g	315–305 g
Thickening	500 g	550 g
Cibaphasol AS	10–30 g	5–15 g
Acetic acid 40%	50 g	25 g
	1 kg	1 kg

Adding Cibaphasol AS helps to ensure production of level shades. The amount employed will depend on the wool fabric being printed. Since the use of Cibaphasol AS results in foaming during printing, CIBA recommend the addition of a foam inhibitor to the print paste.

2.2. Printing silk
When printing silk, complete fixation of Lanasol dyes is possible only in the presence of alkali. As with Cibacron dyes, the best alkali to use is sodium bicarbonate.

Recipe	Print paste	Reduction paste
Lanasol dye	30 g	–
Albegal B	50 g	25 g
Thiodiethylene glycol	100 g	50 g
Albatex BD	10 g	5 g
Water	245 g	310 g
Thickening	550 g	600 g
Sodium bicarbonate	15 g	10 g
	1 kg	1 kg

The print paste usually can be prepared simply by strewing in the Lanasol dye. However, when printing silk with Lanasol Orange G, it is advisable to eliminate the risk of producing specky prints by first dissolving the dye at the boil.

2.3. Outline printing
Cibalan Black BGL conc. D has proved to be very suitable for producing satisfactory black outline prints. The same recipe can be used for wool and silk.

Print paste	
Cibalan Black BGL conc. D	30 g
Urea	100 g
Thiodiethylene glycol	100 g
Water	190 g
Thickening	500 g
Cibaphasol AS	30 g
Acetic acid 40%*	50 g
	1 kg

* 40 g/kg ammonium sulphate cryst. may be used instead of acetic acid.

2.4. Thickeners

With woll and silk the choice of thickeners is subject to certain limitations. The best appear to be locust bean flour derivatives such as Thickening 301 extra[1], Polyprint S-145[2], etc. Crystal gum is also suitable but gives silk a slightly harsh handle.

Sodium alginate can be used only for printing silk.

2.5. Fixation

Lanasol dyes are fixed by steaming the prints for 15–20 minutes in a continuous or star steamer with saturated steam (102–103° C = 216–217° F). Prolonged steaming has no effect on shade or fastness properties.

2.6. Washing-off and finishing

To obtain optimum fastness properties, the prints must first be rinsed in cold, preferably overflowing water, and then washed off at a temperature of at least 80° C (175° F) in a bath containing 2 cc/l ammonia conc. and 1 g/l Ultravon AN. The prints are then lightly soaped at 50–60° C (120–140° F) with 2 g/l Ultravon JU and finished off.

2.7. Mixing and combining dyes

All Lanasol dyes may be used straight or mixed in any proportion with one another.

Their combination with acid and metal-complex dyes is possible in principle. But it is not recommended because Lanasol prints require an ammoniacal washing-off aftertreatment at 80° C.

* Chem. Fabrik Grünau, Illertissen, Bavaria, West Germany
* Polygal AG, Märstetten, Switzerland

Unlike acid and metal complex dyes, most Cibacron dyes can be given an ammoniacal aftertreatment at high temperatures. They can therefore be used in combination with Lanasol dyes on wool and silk without loss of fastness properties.

The Lanasol range at present includes the following brands:

Lanasol Yellow 4G
Lanasol Orange G
Lanasol Scarlet 2R
Lanasol Red B
Lanasol Red 5B
Lanasol Blue 3R

As the range includes no turquoise blue, CIBA recommend the use of Cibacron Turquoise Blue FGF-P and ®Cibacrolan Blue 8G. When printing wool, Cibacrolan Blue 8G paste may be prepared by using the Lanasol recipe. This dye is, however, very sensitive to steam Variations in steaming conditions therefore may result in inadequate fixation. A good safeguard against such incomplete fixation is prolonged steaming.

F. Talamona
Technical Service and Development Department

Initial dyebath alkalinity*

Can salt and alkali be added to the liquor when commencing dyeing with ®Cibacron dyes? In the case of certain reactive dyes, instructions stipulate adding the alkali required for fixation to the bath when dyeing begins.
This method is recommended only when an optimum yield is otherwise unattainable or when optimum exhaustion of the dyebath must be accompanied by simultaneous fixation of the dye. This means that the exhaustion of the dyes employed cannot be controlled. Thus there is a greater risk of producing unlevel dyeings, since the dye is fixed wherever it is deposited and there is no subsequent migration of the dye through the substrate.
If the dyeing procedure involves clearly separate exhaustion and fixing phases, as is the case with Cibacron dyes, the dyes have sufficient time (at least 30–40 minutes) to migrate evenly throughout the substrate before fixation occurs.
However, since Cibacron dyes react comparatively slowly with the substrate, *all the alkali required can be added to the dyebath when dyeing is commenced* whenever this should prove necessary.
In such cases, dyeing must be begun at a temperature of 25–30° C (75–85° F). Moreover, the dyes employed must be adequately soluble in a cold bath in the presence of salt. Most Cibacron dyes meet these requirements. Note, however, that the shade produced will vary to a greater or lesser degree depending on the speed at which the temperature of the bath is raised to fixation level. This makes shade reproduction difficult.

M. Haelters
Technical Service and Development Department

Jig dyeing with ®Cibacron dyes*

When jig dyeing with Cibacron dyes, difficulties have been experienced in obtaining dyeings which are level across the piece. This is because temperature variation between the centre and the ends of the batching roller cannot be avoided during fixation. Enclosed jigs give better results, but do not guarantee levelness in all cases. The advantages gained by using a hood are virtually lost owing to the constant opening and shutting necessitated by the addition of dyeing auxiliaries. Attempts have been made to reduce or eliminate all sensitivity to temperature variations by adding alkalis in greater or lesser amounts and in various combinations.

The tests made indicate that the risk of unlevelness can be minimized by fixing with

10 g/l trisodium phosphate cryst.
+ 10 cc/l caustic soda solution 66° Tw (36° Bé)
or
10 g/l soda ash
+ 10 cc/l caustic soda solution 66° Tw (36° Bé)

for 50–60 minutes at 70–80° C/160–175° F (90–95° C/195–203° F for turquoise blue brands). In many cases, a somewhat better yield may be obtained.
This new recipe is valid for both cotton and regenerated cellulosic fibres. Note, however, that *the stated amounts of alkali should be used only with liquor ratios up to 5:1*—but longer liquors are not generally used in jig dyeing anyway. With longer liquor ratios, there is always the danger of increased hydrolysis of the dye and consequent loss in colour yield.
The new dye fixing recipe may, of course, also be used with the pad-jig method.

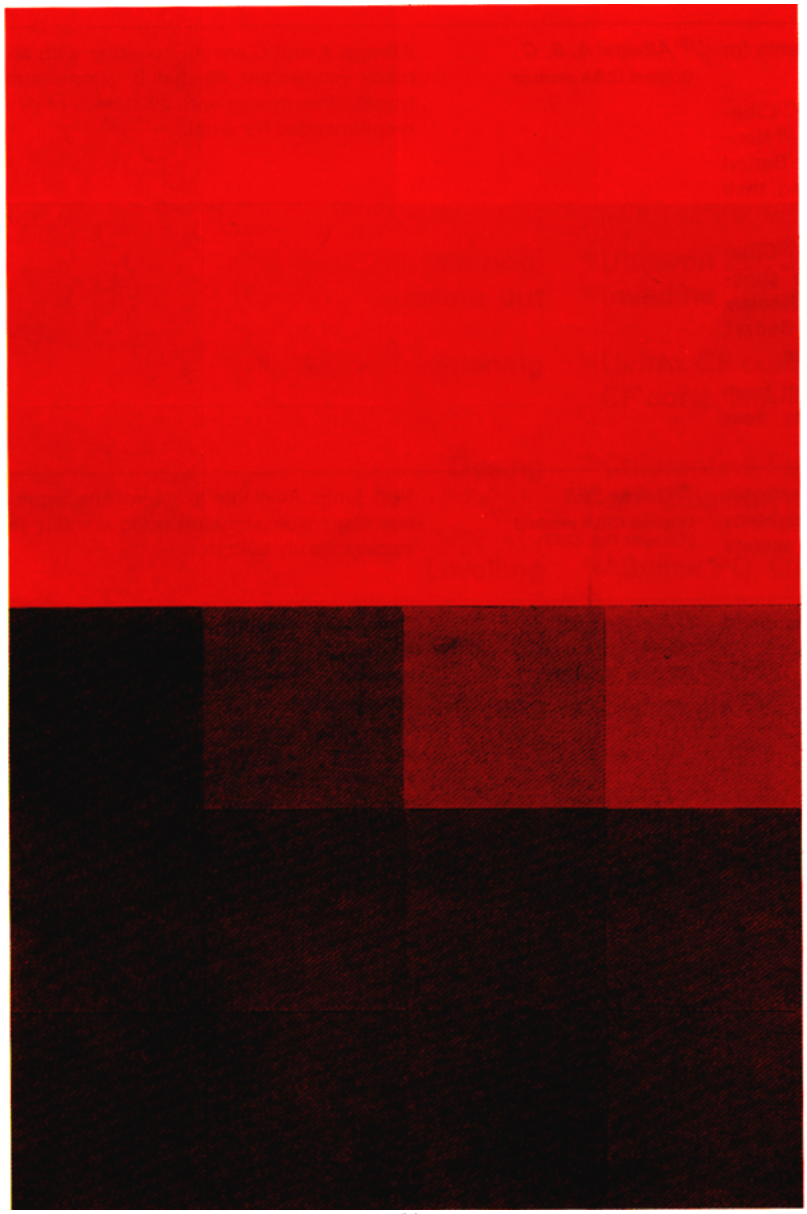
M. Haelters
Technical Service and Development Department

* From: M. Haelters, "10 Jahre Praxiserfahrung mit Cibacron-Farbstoffen im Ausziehverfahren", Melliand, *48*/1967, 2. pp. 191–199 and 3. pp. 314–321.

The effects of varying amounts of alkali on levelness (p. 44, righthand column).

3% Cibacron Scarlet 2G-E

80° C (175°F) 70° C (160°F) 60° C (140°F) 50° C (120°F) Dyeing temperature



15 g/l soda ash +
2 cc/l caustic soda solution 66° Tw (36° Bé)

10 g/l soda ash +
10 cc/l caustic soda solution 66° Tw (36° Bé)

10 g/l trisodium phosphate cryst. +
10 cc/l caustic soda solution 66° Tw (36° Bé)

15 g/l soda ash +
2 cc/l caustic soda solution 66° Tw (36° Bé)

10 g/l soda ash +
10 cc/l caustic soda solution 66° Tw (36° Bé)

10 g/l trisodium phosphate cryst. +
10 cc/l caustic soda solution 66° Tw (36° Bé)

80° C 70° C 60° C 50° C Dyeing temperature

3% Cibacron Red Brown G-E

New CIBA Products

Main application	*Name*	*Remarks*
A balanced system of levelling agents for wool dyes. Albegal A: Dyeing with ®Cibalan, ®Cibalan Brilliant, ®Lanacron, chrome, ®Neolan, ®Kiton, ®Kiton Fast, Benzyl, Benzyl Fast, and Alizarine Fast dyes, and their mixtures. Albegal B: Dyeing with ®Lanasol, ®Cibacron, and ®Cibacrolan, and the application at 80°C/175°F of Lanasol, Neolan, chrome, ®Kiton, ®Kiton Fast, Benzyl, Benzyl Fast, and Alizarine Fast dyes. Albegal C: Strong de-aerating and foam suppressant action. Functions as does Albegal A.	®*Albegal A, B, C* Original CIBA product	Albegal A and C ensure, together with already established Albegal B, simple and trouble-free dyeing with all classes of dye recommended for wool.
Optical brightener for use in cationic *rinse softening agents*. Markedly brightens polyamide, cellulosic, polyester, acetate and triacetate fibres.	®*Uvitex SEB* Original CIBA product (Circular No. 2247)	Non-ionic. Available as micro-fine, aqueous dispersion showing good stability in storage. Easily built in.
Fine, porous coatings for rainwear made of cellulosic/synthetic fibre blends.	®*Dicrylan RP* Original CIBA product (Circular No. 2248)	Reactive copolymer available in aqueous dispersion, and applicable from aqueous emulsion. Good stability of coating pastes. Simple addition of fillers and pigments. Very adhesive coatings. Soft, dry handle showing no tendency to harden. Good pigment binding. Very good stability to washing and drycleaning. Excellent stability to temperature variations.

Errors and omissions

Owing to an oversight, the caption to Figure 36 in CIBA Review 1967/3 ("Oil from the Earth") failed to mention that this photograph was put at our disposal by AGRAR, Wil, Switzerland.

A CIBA product for every dyeing, printing, and finishing process!

Cotton and viscose knitted underwear

Pretreatment, desizing, boiling-out	®Ultravon JU, JF, and W ®Invadine JFC conc.
Bleaching, optical brightening	®Uvitex CF conc. New, and CF conc. Liquid
Dyeing	®Chlorantine Fast, ®Coprantine or ®Cibacron dyes
Levelling	®Albatex PO, OR
Improving wet-fastness	®Lyofix EW
Softening	®Sapamine OC, NP, WL, FL