

nature of the pile due to the difference in the quality of fibre which is here the chief feature.

Cheviot tweeds are not usually raised, the object of the finishing being to retain the natural features of the wool or raw material, but certain styles of fabrics made from Cheviot or Crossbred wools are raised for a special finish, as in rugs, and medium and coarse qualities of blankets. In the Irish frieze there may not be actual raising, but in felting a nap is formed, having some of the qualities of a raised texture. Dry raising is not usual in

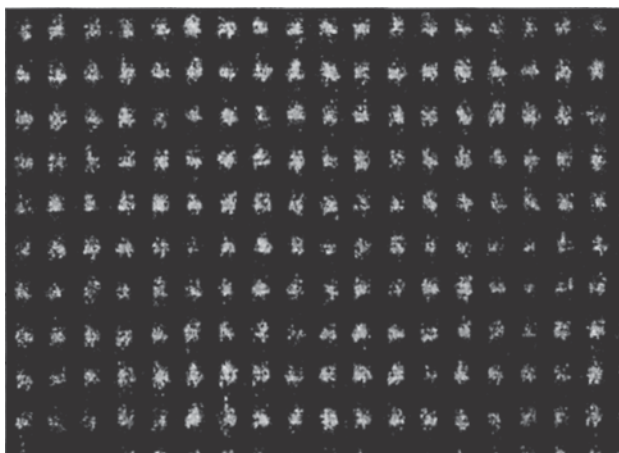


FIG. 92.

the finer Cheviots, but when a Cheviot cloth approaching a Saxony in appearance is wanted, such may be milled, raised and cut clear.

Saxony cloths undergo more diversified routine than is possible in fabrics made of Cheviot and Crossbred wools. In some instances, raising is done to produce a clear surface, but in other cloths, to give, in different degrees, a soft and full fibrous pile. This pile may be developed on both sides of the cloth, as in travelling and carriage rugs, or it may be simply a quality of the face of the cloth, or, if a compound fabric, of the back of the cloth with the face clear in weave, colour and pattern.

Fabrics of the Saxony type may be classified as to raising as below:—

- (1) Cloths with a pile of fibre on both sides.
- (2) Cloths with a soft finish.
- (3) Cloths with a soft fibrous lustre or dress-face finish.
- (4) Cloths in which the face is a clear finish, and the back of the fabric raised.

The nature of the finish is determined by (*a*) the make of the fabric; (*b*) the materials used; and (*c*) the application of the fabric.

The first class includes blankets, rugs, shawls, travelling mauds, golf cloakings and fabrics which may require to be finished on both sides, the object being to get the greatest possible fulness of handle. By raising damp, a vertical pile is formed which is made fuller by treating the pieces on the "beating" frame. The distinctive feature of this raised surface is, that it is not readily damaged or marked by moisture.

The second kind of raising, which gives a soft texture, may be defined as semi dress-face, and is adapted to light-weight suitings, costume and dress fabrics. Such fabrics are slightly or moderately milled. The finish applied is chiefly due to damp or moist raising. If the colours in the fabric are not bright and fast to milling, and the pattern of a simple stripe or check character, the fibrous condition is fixed, and the brightness of colour improved by blowing the cloths with steam. It is not desirable to practice boiling with thin fabrics of delicate colours, as by effective raising and steaming, a sufficient "face" may be obtained.

In the third class of Saxonies, the most heavily raised fabrics are comprised, namely, superfine plain cloths, billiard cloths, doeskins and beavers. As shown, the raising routine here is of a diversified nature, and modified as to the quality of the material, structure of the fabric, and lustrous quality of the finish which has to be acquired.

The Saxony textures mentioned are raised moist or wet to give fulness of pile and softness of handle, but in the fourth class, raising is done either damp or dry, to accentuate the distinctive elements of the pattern, and face of the fabric.

(82) *Raising and Weave Structure.*

The several types of woven surfaces, such as warp, weft, and warp and weft equal, and the manner in which they are affected by raising, have been defined; but weave and fabric structure may be varied in each of these three principal types. Some analyses may be made of these textures, illustrated in Figs. 93 to 96, as they behave in the raising process. Fig. 93 is an ordinary sateen, with the twill in the reverse direction to the twine in the yarn, giving a venetian pattern, having four-fifths

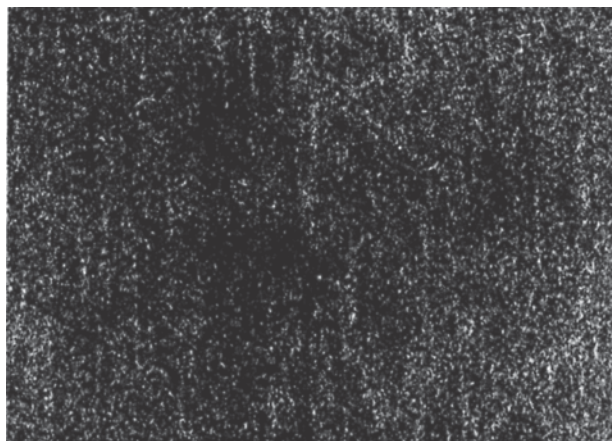


FIG. 93.

warp to one-fifth weft on the face, so that the raising is chiefly on the warp and has little or no effect on the weft. The fabric has a soft, fibrous quality, the twill effect being scarcely visible. Raising is on the length of the thread, giving a straight draw of fibres.

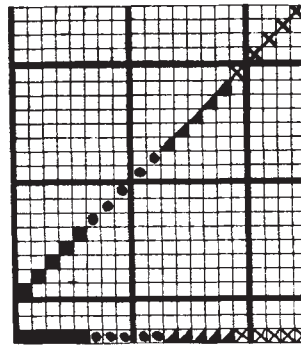
Figs. 94, 95 and 96 are illustrative of compound weave surfaces: first, of fabrics with a warp face and weft face alternately; second, of fabrics with a warp face in the ground portions and weft cord for striping; third, of check patterns developed in weft cord with  $\frac{2}{2}$  twill backed in the weft for ground. The particulars of manufacture of these cloths are as follows:—



FIG. 94.



PLAN 94A.



	A	B	C	D
→	20	10	5	10
	10	20	10	5
	5	10	20	10
	10	5	10	20

PLAN 94B.—Healding draft.



Fig. 93 (Plan : 5-end sateen) and Fig. 94 (Plan 94A).

*Warp and Weft* : 20 skns. Saxony, 10's reed 4's, 40 picks per inch.

Set 72 inches wide in the reed for 56 inches finished.

Fig. 95 (Plan 95A) and Fig. 96 (Plan 96A).

*Warp and Weft* : 30 skns. Saxony, 12's reed 4's, 80 picks per inch.

Set 72 inches wide in the reed for 54 inches finished.

The block check, Fig. 94 (Plan 94A, Healding Draft 94B), is composed of warp and weft face weaves, so that raising is on the length of the thread in the warp, and across the thread in the weft. This pattern is an example of one of the principles of raising, namely, that a smoother pile is obtained by raising on the length of the thread, and a rougher pile by raising across the thread. Warp and weft face weaves, such as are here combined, are used in designs for costumes, mantles and vestings, the spotting or figuring developed in weft having a different appearance, as a result of raising, from the warp ground. Not only warp and weft sateens, but warp and weft twills are used for a similar purpose.

Cord weaves of the weft type, Fig. 95 (Plan 95A, Healding Draft 95B), have other textural qualities when considered in relation to raising. In Fig. 95, the cords run lengthways of the piece, a solid weft surface being in contrast with a warp twill, the yarns in both being of a similar quality, and the raising contact in the direction of the warp. The cord sections form a special feature in raising. Should the raising be across the fabric, the fibres of the weft cord would be trailed over the edges of the stripes of warp effect, but by raising lengthways, the fibre in the weft forming the cords is got up, and the piping or cord lines remain clear at the edges though softened in appearance.

Raising across the weft when the cords are in a line with the weft has a very different effect, as shown in Fig. 96 ; the action of the raising points on the lines A and B in the warp is similar, but on lines C and D the fibres are drawn over a portion of the

weft twill. Clearly, the cords running warp ways are as fibrous, after raising, as those across the fabric, but the teazles moving

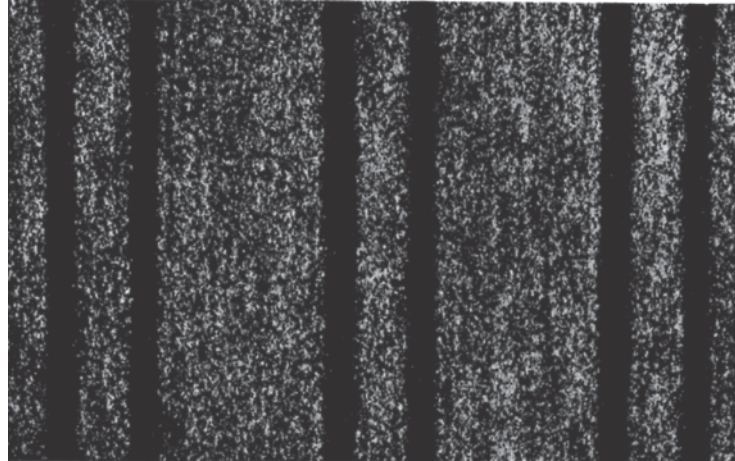
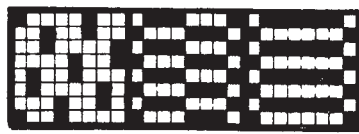
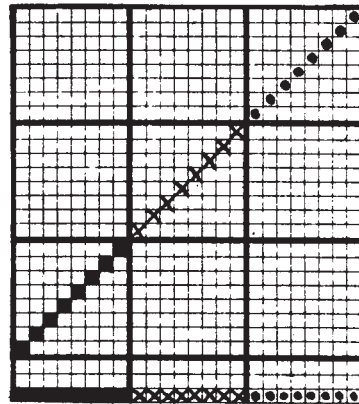


FIG. 95.



A B C  
PLAN 95A.



→	A	B	C
	48	8	—
	16	—	8

PLAN 95B.—Healding draft.

in the line of the cords, simply straighten the fibres in the same way, whereas in cord C, similar to A, but across the fabric, the fibres are more disturbed, being combed beyond the actual woven dimensions of the cord.

(83) *Quality of the Fibre and Yarn Structure.*

Examples may now be considered in which mohair yarn is used in certain sections of the pattern, illustrated in Figs. 97 and 98, with similar counts of ground yarn and the same setting as in Figs. 95 and 96. In the first of these examples, the weft is one pick Saxony and one pick of 12's mohair. The felting is similar to that of Fig. 95, and, on leaving the loom, the mohair cords in the fabric have an ordinary plain surface.

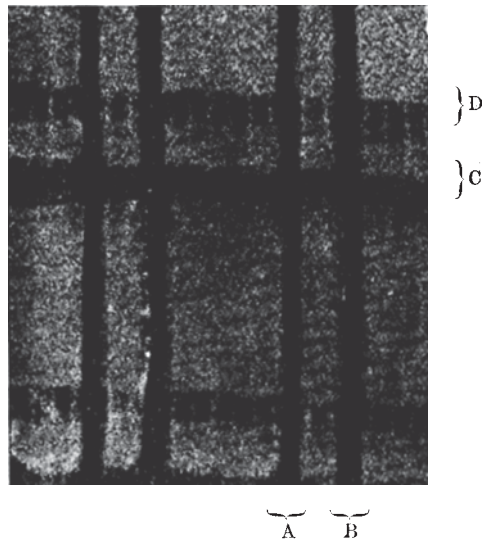
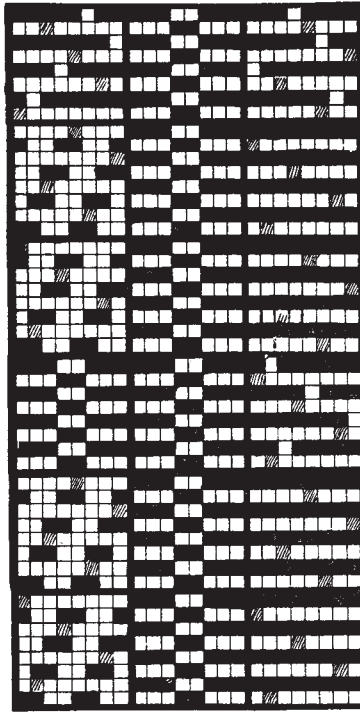


FIG. 96.

The difference between Figs. 95 and 97 is due entirely to changing the weft yarn forming the cord. This long-fibred lustrous material is of less felting property than the Saxony yarn, so that, in milling, it curls or loops. Raising follows, and if this is done when the cloth is in a damp condition, the wavy effect and the irregular shagginess of fibre are produced, observed in Fig. 97.

The quality of the mohair as a raising material is equally distinctive in Fig. 98 (Plan 98A, Healding Draft 95B). This, as

will be seen, is a backed  $\frac{1}{2}$ - $\frac{1}{2}$  twill, with every 16th pick floating over eight threads in Sections A and B, bringing the mohair, which in other portions is on the back of the fabric, on to the face. It forms a mere spot on the dark line due to using dark warp threads in this section of the pattern. Raising draws the mohair fibre over this line, and produces an appearance of short tufts of fibre inserted into the fabric after weaving.



PLAN 96A.

It has been shown by the specimens referred to in Figs. 95 and 97, that the nature of the fibre used in the manufacture of the yarn results in distinct raised effects, though the fabric structure may remain the same.

Research has been made to further illustrate raising on this kind of material; and fabrics have been specially designed, the

weft forming the face only, and composed of Cheviot and mohair, Saxony and mohair, and Cheviot, Saxony and mohair yarns. These materials were woven in stripe and check form. Raising was done, first, on the length of the thread, and second, across the thread, and with the fabrics in dry and moist conditions.

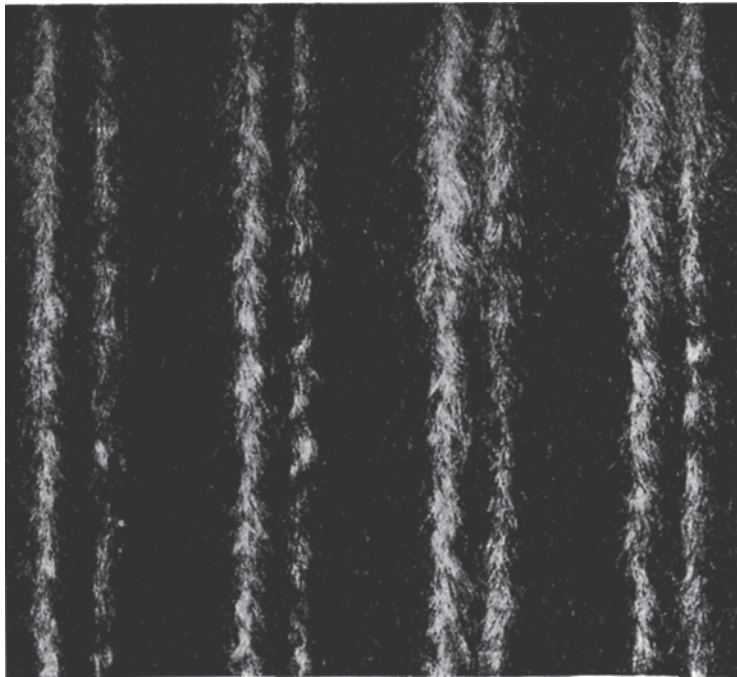


FIG. 97.

In order to understand the nature of fibrous pile obtainable by using such yarns in textures constructed on these lines, reference will be made to Figs. 99, 100 and 101 (milled), and Figs. 102, 103 and 104 (milled and raised). The warp in each case is cotton, and the plan, a reversible weft weave, so that in Section A of Fig. 99, the mohair is on the face, and in Section C, the Saxony yarn. It will be seen that, even in milling, a number of mohair fibres have worked through from the back

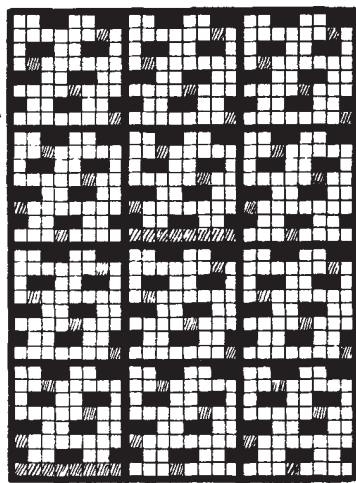


FIG. 98.

A B

*Mohair pick.*

*Mohair pick.*



PLAN 98A.



to the face in Section B. The wefting of Fig. 100 is two picks mohair and two picks Saxony; the intermediate spaces A, are, therefore, equal to pick and pick on the face, and the same on the back. Where the picks interchange from face to back, Section B, the curliness is developed in milling. Fig. 101 is woven one pick mohair, one pick Saxony and one pick Cheviot yarn, so that Sections A and B are composed equally on the face and



FIG. 99.

on the back of these yarns, but the reversing of the positions of the picks occurs with the interchanging of the weave.

It is not necessary here to explain how the curliness or buckles have been developed, but rather to show that such fibrous surfaces as Sections A and B in these respective cloths (Figs. 99, 100, 101) have distinct raising properties.

Comparing the raised specimens, Figs. 102, 103, and 104, the

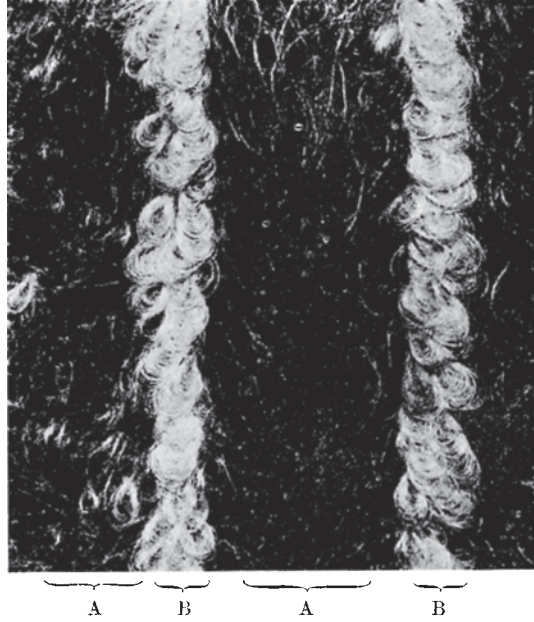


FIG. 100.



FIG. 101.

appearance and effect in each fabric are quite different. The curliness so characteristic of the felted cloths has been combed out by the action of the teazles, and the mohair sections have become a shag of fibres. Another distinguishing feature is the intermingling of the fibres of the Saxony, Cheviot and mohair yarns used in the weft (Fig. 104). From each a proportion of fibre has been raised, producing a similar effect to the processes of blending and carding of materials of different qualities and

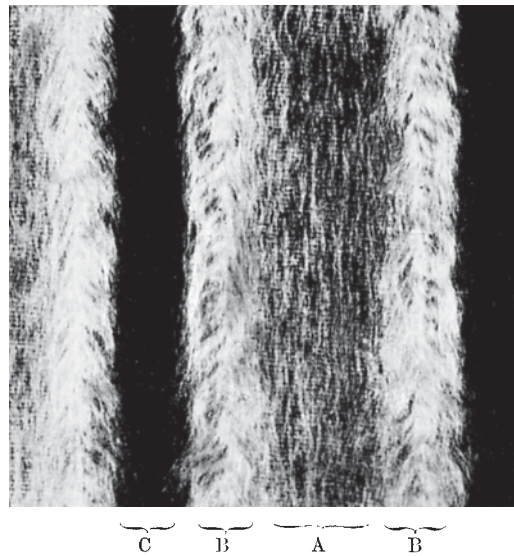


FIG. 102.

shades. In stripes B, the effect is seen of bringing the mohair yarn on to the face of the cloth. An irregular pile of fibres is produced with some of the features of a plush fabric. The mohair fibres of the weft on the under side also impart character to the texture. Some lessons as to the influence of lustrous and comparatively straight fibres might be drawn from this illustration, but it is now a question of how they influence the appearance of the face of the fabric by raising. A two-ply texture,

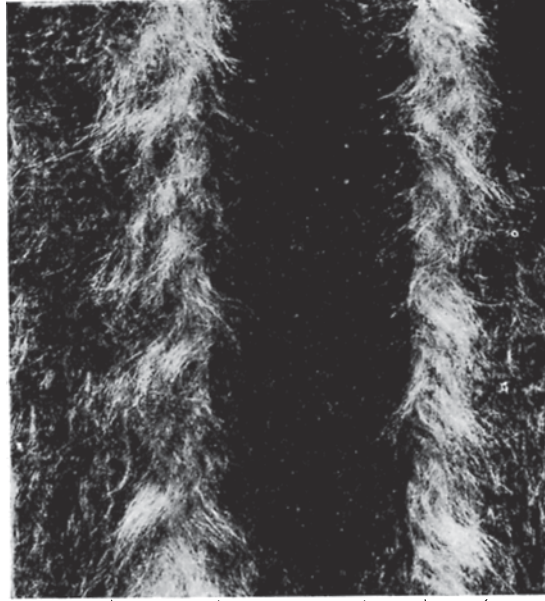


FIG. 103.

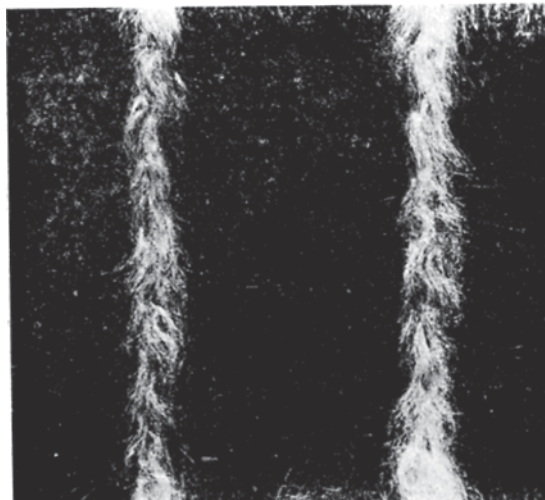


FIG. 104.

woven one pick Saxony (face) and one pick Cheviot (back), when raised on each side, possesses the characteristics of each kind of yarn only. But the use of a fibre like mohair in a threefold texture, on the face, in the centre or on the underside, has some effect, when raised, upon the nature of the woven surface treated. This is specially noticeable in the series of experiments from which the pattern given in Fig. 101 has been taken.

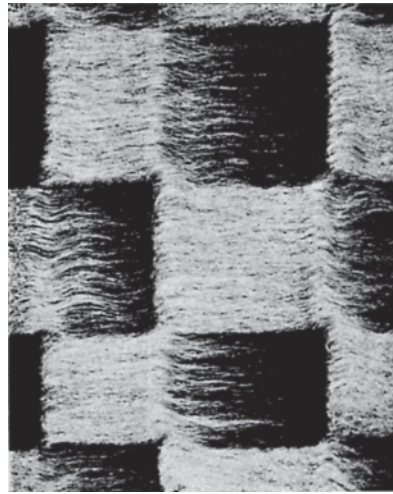


FIG. 105.

Some check patterns of a similar construction, composed of the same yarns, offering other raising characteristics, are illustrated in Figs. 105, 106. These show the difference in effect of raising two adjacent woven surfaces made of Saxony and mohair yarns. The examples indicate the diversity of raised effects, and the possibility of acquiring, in this finishing process, qualities of texture not producible by other methods. The nature of the fibre, yarn, and fabric construction, modify the raising routine and textural character.

Contrast, in the first place, the effect of the raising action in

these fabrics when operating in a line with the weft (Fig. 105) and across the weft (Fig. 106). They do not appear to be of the same woven structure, with the exception of the style of pattern. The mohair yarn is the cause of the chief points of difference. Raising in the line of the weft (Fig. 105) combs up a shag of fibres, slightly wavy owing to the manner in which these parts are affected in milling. The combing and straightening action is apparent. It has laid and spread the fibres over the face of the fabric. How different in the cross-thread raising (Fig. 106). In this texture there are wavy, undulating lines of

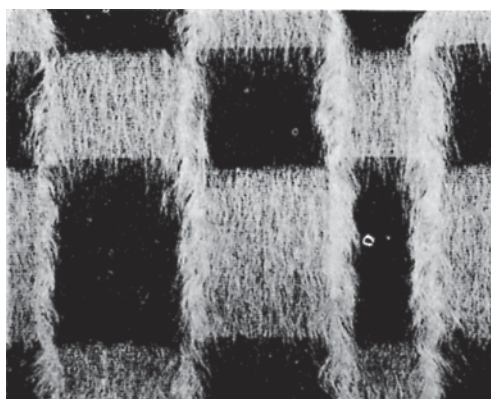


FIG. 106.

lustrous fibre, running in stripes down either side of the black and white checks. Further, there is a marked contrast between the spaces of mohair and of Saxony cloth. In the straight-thread raising (Fig. 105) the fibres are drawn from the side of the spaces, where the protruding mohair yarn is brought in contact with the teazles, and trailed over the Saxony weft portions of the pattern. The effects are exaggerated by using mohair, alpaca, or lustre worsted, but they would also be present, though in a less degree, if Cheviot, Saxony and other yarns had been used. One feature which, however, would not result is that due to the buckling or curling in felting (see Figs. 99, 100, and 101), but



the direction of the fibre in the two kinds of raising, and the relative density of the pile, would correspond to those in the examples.

There is another feature for comparison, namely, the condition of the fabric as to moisture, Fig. 106 having been raised dry, and Fig. 107 raised damp. In dry raising, with material like mohair, the fibre is easily disturbed on the surface of the texture, and if the action of the teazles is carried too far, the density of the pile will be impoverished. This is seen if the grey sections in the two illustrations are contrasted. The

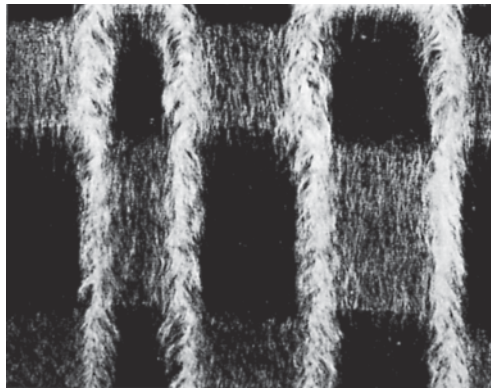


FIG. 107.

fabric raised damp has a comparatively fuller and more uniform pile. This applies to figured fabrics, as well as to those shown, in which such materials are used as in the specimens.

An example of a tapestry fabric raised damp is given in Fig. 108. It will be noticed how different are the surfaces in the respective portions of the figure, apart from the change in shade. The densest pile is on the medium shade, which is Saxony yarn, then follows the dark shade, Cheviot, and the lustrous surface, the mohair. The structure is three-ply in the weft, similar to Fig. 104, and the respective sections of the

pattern may be changed as to the material in which they are developed. Raising is here effective in giving novelty of character



FIG. 108.

to what would, otherwise, have been a clearly outlined pattern : it softens and tones the edges of the figuring, and destroys the fine detail, but where the style of design consists of fairly large

spaces and forms, it is a system of finishing which imparts the specific qualities indicated.

(84) *Raising of Fabrics in which Special or Fancy Yarns are used.*

As shown, raising is one of the processes of finishing which may be useful in giving novelty of texture and design. It will be helpful to see how the theories which have been defined, may have, in the fancy trade, important results. Examples will be analysed (Figs. 109, 110 and 111) in which (1)

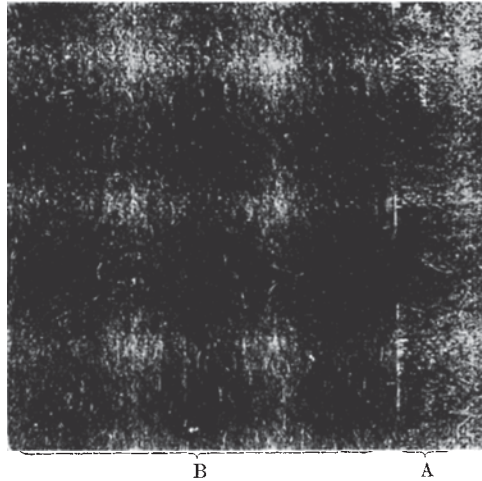


FIG. 109.

a shaded check is obtained by applying mohair to a Saxony ground; (2) in which flake yarns are used in the warp; and (3) in which curl yarns form checking lines in both warp and weft.

These examples show the utility of using fancy yarns on Saxony and Cheviot grounds. The shaded check (Fig. 109) is a pattern produced or developed in raising, Section A being unraised, and Section B raised. As is well understood, shaded patterns are obtainable by weave, methods of warping and wefting, and in compound cloths. Here, mohair yarns are suitably grouped in the warp, and in the weft, in combination

with Saxony yarns. There is, after milling, some shaded effect, but it is in raising where the softness and graduated shading

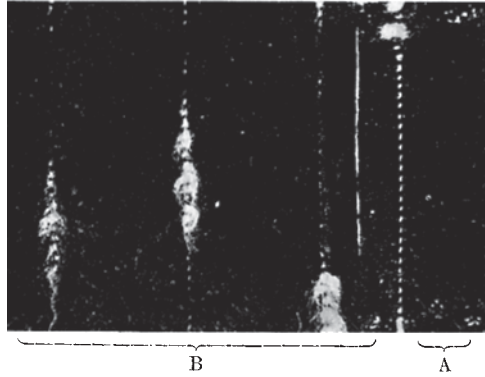


FIG. 110.

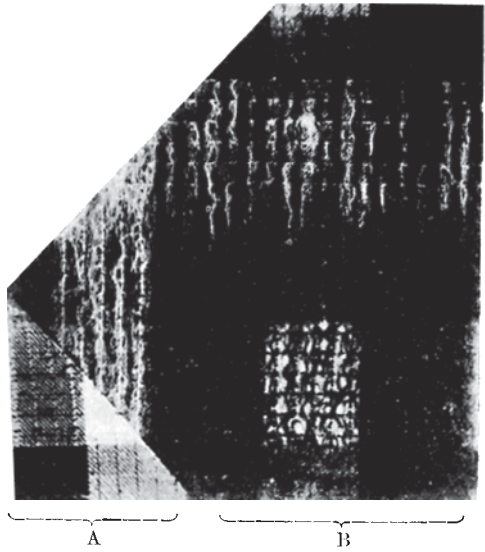


FIG. 111.

are chiefly developed. Had the fabric been made of one quality of warp and weft, then this softness of tone would not have been possible to the same degree.

Costume, vesting and mantle cloths, in which fancy yarns, such as knop, flake, curl and mohair are used, and the textures raised, give results similar to those seen in Figs. 110 and 111, the former being a costume fabric with a large knop-twist yarn inserted in the warp, and the latter, a check style in a twofold fabric with a fine ground and mohair checking yarns. In Fig. 110, Section A is unraised, and Section B raised: in Section B, the long fibres appearing on the face, impart a grey tone to the

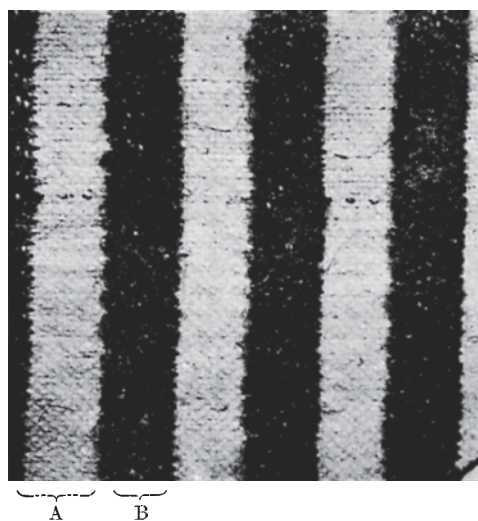
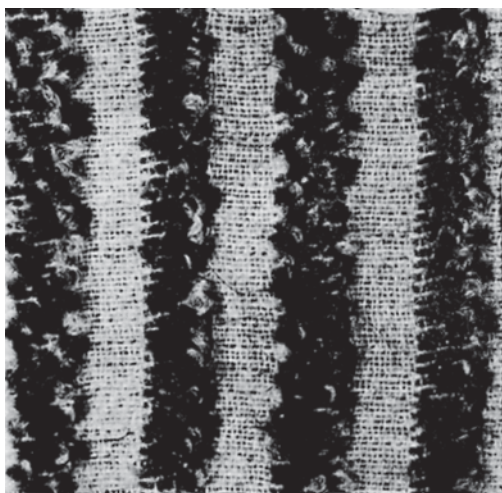


FIG. 112.

fabric, and there is an absence of the thready characteristic of Section A.

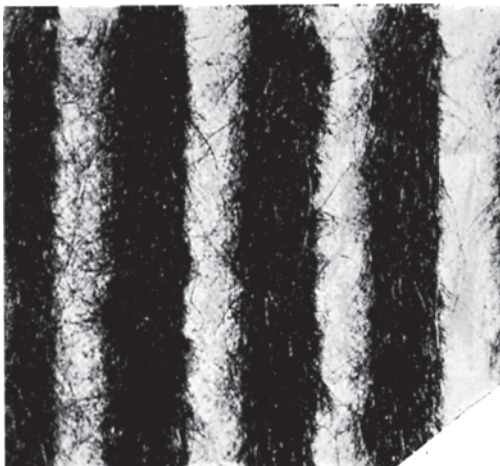
One further comparison or contrast in the woven and raised effect is seen in Fig. 111. The difference is emphasised by the length and lustre of the mohair yarn which modifies the ground-work of the texture. Before raising, the checks of white, brown and intermediate shades, Part A, are quite distinct, and possess clearness of definition, which, in large patches, form unsatisfactory, if not displeasing and inartistic contrasts. The drawing and trailing of the mohair checking lines on these squares of colour, has given the subduing and mellowing quality of





A B

FIG. 113.



A B

FIG. 114.



tone so distinguishable in this example. The bright touches of colour, helpful in imparting freshness to the style, are not, by the process, obliterated, but are, if anything, made increasingly valuable in lending beauty of textural quality and colour contrast.

Four textures specially designed to emphasise the difference in the milling and raising qualities of the yarns, are given in



FIG. 115.

Figs. 112 and 113 (milled only), and Figs. 114 and 115 (milled and raised).

The milled results are interesting, and suggestive of certain theoretical principles in the weaving and felting of such fabrics; for, as seen in Figs. 112 and 113, Sections A are perfectly level as in an ordinary texture; Sections B, curled or buckled, Fig. 112 having the appearance of a terry pile, and Fig. 113 of a curl, due either to the use of a folded yarn or some principle of pile weaving. Raising in both examples re-

moves the loop pile characteristic. Comparing Fig. 112 with Fig. 114, raising in the latter pattern has disturbed the surface fibres, and changed the curliness into a comparatively long shag or velvet pile. The difference between Figs. 113 and 115 is somewhat more striking, two kinds of yarn having been used in Section B, of Fig. 113, namely, mohair and camel's hair, which have not raised exactly to the same degree. The stripes B in Fig. 115 have a more wavy quality than in Fig. 114, but

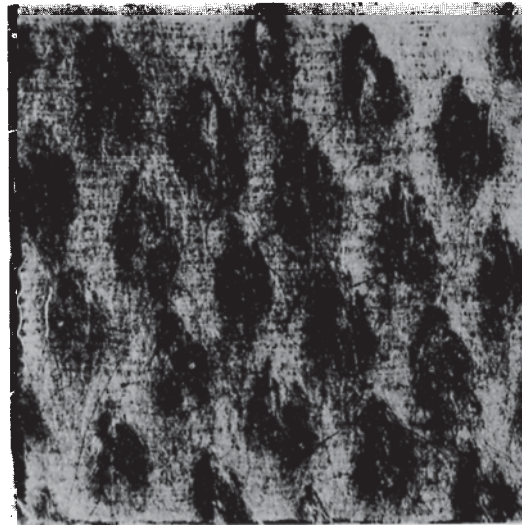


FIG. 116.

the contrast between the Saxony surface and the surface due to the lustrous yarns is still well marked.

That this is a useful scheme of weaving, milling, and raising, is not only clear from these patterns, but from the spotted effect (Fig. 116) which shows that several designs are possible, and that successful imitations of woven pile fabrics may be made by milling and raising, for the spots are regularly distributed, and there is an equal amount of shag or fibre in each. It is a method of fabric production which is capable of being utilised, when treated on the lines defined, in mantle, costume, decorative and other fancy fabrics.

## CHAPTER IX.

### RAISING MACHINERY AND THE RAISING PROCESS.

(85) Hand Raising. (86) Raising Gig. (87) Operation of the Raising Gig. (88) Two-Cylinder Raising Gig. (89) Teazle Raising. (90) Teazles and Card-wire compared. (91) Card-wire Raising Machines. (92) Modern Card Raising Machines. (93) The Horizontal Machine. (94) Rotary Machines.

#### (85) *Hand Raising.*

RAISING was formerly a hand operation. The teazles were fixed in frames as seen at Figs. 117 and 117A. The teazle, as in gig raising, varied with the character of the fabric and the hardness of the surface of the cloth. The frames were drawn alternately across the texture, the points of the teazles being kept in contact with it. The piece was spread in lengths on a padded board fixed at a suitable angle and height. The upper and lower ends of the board were mounted with card-wire or clothing for maintaining the length of cloth being raised, at the proper tension and evenness. By this method, the fabric could be raised either warp or weft way, so that in one sense, hand raising had an advantage over gig raising, which is limited to treating the piece in the direction of the warp. It was, however, a slow and tedious operation. Still, such raising is useful in combination with the gig, producing the fullest pile and softest handle on certain makes of woollen cloths.

#### (86) *Raising Gig.*

The oldest type of machine for this process of finishing is the "gig" (Figs. 118 and 118A). It consists of the main cylinder C, a number of guide rollers G, G<sup>1</sup>, G<sup>2</sup>, G<sup>3</sup>, and G<sup>4</sup>; folding motion

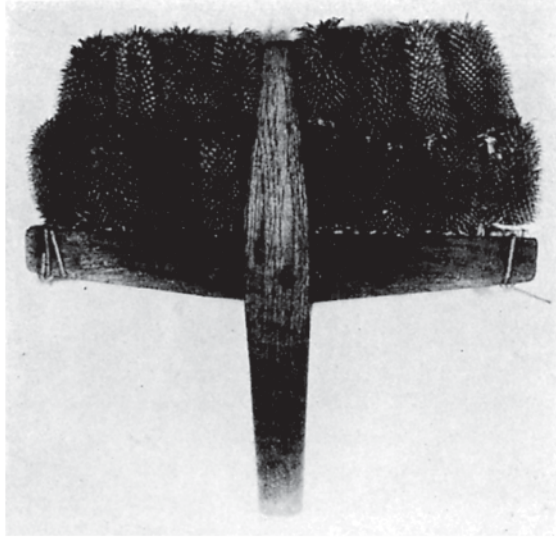


FIG. 117.—Hand Raiser (*Small Teazles*).

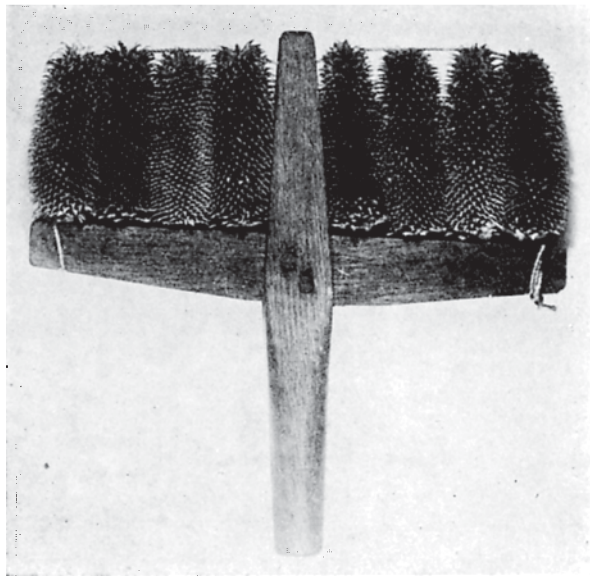


FIG. 117A.—Hand Raiser (*Large Teazles*).

F; the scray S; the expanding roller E; and the rack for the expanding roller R. The teazle rods or frames—twenty-four or

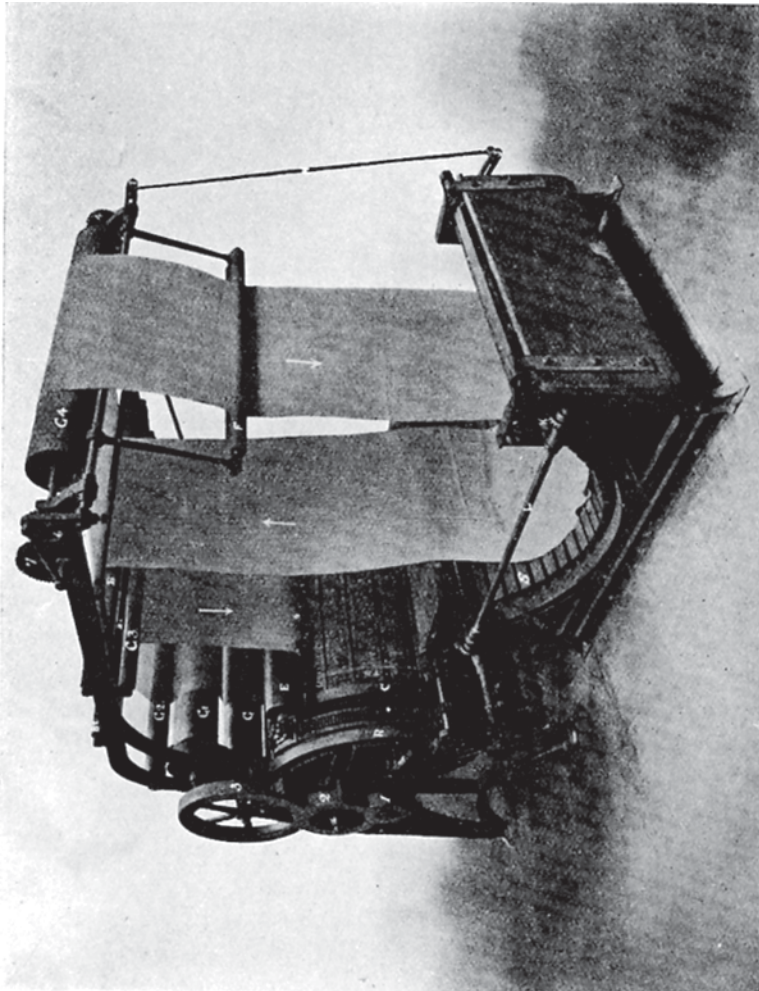


FIG. 118.—Raising Gig with Cloth.

more in number—are arranged in the cylinder or gig. This cylinder, usually 40 inches in diameter, makes from 150-160 revolutions per minute.

The actual measure of cloth in contact with the raising points during the operation of the gig, may vary up to 25 inches, according to the position of the expanding roller in the rack. Motion is imparted direct from the driving pulley P<sup>1</sup>, on the central shaft running from end to end of the machine. The strap is moved from the loose to the fast pulley, either in the ordinary way or by the screw arrangement M. To put the machine out of operation, the strap is taken from the fast pulley P<sup>1</sup> on to the loose pulley P, and the brake, controlled by handle N, is used for rapidly checking the movement of the cylinder. The main shaft carries a pinion 1, which meshes with pinion 2, imparting motion to wheel 3, on the shaft of which is a wheel driving G<sup>1</sup>. Draw rollers G and G<sup>1</sup> cause the piece to travel in the direction indicated by the arrows.

The folding motion is driven by wheel gearing on the shaft of roller G. The shaft D, which extends along the top and side of the machine, is mounted at the front end with a bevel wheel 5, gearing with wheel 4 on the shaft of G<sup>4</sup>, at the other end of which are wheels 6 and 7, and also crank and lever gearing, which give a backward and forward movement to the folder F.

The scray, operated by means of connecting rod H between levers I and J, moves the piece lying in folds gradually forward. This scray is an endless lattice apron, directly actuated by lever J, mounted with a catch engaging the catch wheel (not shown) on shaft K, which turns cross-shaft L, driving the shaft at the rear end of the scray.

(87) *Operation of the Raising Gig.*

Fig. 118 is the machine prepared, or "dressed," for raising a piece of cloth. Guide rollers and tension bars keep the piece perfectly even and level, and at a constant tension. Any defect of this kind would result in the action of the teazles being uneven, and in the development of streakiness or teazle marks.

In starting the machine, the tail-end of the piece is taken over the tension bar B, under roller G<sup>3</sup>, over B<sup>1</sup> and under the expansion roller E, over the surface of the gig, and round guide rollers G, G<sup>1</sup> and G<sup>2</sup>, and over B<sup>2</sup> to the guide roller G<sup>4</sup> at



the front of the machine, then between rollers of the folding motion F back to the scray.

The degree of raising for each round of the cloth, the length of cloth treated at each revolution, and the closeness of contact with the teazle points, are determined by the setting of the expanding roller E. In dry raising, only a minimum length of fabric is acted upon at one time, but in damp, or wet raising, the expanding roller is lowered in the rack after each process, gradually developing density of pile.

The draft in raising is fixed by the relative speeds of the cylinder and of the movement of the cloth. Taking the surface speed of the gig as about 1,600 ft. per minute, and that of the piece 80 ft., the draft would be in the ratio of 20 to 1. This gives some idea of the combing and straightening out of the fibres which is effected during the operation.

“Dry-beating” is a process done on the raising gig, a steam box being fixed in the position of roller G<sup>3</sup>, Fig. 118, with a perforated roller extending from end to end, through which the steam passes. The object is not so much to raise, as to straighten the fibres, and also to prepare the pieces for cutting.

(88) *Two-Cylinder Raising Gig.*

Several improvements have been added to the ordinary raising gig, one of which consists in setting the teazles at an angle, in order to obtain a more equal amount of raising on the warp and weft. A second improvement, made by Krantz (Fig. 119) is the addition of another cylinder, which may revolve in the same, or in the opposite way to the first cylinder round which the piece passes. When the gigs revolve to the right and left respectively, what is termed “pile to pile,” or “counter-pile” raising results, that is, the teazles act on the cloth in two ways, first opposing the movement of the cloth, and second, drafting with the cloth. This is an effective method of getting up and laying the fibre. It is a system that may be practised with satisfactory results on the rougher, heavy-pile fabrics, such as rugs and blankets, and the coarser qualities of cloths where a rough pile is a feature of the finish.

The cloth is taken from the cuttling board, over guide roller G, under G<sup>1</sup>, round the expanding roller E, coming in contact

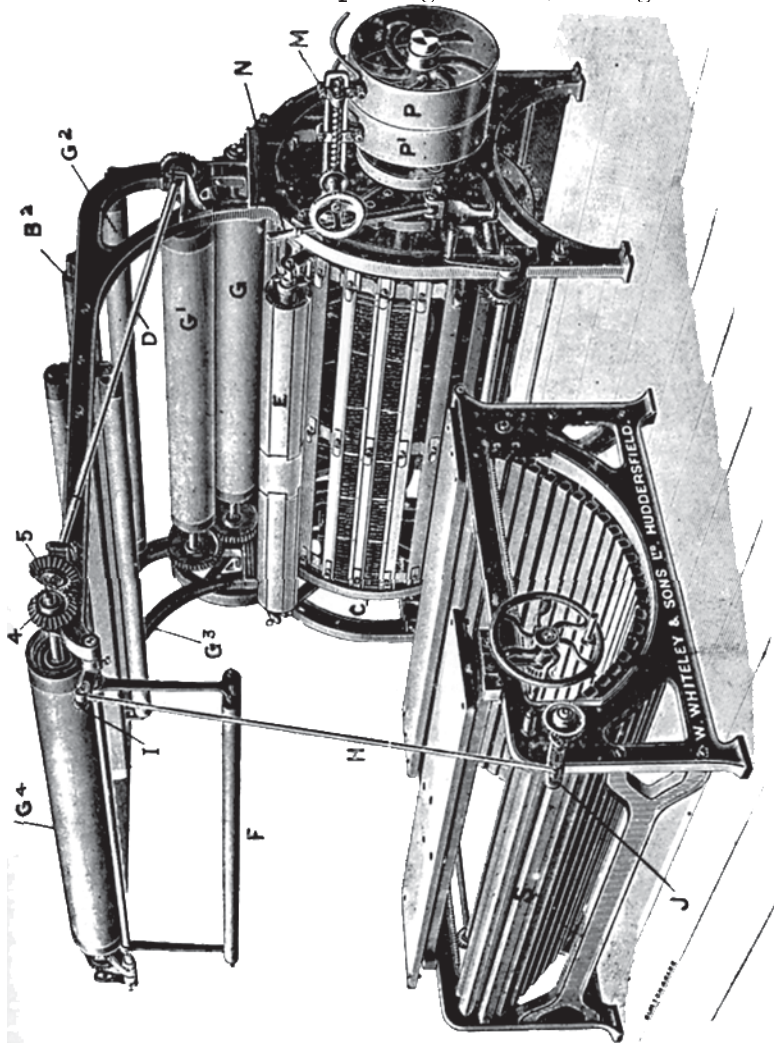


FIG. 118A.—Raising Gig without Cloth.

with the teazles in cylinder A, then round G<sup>2</sup> and upper expanding roller E<sup>1</sup>, and round the positively driven cylinder B. There are tension bars, as shown, for each cylinder. After the

last contact with cylinder B, the piece passes over guide roller G<sup>3</sup> to the cuttling board. Cylinder A is driven by strap from cylinder B, and as the belt may be either straight or crossed, may be run with or against the cloth as required. There is a damper or spray S, fixed in the position indicated.

(89) *Teazle Raising.*

It will be seen from the natural form of the teazle (*Dipsacus fullonum*) that it possesses diversity of flexibility from the base

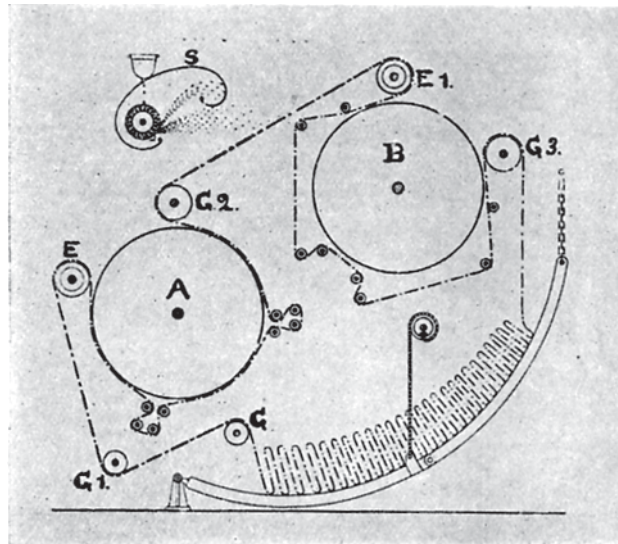


FIG. 119.

to the apex, and also greater pliability at the point of each petal than at the root. These are features which, combined with the cylindrical shape, make it specially adapted for raising the fibre on the surface of a woven or felted texture.

Figs. 120 A, B, C, and D, are sections of rods mounted with teazles of different sizes and raising strength. Those in Section A are known as "two's," two rows of teazles of equal size being inserted into each rod. In Section B the teazles in the lower row are larger than those in the upper row: in Section C

a medium sized teazle fills about two-thirds of the space across the frame, the smaller space being filled with a row of "buttons," the smallest size of teazle : Section D consists of the largest size, known as "kings," the strongest growth of teazle and the one used for the raising of hard-milled fabrics. New teazles are

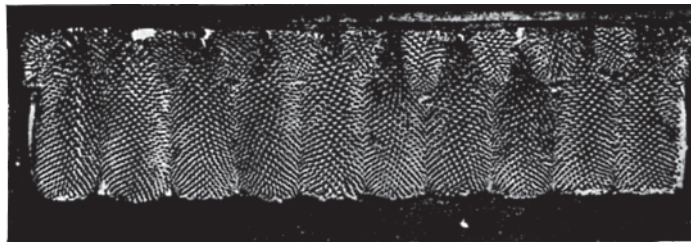


FIG. 120A.

termed "breakers," and when one side has been used of any kind of teazle, they are defined as "chalked".

In practice, the frames are arranged variously. For example, first raising should be done with teazles that have been used for some time, and of the smaller kind, as too drastic treatment at

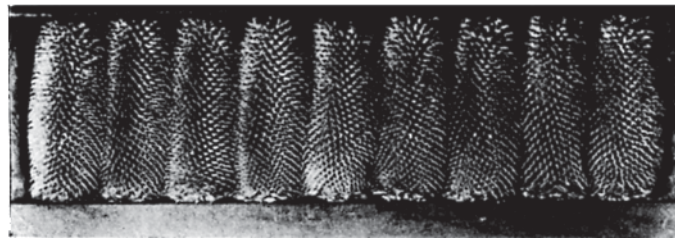


FIG. 120B.

this stage is liable to result in waste of fibre. Subsequent raising may be with newer teazles, and with several rods of one kind, following with rods of the medium size, such as Fig. 120B. The adjustment and changing of the rods are affected by the character of the cloth being raised, and the pile to be produced.

By having the teazles set in two rows (Figs. 120A, B and c),

evenness of raising is facilitated. In rods set as in Fig. 120d, there is a ridge between the teazles. To prevent streakiness in raising, when such teazles are used, the rods are so fixed in the gig that teazles of succeeding rods come between each other.

The setting or arrangement of the teazles is a work requir-

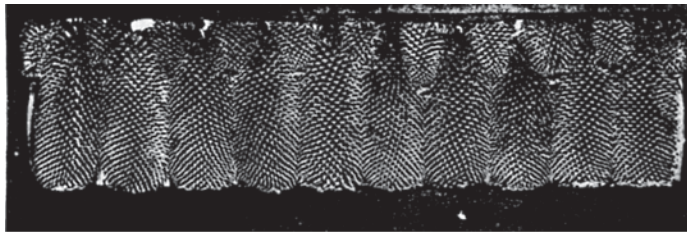


FIG. 120c.

ing care and experience. They must be arranged so as to get equality of raising point from side to side of each bar in the gig. If any teazles are more prominent, that is, project slightly more than others, or if they are not of an evenness of pliability, they will have a keener action, and the raising will not be uniform.

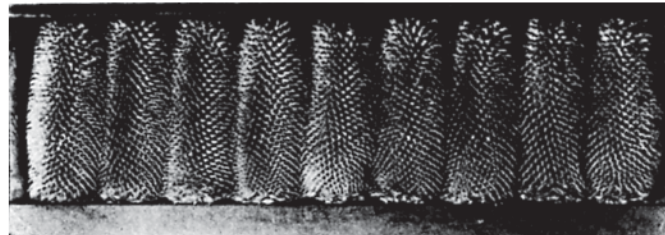


FIG. 120d.

The selection of the teazles, and the changing of the teazles in the bars of the gig, are important in getting a full and close pile. To maintain efficiency of raising, and this economically, it is the practice to change a number of bars, as for example, bars of old teazles alternating with newer ones. Then again, the bars are turned over, that is to say, if the teazles have been used on one side, or "chalked," then by reversing the bars the



unused points are brought into contact with the cloth. Another feature which the practical raiser has to observe, is the changing of the teazles to increase the keenness as the pile becomes fuller.

In changing the rods, the teazles which have been used are cleaned of flock by a preening brush. This is brought in contact with the teazles when in a damp condition. After each changing of the rods, they are "chalked" as many as ten to fourteen times in succession.

(90) *Teazles and Card-wire Compared.*

The two raising points in either "hand" or machine raising are the teazle and card-wire. The latter is somewhat similar in point and finish to the clothing used in scribbling and carding. In carding, such wire teeth are for opening the staple of the wool and separating fibre from fibre, reblending or remixing them into a fleece of uniform density. In raising, the revolving cylinders of the machine, covered with wire teeth clothing, are brought in contact with the surface of a firmly-woven and milled texture.

Card-wire raising is more drastic in nature, and more disturbing to the external structure of the yarns, than teazle raising. The more pliable the raising point, the longer the process in obtaining a dense pile, but less destructive to the texture. With a raising point wanting in pliability, and which digs into the threads, it is possible to obtain a pile quickly, but it would be defective in regularity, smoothness and length. The action of the teazle is apparently less severe than a wire point of whatever fineness and shape. The moisture applied to the piece softens the vegetable point, but not the card-wire, so that the teazle point drafts through the face of the texture with a minimum amount of disturbing effect on the structure of the yarn. The process is gradual and progressive, and should result in a close, compact pile of filament, with the foundation of the fabric unaffected in strength and quality. On the other hand, raising with card-wire is adapted, at certain stages of finishing, for producing a dress-finish on both light and heavy



fabrics, and also for developing the peculiar character of the "moss" finish. Raising on the card-wire machine is, necessarily, more economical as to time, and number of operations, than teazle raising, but quality of finish is as important in fabrics made of good material as economy of work. To combine the two systems, as indicated, is in some classes of finish and cloths the better plan.



FIG. 121.

The card-wire for cotton fabrics, and also for fabrics which are raised dry, is of the ordinary tempered wire, but that used for raising cloths wet or damp, is made of brass. The foundation of the clothing consists of a thin layer of rubber composition, a layer of cotton fabric and an upper layer of rubber. The usual bend of the wire, which has a needle point, is that seen in Fig. 121. Sellars made some alteration in the card-cloth-

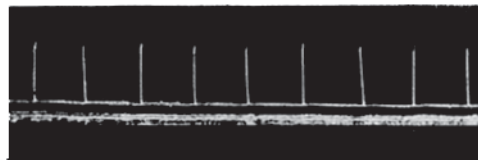


FIG. 122.

ing used for his vertical machine. That for cross-raising was a straight wire (Fig. 122) pricked in a twill or diagonal form (Fig. 123).

The clothing is wrapped spirally on the raising rollers (Fig. 124) the clothing on one roller being wrapped from right to left, and that on the adjacent roller from left to right. The direction of the movement of the rollers, and the method of

clothing, may cause the points of the card-wire to operate on the cloth in two ways: first, the points of the wire may move through the face of the fabric in the direction of the bend, and second, in the opposite direction to the bend.

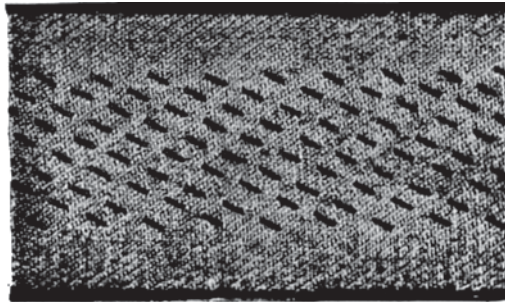


FIG. 123.

(91) *Card-wire Raising Machines.*

One of the earliest attempts at substituting card-wire for teazles was that made by J. C. Daniells of Frome, who in-



FIG. 124.

vented a card-raising machine in 1819. The clothing was nailed on to the main cylinder in strips, taking the place of the teazle frames on the gig. Later, the cards were pricked with two heights of wire, so that the effect might be less at the commence-

ment of raising, by fewer points being active, than when some fibre had been raised, and the piece brought into closer contact with the strips of card. The shorter wire was intended rather to comb and straighten than raise, and, for this reason, was duller at the point than the longer wire. The character and bend of the two series of teeth are shown in Fig. 125.

That the inventor found difficulty in the use of this machine is indicated by a modification which he also patented, with the strips of clothing adjustable on springs to increase their elasticity and pliability. Raising was done, as on the gig, in the direction of the warp.

Ferrabee invented a cross-raising machine in 1830, in which the strips of clothing were fixed on endless belts, traversing

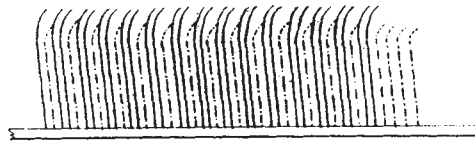


FIG. 125.

from list to list of the piece. This is one of the earliest machines for raising the cloth from side to side, or with the weft.

Worrall & Kershaw in 1887 endeavoured to raise equally on the warp and on the weft at one and the same process, the raising cylinder being set at an angle with the length of the cloth, so that the raising action was not parallel with one series of threads and at right angles to the other. This should give, theoretically, the fullest pile of fibre on the cloth, and hence the twofold raising which is practised in the finishing of face-cloths, namely, raising on the length of the piece and on the width in succession.

(92) *Modern Card-raising Machine.*

The types of card-raising machines are :—

- (1) The vertical machine.
- (2) The horizontal machine.
- (3) The rotary machine.

The first type is chiefly adapted to the treatment of fabrics of the cotton blanket and rug class, and heavy cottons with a pile surface, such as fustians and moleskins. The machine is simple in construction, consisting of suitably arranged tension bars, and of a series of rollers one above the other covered with card-clothing. The pieces to be raised having been passed round adjustable stretchers or bars at the bottom of the machine, are brought in contact with the raising cylinders in succession.

An early type of the vertical machine was invented by Hampson & Marshall in 1887. It is known as the "Direct Upright". Eight rollers about four inches in diameter covered with card clothing are used, and may be run either with or against the cloth as required. They are driven by bevel gearing, and make from 300 to 400 revolutions per minute. The machine is used chiefly for hard cottons and flannelettes, not being gentle enough in action for woollens.

One of the latest inventions is that of Sellars, who endeavoured to solve several problems in raising, such as the method of standardisation by a system of adjustment of the raising parts. As the raising efficiency of the teazle deteriorates from the first to the last contact with the cloth, it could not be successfully used in experiments of this character, for it does not, like card-wire, retain its original raising point. Sellars' machine was invented and constructed to give, by means of requisite mechanical adjustments, the same raised results, by corresponding routine, on pieces of like manufacture.

The machine consists of a series of raising rollers, and of pairs of presentation rollers for maintaining the cloth at the same tens on during the work. The raising rollers, fixed one above the other on each side of the machine, are hexagonal in shape, so that a straight flat portion of card-wire operates on the face of the cloth. Each section of these rollers is 2 inches across, and 54 inches in length, equal to 108 square inches of card-raising surface. These rollers are fixed in a frame which is operated by eccentrics at the bottom of the machine, and makes from 700 to 1,000 strokes per minute. The movement of the raising rollers is in the form of the letter D: if

they moved straight up and down, the result would be a ruffled pile, but not combed and straightened. A feature of raising, under any condition or system, is the production of flock or loose fibre, which on both teazle and card-wire in time lessens the efficiency of the raising contact. By using hexagonal-shaped rollers, frequent and automatic changes of the card are effected. Such rollers turn intermittently, so that the used surface is regularly cleaned of fibre. This is done by the rollers coming in contact with revolving brushes, which also keep the teeth or points of the card-clothing in a satisfactory condition for raising.

The presentation rollers are positively driven, independently of the hexagonal card-raising rollers. They carry the cloth forward at a uniform speed, varying from four to ten yards per minute. Variation in this speed determines the amount of draw or draft through the cloth. Assuming the raising roller makes 700 oscillations per minute, and the cloth travels at 180 inches per minute, the raising surface would lead the cloth by 520 inches, hence in travelling past each flat, it is raised approximately four times, and if there are seven flats on each side of the machine, treated fifty-six times with even results from list to list. The accurate mechanical regulation of the relative speeds of the raising surface and of the fabric is a special feature of the machine. There are, also, means for adjusting the distance of the flats from the face of the fabric to the one-thousandth part of an inch, and this adjustment is registered on a dial, so that subsequent pieces of the same structure can be treated in exactly the same way.

Cross-raising is done by three rollers,  $2\frac{1}{2}$  inches in diameter at each side of the machine, covered with a special straight wire, (Fig. 122). Such rollers travel at the same speed as the fabric, but in addition, oscillate to and fro, or from side to side of the fabric, from 1 inch to  $1\frac{1}{2}$  inches, making 400 to 500 traverses per minute, and operate on the piece immediately it leaves the top presentation roller. As these rollers travel with the piece, they are not liable to disturb the weft yarn, but give satisfactory raised results.

(93) *The Horizontal Machine.*

A simple type of horizontal machine is that used in the raising of blankets, and consists of a raising roller covered with card-clothing spirally, with smooth spaces between the strips of clothing. The cylinder revolves, and also oscillates backwards and forwards, having, in consequence, two effects in raising the fabric: first, that due to the revolving of the cylinder, and second, to the lateral traverse. As in other types of card-raising machines, a brush is used for maintaining the card-teeth in good raising condition.

Fig. 126 is a section of Tomlinson's horizontal machine. Two pairs of raising cylinders are used, and the fabric may be raised on both sides at the same time. The piece is stretched between the rollers A, A<sup>1</sup>, and passes under the raising cylinder B, where it is treated on the upper side, over the raising cylinders C, C<sup>1</sup>, by which it is treated on the under side, under B<sup>1</sup>, and again raised on the upper side. The points of the card-wire, as seen on the rollers B, B<sup>1</sup>, and C, C<sup>1</sup>, are in opposite directions to each other. The brushes are used for cleaning the upper and lower raising rollers.

The piece drafts through the clothing of rollers B and C<sup>1</sup>: on the other hand, the points of the card-wire of the raising rollers C and B<sup>1</sup> are in the same direction as the movement of the fabric, and the rollers have greater surface speed than the cloth. Two effects are thus obtained: first, the piece is drawn forcibly over the clothing of rollers B and C<sup>1</sup>, and second, the two raising rollers C and B<sup>1</sup> comb through the fibre on the surface of the fabric.

The cloth first passes over guide roller A, coming in contact with the wire of roller B, which imparts movement to roller C underneath the cloth, by wheel gearing; passing from this roller, it comes in contact with the clothing on C<sup>1</sup>, which transmits motion to the raising roller B<sup>1</sup> operating on the upper side of the cloth, after which the piece passes over guide roller A<sup>1</sup> to the usual folding motion.

Another form of construction is that in which a pair of



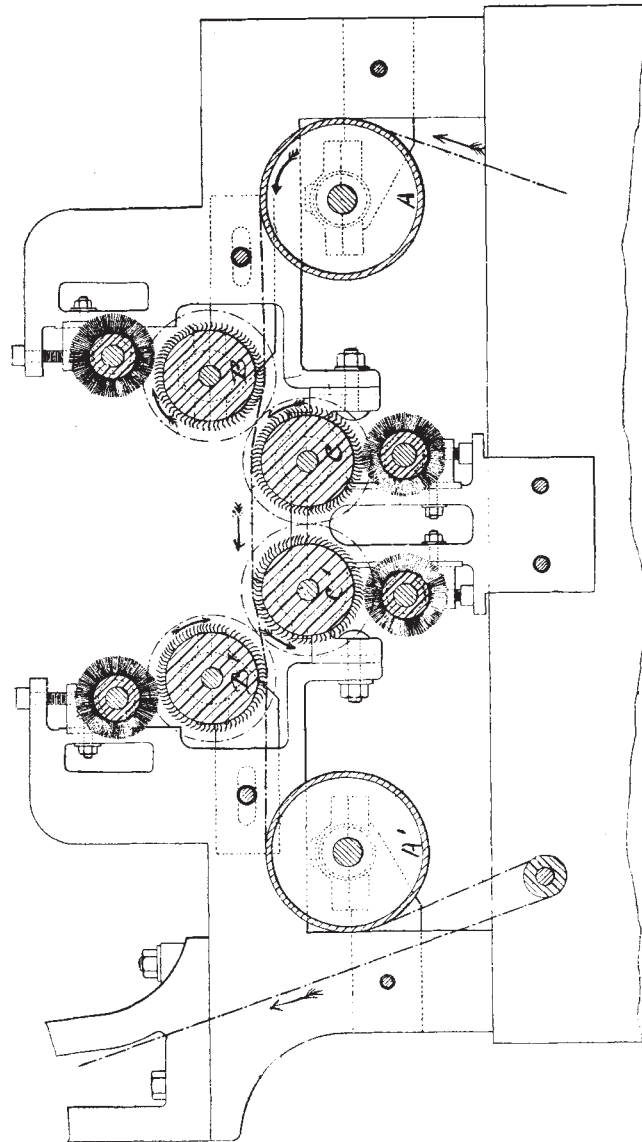


FIG. 126.

rollers is fixed in a swing or oscillating frame, which moves backwards and forwards, whilst the rollers rotate, as in the blanket raising machine. The points of the card clothing are in opposite directions on each roller.

These horizontal machines have been almost entirely superseded by those of the rotary class.

(94) *Rotary Machines.*

The principal type of card-raising machines of the rotary construction is the Moser. As originally patented in this country in 1885, there were five points of contact between the cloth and the raising rollers for each passage of the piece through the machine, with requisite tensioning parts for maintaining the fabric at the same stretch. The leading features of the machine have been retained in later improvements, but increased raising efficiency has been acquired by keeping the pieces more in contact with the card-clothed rollers, and also by other devices for the regulation and adjustment of these rollers.

Moser made a distinct advance in the use of card-wire teeth for raising, as a substitute for the teazle. One branch of cotton manufacturing has been largely developed by the use of machines of the Moser type. On one of the vertical card machines, to which reference has been made, thick, rough cotton fabrics, such as blankets and rugs, may be successfully raised: on the Moser machine, thin fabrics, such as flannelettes, may be covered with a soft pile of fibre which gives them a similar character and handle to a woollen flannel.

The horizontal and vertical machines have not had much success in the woollen trade, machines of the rotary construction having been preferred. The card-wrapped rollers on these machines are fixed in a revolving cylinder, and take the place of the teazle rods in the ordinary gig. There are many features in which the raising gig and the Moser machine differ from each other. In the single gig, the cylinder travels in the opposite direction to the fabric: in the Moser, the card rollers are driven independently of the cylinder, and may be made to

operate on the cloth in two ways, which gives increased possibilities as to diversity of raising effect.

There are two important classes of these machines, known as single- and double-action, respectively. In the former, the raising rollers and the cloth move in the same direction, the rollers having the higher superficial speed, but the cylinder moves in the opposite direction. In the double-action machine the cylinder travels with the cloth, but alternate rollers revolve at different speeds in the opposite direction.

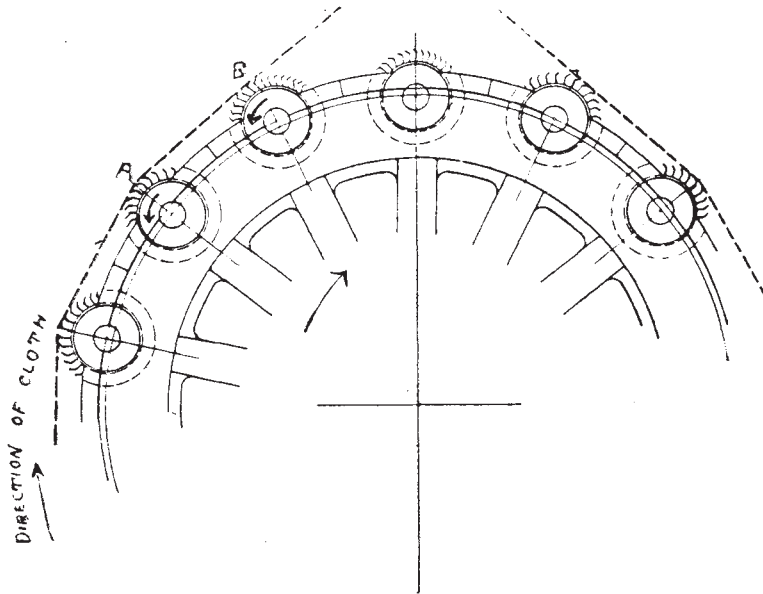


FIG. 127.—Cylinder of Raising Machine.

Fig. 127 shows the positions of the card rollers in relation to each other in the double-action machine: rollers A and B revolve against the fabric, series A using the points of the wire, and series B the back of the wire. Rollers A are, therefore, primarily retainers, or resist the forward movement of the cloth (the piece drafting through the teeth of the clothing), bringing the fibre on to the face, whilst rollers B comb and lay the fibre. A change in the relative speeds of the two series may cause series A to have an increased raising effect.

The "moss" finish, a somewhat rough and irregular pile, is obtained by running the cylinder the reverse way of the piece, with all the rollers moving with the piece, and using the points of the teeth, which has the effect of disturbing the fibre and producing the rough characteristic named.

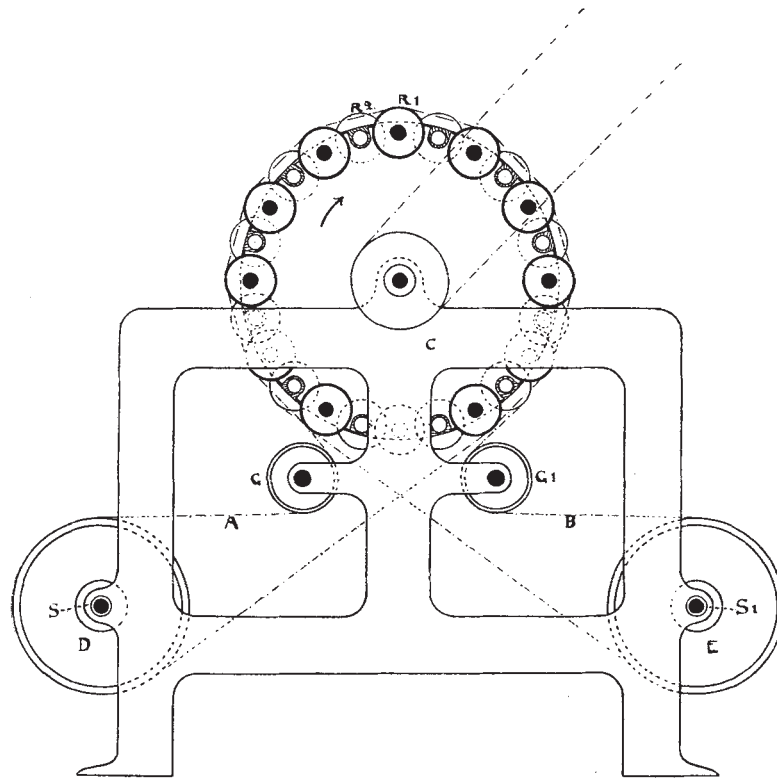


FIG. 128.

Figs. 128 and 129 are the two opposite ends of one type of a 24-roller Tomlinson machine: a later construction is shown in Figs. 130 and 131. The two series of rollers,  $R^1$ , and  $R^2$ , are driven by belts A and B passing round pulleys D and E, and guides G and  $G^1$ .

The speed of the rollers may be varied by using step or cone pulleys. The shaft of the cylinder carries a toothed wheel,

gearing with the wheels on the shafts of the upper cone pulleys P, P<sup>2</sup> (Fig. 129). Straps pass round these pulleys and the cone pulleys P<sup>1</sup> and P<sup>3</sup>. The speed of the cylinder is constant but that of the raising rollers, by the use of cone pulleys, is variable.

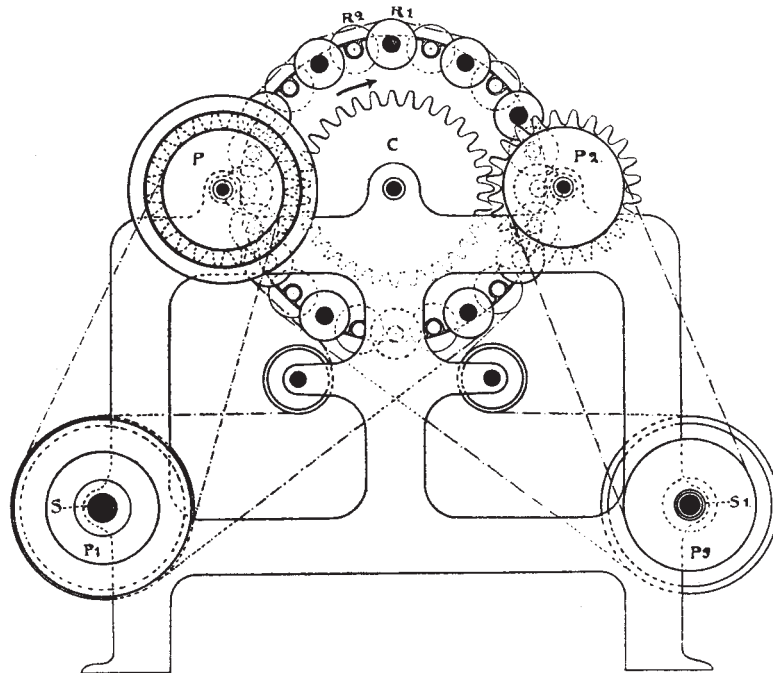


FIG. 129.

(95) *Routine of the Piece.*

This is shown in Figs. 130 and 131, a 14-roller machine for felt nap raising. The teeth of the card-clothing of each roller are in the same direction.

The piece from the cutting section A, passes over the tension guide B, under C, round D and tensioning roller 1, under roller 2, and over the cylinder to tension roller 2A, over top roller 3 and the head of the machine to the folding motion.

The method of driving is also indicated. On the main cylinder is the driving pulley, from which all other motions

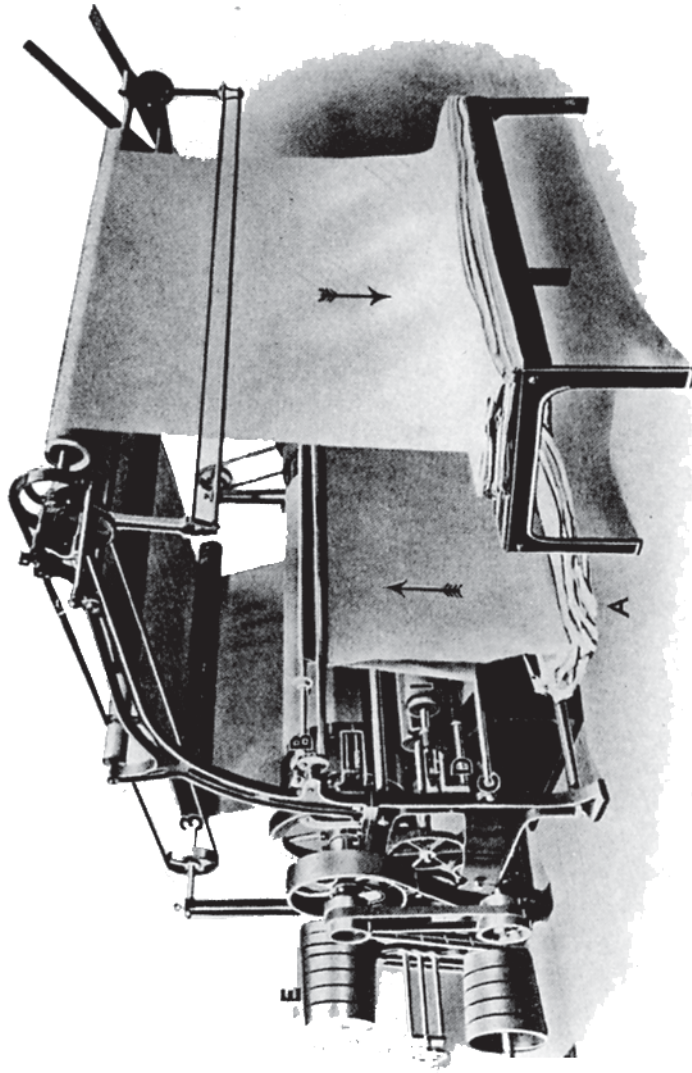


FIG. 130.—Tomlinson's Card-Raising Machine.



are derived. On the cylinder shaft is fixed a belt pulley which drives a pulley on the stud, which carries cone pulley F. From

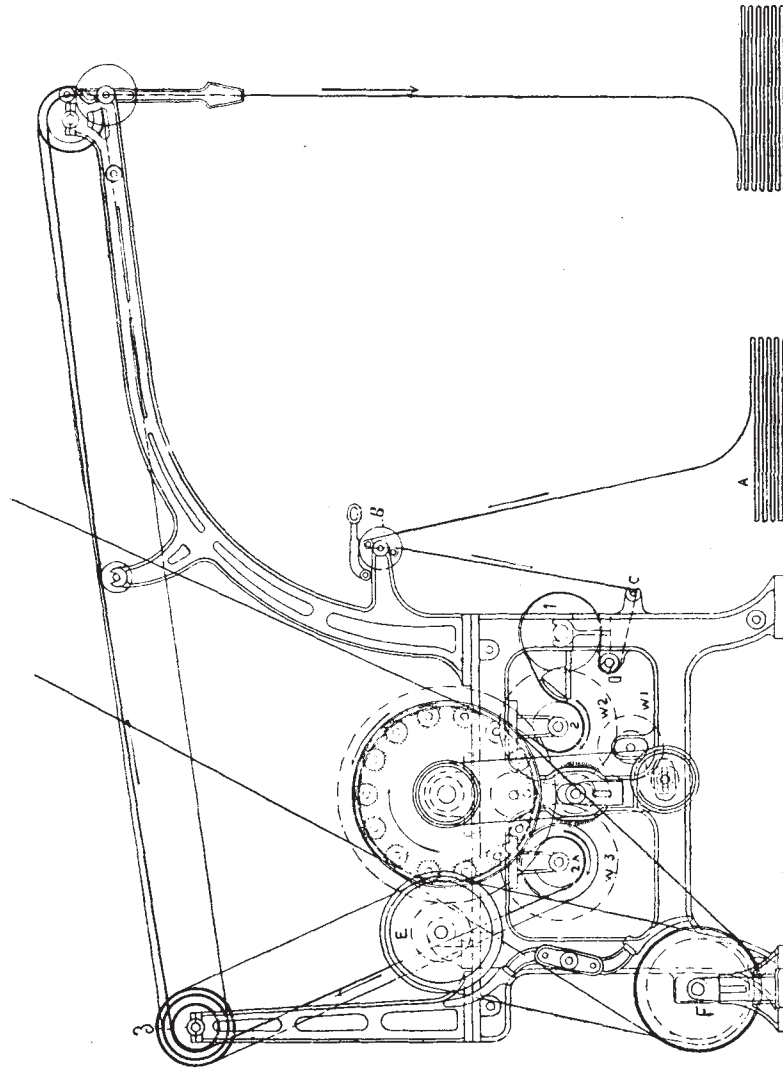


Fig. 131.

this cone pulley motion is imparted to the upper cone pulley E. On the shaft carrying the latter pulley is a toothed wheel at

each end of the cylinder, which gears into the large wheels running loose on the cylinder shaft. These wheels each carry an arm to which are secured the ends of the belts which encircle the pulleys on the ends of the card-raising rollers, which are thus made to revolve in the reverse direction to the cylinder. A belt passes round the cone pulley on the main shaft and the pulley mounted on a stud in the centre of the frame, at the bottom of the machine. This pulley carries a pinion, which by wheel gearing,  $W^1$ ,  $W^2$ ,  $W^3$ , gives motion to the strap pulley 3, fixed on the top roller for conveying the fabric forward. In this way a definite length of cloth is carried to the cylinder, and a corresponding length of cloth is positively removed, under uniform tension. By means of this cone arrangement, the requisite changing speeds imparted to the movement of the cloth, can also be made readily to the rollers for conveying the cloth to the folding motion.

(96) *Brushing and Steaming.*

This is done on the Brushing Mill (Fig. 132) which may be either single or double in action, that is, have one or two brushes. The ordinary machine is simple in construction, consisting of the steam box A, the revolving brushes  $B^1$  and  $B^2$ , and of the folding motion. The piece passes over the steam box from the cuttling board, then between guide rollers, over brush  $B^1$ , over central guide roller, and brush  $B^2$ , under back guide roller, and over the top guide rollers to the folding motion. Steaming softens the fabric, so that the action of the brushes is more effective. Brushing is done in worsteds to prepare for cutting, and has a similar effect to raising a woollen cloth, but is of a milder character. After the final pressing, the cloths are also steamed and brushed, to further dress the surface of the fabric, as well as to remove any excessive glaze or unnatural quality of lustre.

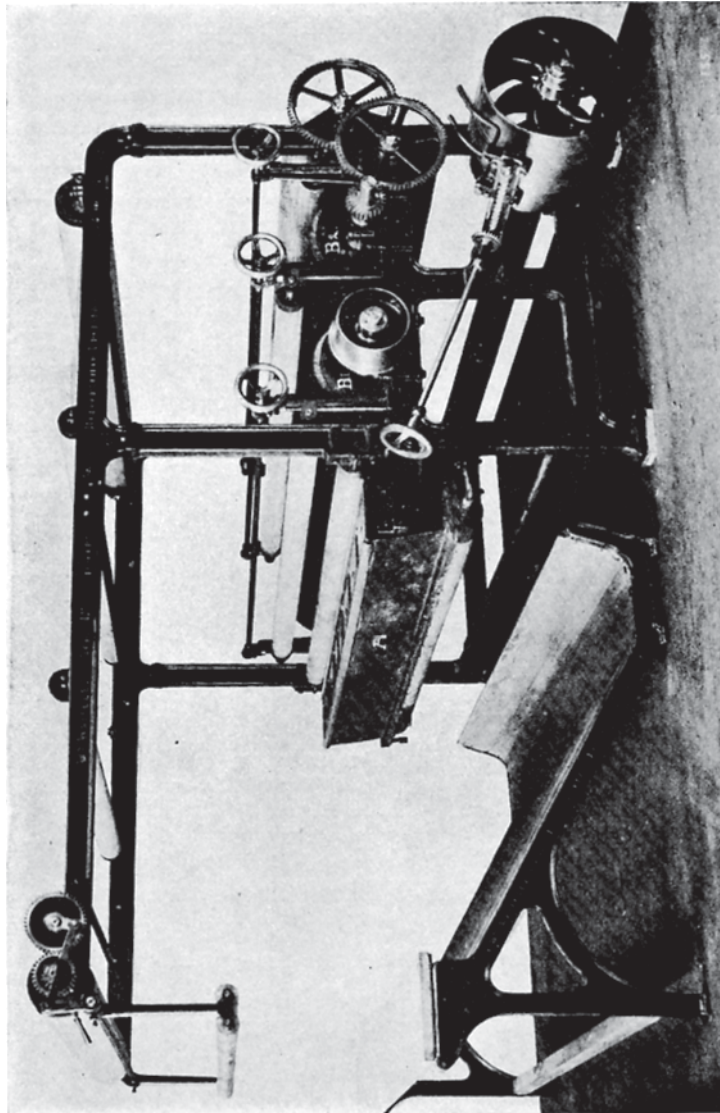


FIG. 132.—Whiteley's Brushing Mill.

## CHAPTER X.

### CUTTING, CROPPING, OR SHEARING.

- (97) Cropping. (98) The Effects of Cutting. (99) Cutting Machines. (100) The Cross-cutting Machine. (101) The Continuous Cutting Machine. (102) Setting of the Cutting Parts. (103) Form of the Bar or "Bed" under the Cutters. (104) Machines with Two or More Cylinders. (105) Grinding.

#### (97) *Cropping.*

BEFORE the invention of the Cross-cutting Machine—the earliest form of cutting machine—the pieces were sheared by hand, (Fig. 133) being stretched in successive lengths in a suitable frame, when the croppers with their shears operated from end to end and side to side of each length. The two terms "shearing" and "cropping" originated from the huge hand-shears A (Fig. 133), used in this work, and the designation applied to the operatives engaged therein, namely, that of "croppers". These terms have ceased to have the same meaning which in the old days they conveyed.

To cut, or "crop," as it was significantly termed, the surface of a fine woven and well-raised piece, was a skilful performance. How it was successfully accomplished with the instruments used, it is not easy to apprehend: but the face-cloths treated in this manual way, prove the cropper to have been a capable operative. No wonder that he should have formed a remnant of the textile workers who opposed, to the bitter end, the use of automatic machinery in substitution of manual dexterity.

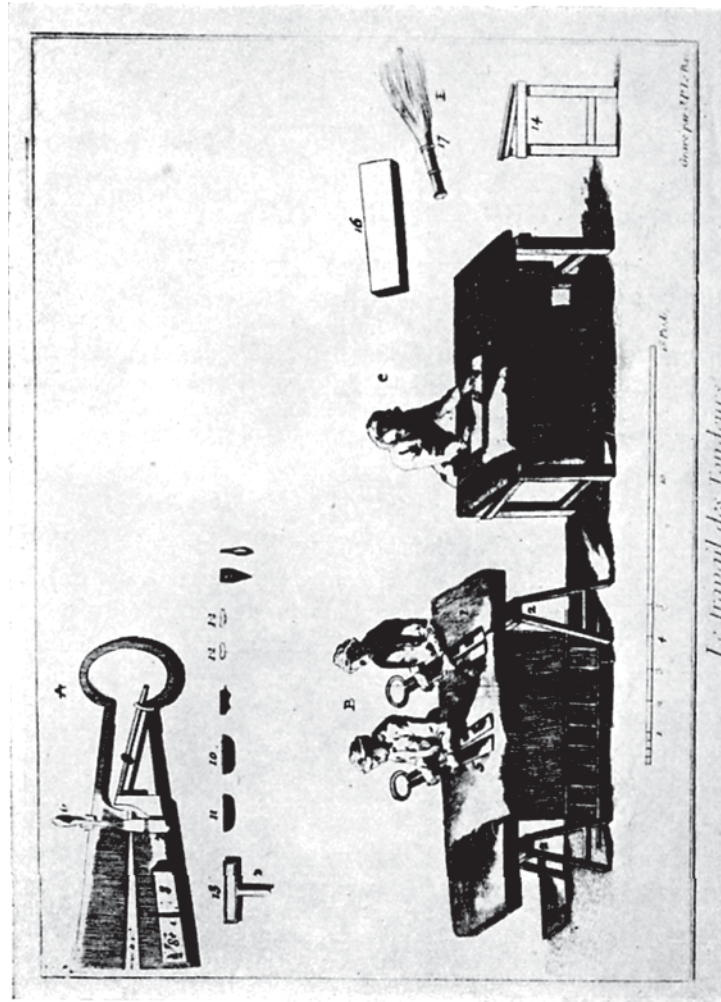


FIG. 133.—A reproduction of a wood engraving from an old French work.  
 A. Hand shears mounted as used. B. Croppers at work. C. Operative hand raising. D. Hand raiser.  
 E. Whisk for brushing the cloth.

(98) *The Effects of Cutting.*

Cutting or cropping is a purely mechanical operation, and has only a "machine" effect upon the face or back of the cloth. It is, however, an operation done to obtain several distinct effects varying with the structure and quality of the fabric, the materials used in its manufacture, and the style of finish wanted. For example, it may be practised to even or level a raised pile of fibre, to impart colour and weave definition, as in clear-finished Saxonies or Botany worsteds, or to brighten and give smartness to an ordinary Cheviot suiting or costume.

To understand more fully the nature of the work, it may be considered in relation to the effects it produces on Cheviots, fine woollens with a clear or soft finish, Crossbred and Botany worsteds, also velvet-pile rugs, meltons, doeskins and beavers.

*Cheviots, Flannels, etc.*—These cloths are only slightly cut. The natural handle of the fabrics should be retained, which would not be the case if they were cut clear or smart. This particularly applies to Cheviot fabrics where crispness of handle should be a feature, so that a certain amount of surface fibre is essential. Moreover, such fabrics are not suitable for a close-cut operation, as the threads would become too bare and distinct, and the patterns too well defined.

*Clear-faced Woollens.*—The clear-cutting of woollens is applied to twist-warp fabrics of the whipcord and buckskin type, and also to well-felted double-plain fabrics. The cloths have quite different qualities to the Cheviot, being made of different materials and undergoing a routine of finish which makes a close texture. At the same time the fabrics, in some instances, are more firmly woven than a Cheviot. Clear-cutting, therefore, brings out the characteristics of such cloths when finished, namely, smartness of definition of pattern, whether due to colour, weave or both.

*Soft-finished Woollens.*—In these fabrics, closeness of cutting would not be an advantage, because the softness or kindness of handle is a special quality of woollens of this class. The cloths are not milled to the same extent as in a clear-cut finish, but



left more elastic or supple. To remove all surface fibre would have a somewhat similar effect to clear-cutting on a Cheviot.

*Botany Worsted.*—These are treated according to the quality of the yarns, and the style of finish. In Botany fabrics the finish may be either milled or unmilled, each being differently treated in cutting. A smart, clear surface is one in which cutting is done almost as closely as possible, removing all surface fibre from the threads, so that weave, design and colour-effect are well defined. On the other hand, in a milled finish, the face of the fabric is not cut so clear, and the fibre left on the surface improves its handle.

*Crossbred Worsted.*—These are usually clear cut, though there is considerable difference as to the degree of closeness. When in Crossbreds, shrinkage is practised, it is not usual, as in milled Botany worsteds, to cut clear.

*Pile Cloths.*—First, in which there is a vertical pile, as in rugs and velvet-finished cloths, where, if cutting is done, it is only to top or level the fibres. Second, in meltons, where close-cutting is not required, as it would make the surface of the fabric too bare, reducing the wearing quality. Third, in dress-face fabrics, cutting has to be very carefully done, with the object of getting an even pile, short, but not too close, as the lustre and density of the pile are important qualities of the finish.

The consideration of these cloths makes it evident that though a mechanical work, “cutting” must be practised with judgment, and with regard to the quality and character of the fabrics treated. Minute and frequent adjustment of the cutting parts is an essential of good work in the running of the machine.

The fabric should be examined after each operation, care being exercised that it is not sheared too “close”. This, in any quality or make of cloth, tends to impair the fulness of handle and also to diminish the wearing quality. By removing such a quantity of fibre as to leave the threads of warp and weft too distinct, a fabric is produced, which, in the made-up garment, soon becomes shiny and unsatisfactory. Whether a Cheviot or a Crossbred fabric, in which shearing should have but a “topping” effect; or a dress-face woollen, in which it should produce

a perfectly even pile of fibres ; or in a fine worsted, where the idea is to acquire clearness of weave and colour pattern, cutting should not be continued until the texture suffers in softness and quality.

(99) *Cutting Machines.*

The two types of cutting machines are the "Cross-cut," and the "Perpetual". The cutting parts of the former (Fig. 134)

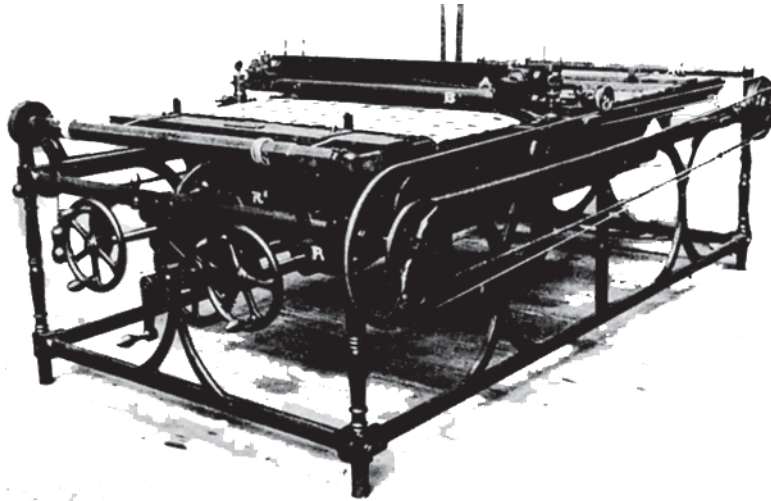


FIG. 134.—Cross-Cutting Machine.

operate from selvedge to selvedge of the piece, and of the latter (Fig. 135) from end to end. As already stated, the Cross-cut is the original construction of machine. Though not now used to any considerable extent, it has still a useful place in a plant of finishing machinery. To obtain the smartest effect by cutting, either on a fine woollen or worsted, both the cross-cut and the continuous method of cutting may be practised. That, generally, only the latter is done, is chiefly on account of economy of routine, Cross-cutting being a longer operation than cutting on the Perpetual.

In figured or spotted designs, in which the effect is due to the weft (*e.g.*, vestings and certain classes of dress and mantle cloths), it is useful to cut in a line with the weft yarn. Should the fabric have a warp or weft face, a "clear" cut is better obtained by practising both systems. The same also applies when the warp and weft yarns are equally on the upper side of the fabric. Reverting, for example, to the texture illustrated in Fig. 90, in cutting such a fabric on the Continuous machine, a portion of the extraneous fibre would be only partially affected. Filament betwixt the warp threads would be more evenly shortened or removed—according to the closeness of the cut—by also treating the piece on the Cross-cutting machine. Still, it should be observed that in the ordinary classes of fancy and wool-dye woollens, and of fancy and piece-dye worsteds, the Continuous machine is, in practice, the one chiefly used.

(100) *The Cross-cutting Machine.*

This consists of the frame in which the piece is stretched in lengths, passing from one piece roller R to another roller R<sup>1</sup> (Fig. 134). The cloth is carried over a flexible bed, above which are fixed the cutting parts A. These all operate in a carriage B, which runs across the machine, or from list to list of the piece, cutting taking place at the same time. On reaching the opposite side of the machine to the starting-point, the cylinder is automatically put out of gear, and may then, with the other cutting parts, be readily drawn back by the operative to the normal or starting position. If the length of cloth treated is satisfactory, it is wound from the starting to the finishing roller. By this means, the same stretch of fabric may be operated upon as many times as required.

(101) *Continuous-cutting Machine.*

A view of this machine is given in Fig. 135, and two end elevations in Figs. 136 and 137. (The letters in the illustrations indicate corresponding parts.) The method of driving is shown in Fig. 136 and the routine of the piece in Fig. 137. The driving

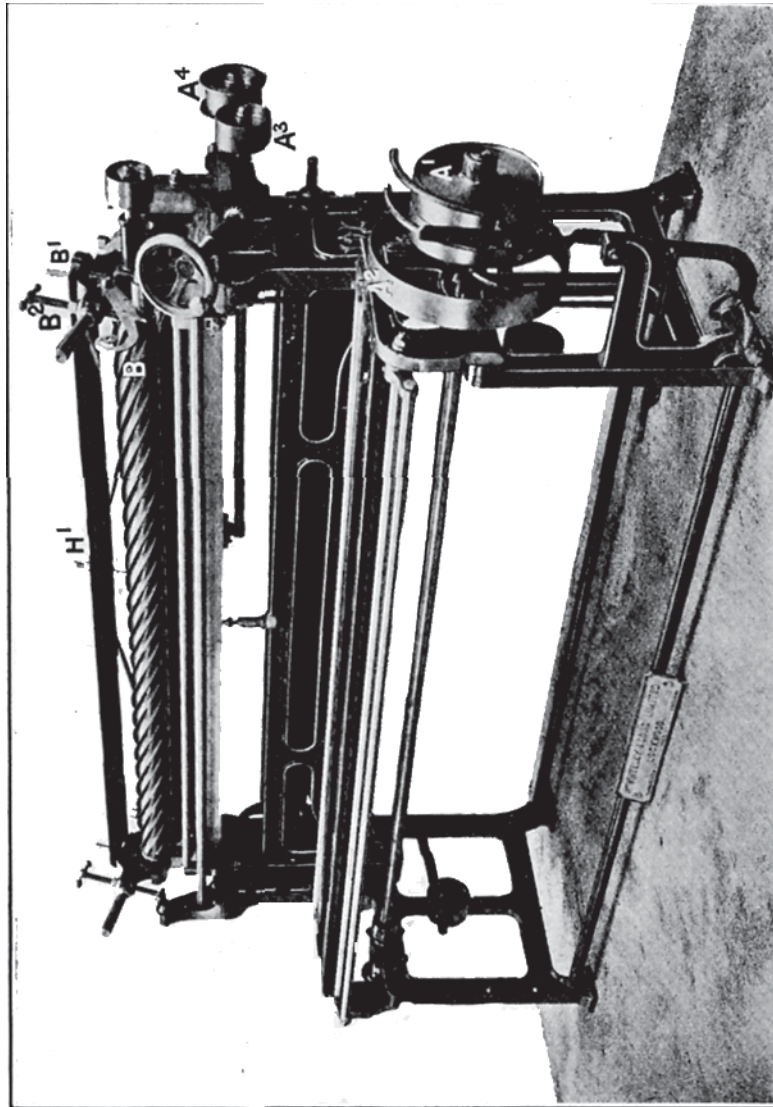


FIG. 135.—Whiteley's Perpetual, or Continuous Cutting Machine.

is effected by belt round  $A^1$ . First, motion is given by  $A^2$  to the cylinder B, by strap passing round pulleys  $A^3$  and  $A^4$ , enabling

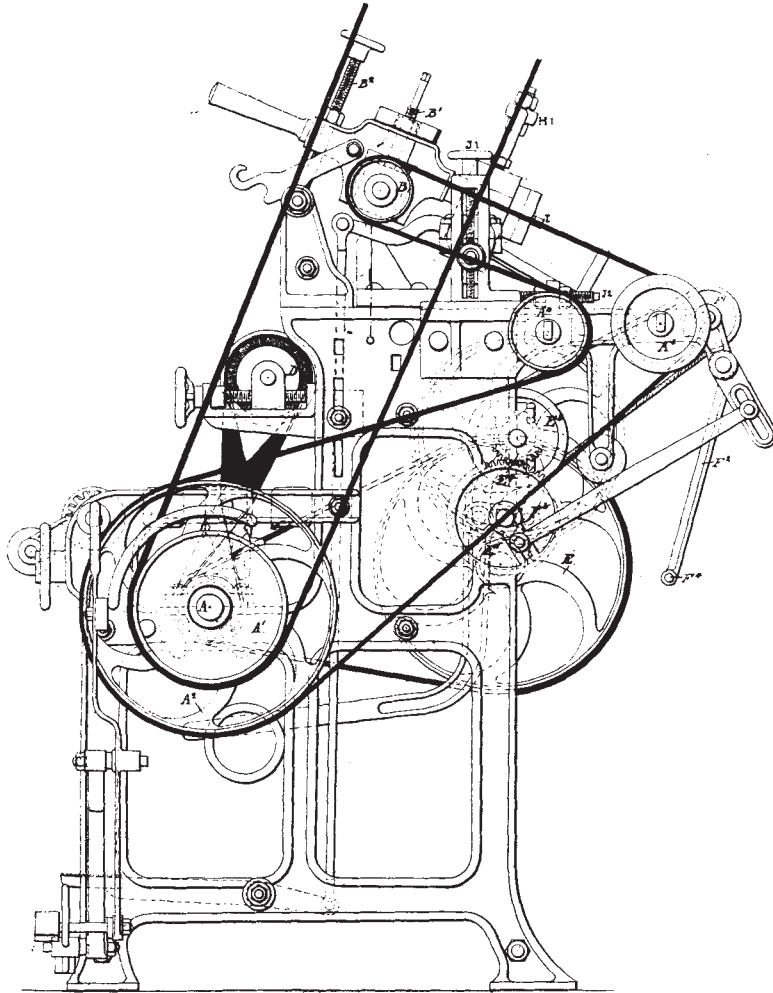


FIG. 136.

the operative to raise the cylinder and cutting parts, from the face of the cloth, and prevent accidents or damage to the piece. Should there be any knot, snarl, or irregular place from whatever

cause, by this system of cylinder drive the cutting or cropping mechanism can be put out of action, and yet the piece continue to travel forward.

The remaining parts, namely, the fan, the brush, the draw roller, and the folding motion, Fig. 137, are operated as follows :

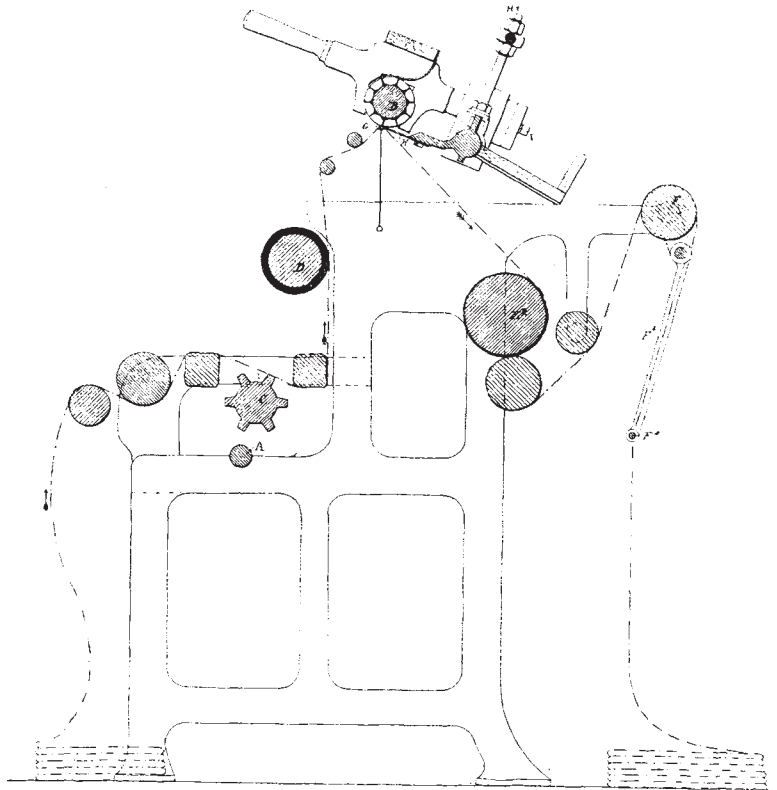


FIG. 137.

The fan C is driven by open belt passing round pulley on shaft A ; and the brush D, by a cross belt passing round a pulley on the same shaft. The wheel on the shaft of the draw roller E<sup>2</sup> (Fig. 136) is driven by E<sup>1</sup>. On the shaft of this roller is a pulley E<sup>3</sup>, and a band passing round it and the pulley F<sup>1</sup>, drives the feeding roller F of the folding motion. On the shaft of E<sup>3</sup> is a pinion E<sup>4</sup>, gearing with the wheel mounted with crank F<sup>3</sup>, which, by lever



connections, gives motion to the folding arm  $F^2$ , carrying the cuttler bar  $F^4$ .

*Routine of the Piece.*—This is shown in Fig. 137. It is clearly indicated how the piece travels through the machine to the folding motion. First, round guide rollers, between tension bars to supplementary fixed guides, over the "bed" or surface  $G$ , to the draw or drag roller  $E^2$ , and thence to the folding motion. The degree of tension applied to the fabric can be regulated. The beater or fan  $C$  is useful in loosening the fibre on the surface of the fabric. The brush  $D$  further prepares the texture for the cutting or cropping operation. Sometimes an emery roller is used in place of the brush, and has a more severe action. The degree of tension on the piece is modified, in the first place, by a number of fixed, smooth bars and guide rollers, over and under which the piece passes; and second, by the draw or drag on the piece by roller  $E^2$  and the roller beneath it, which are kept in contact with each other by weighted lever.

Too much importance cannot be placed on maintaining the cloth at one uniform tension, not only from end to end, but from list to list. Successful work is dependent upon this, as upon the efficiency of the cutting parts. Adjustment and attention to both are essential.

(102) *Setting of the Cutting Parts.*

This is all-important in the treatment of worsted and fine woollen fabrics of every grade. Should the cylinder not be truly set, that is, level in relation to the lower cutting blade, there will be unevenness of result, very difficult to overcome. It is, of course, understood that any inequality in the cutting efficiency of the lower blade, in the bed or surface over which the piece passes, or in the setting and grinding of the spiral blades of the cylinder, will cause defective work.

For the cylinder, there are several points of adjustment. These are seen in Figs. 135 to 138, the latter being a view of the cutting parts placed in a vertical position, or removed from the cloth. It is necessary to be able (1) to adjust the cylinder in relation to the blade; and (2) the cylinder

and the blade as regards closeness of contact with the piece. Screw B<sup>2</sup> lowers both the cylinder and the blade on to the

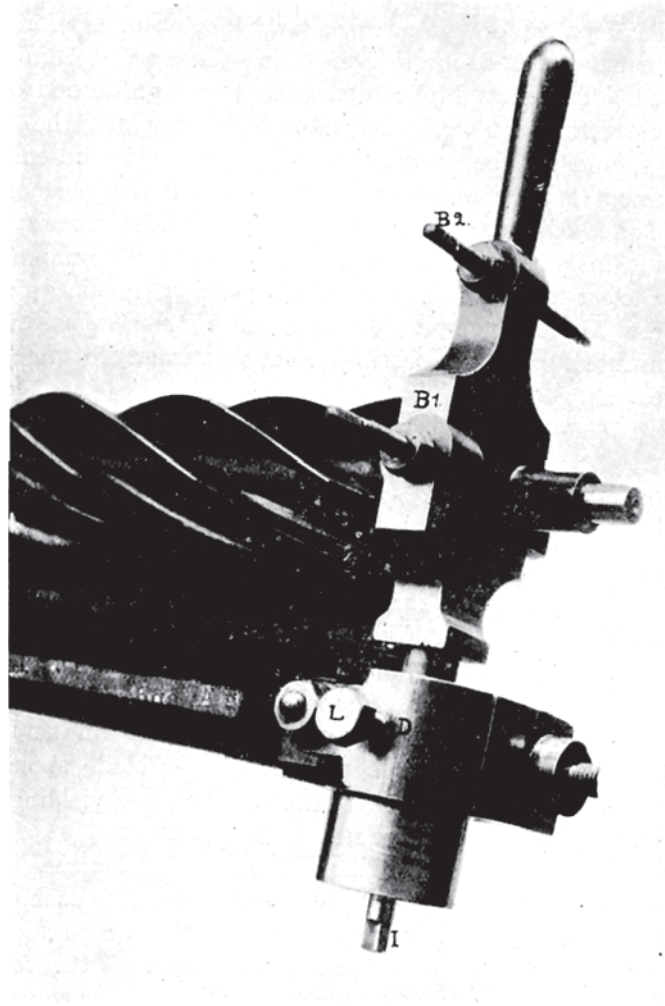


FIG. 138.

piece, increasing the severity of the cutting process. Sometimes in practice, instead of altering the screw, small, thin metal

pieces are placed under the bottom of the screw. To get a cleaner cut, by bringing the cutting parts into closer contact with each other, screw B<sup>1</sup> is altered. For pressing the cylinder forward or backward, screw I is used. Before this screw can be turned, the lock nut L on the bracket D must be released. There are duplicate parts at the opposite end of the machine. Providing, as may happen in working, the lower blade should not be so true in the centre as at the ends, an adjustment may be made by screw H<sup>1</sup>, which is placed on the stay of the bed of the lower blade. The entire headstock of the machine may be lowered or highered by screw J<sup>1</sup>, and moved nearer to, or further from the bed over which the piece passes, by screw J<sup>2</sup>. This screw system of altering the parts makes the minutest changes possible, yet permanent to the parts affected.

(103) *Form of the Bar, or "Bed," under the Cutters.*

The surface over which the piece passes in cutting may be rigid or flexible. This surface, or "bed," as it is technically termed, is illustrated in Fig. 139 in different forms, solid as in A and E, spring as in B, and hollow as in C and D. In the woollen and worsted trades the solid type A, and spring type B, are generally used, these being more suitable for fine and true cutting, but they necessitate that the lower blade should be evenly set. The spring type is necessarily more yielding, and adapted for fabrics which are not cut so close.

Fig. 140 is the form of bed patented by Martin. As is shown, it consists of two parts B and C, secured to each other, leaving a space of a fraction of an inch through which is passed a glazed texture. The upper and lower portions of this texture are looped, a rubber tube H being inserted in the former, and an iron rod or weight J in the latter: the remaining parts are similar to those in the ordinary "Cutter". The object of this improvement is to have a more elastic surface for the piece to

pass over, so that any knots would sink into the bed, and so prevent holes being made by cutting.

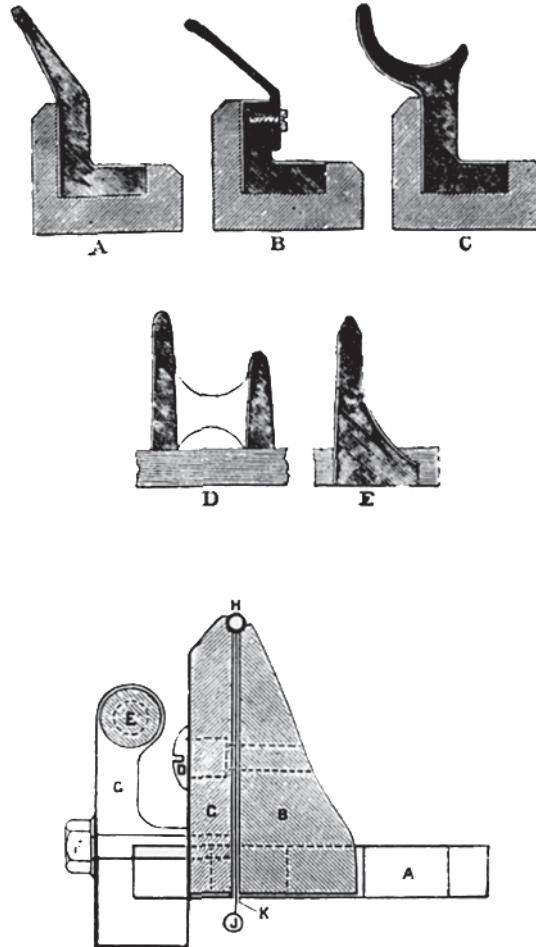


FIG. 140.

Whatever the form of the bed, it should present an even surface to the cutting blade. Any inequality in the slightest degree will cause irregular shearing.

(104) *Machines with Two or More Cylinders.*

Machines of this type are constructed with two, three or four sets of cutting parts. They are chiefly employed in the finishing of stuff fabrics and certain classes of linens. The idea is to complete the process at one passage through the machine, securing as many as four successive croppings at one operation. This work in a single machine would necessitate the piece being treated four times. It is, therefore, an economical system on the classes of fabrics named, but is not adapted for the ordinary classes of woollens and worsteds. A more gradual removal of the surface fibre, and acquirement of the requisite closeness of contact of the cutting parts with the piece—adjusted as found desirable after each cut—gives in these cloths a more satisfactory effect.

Another feature to be noted in the use of compound machines on woollens and worsteds is that any fault in the yarns, such as knots or slubs, would be likely to produce more serious damage before being discovered than in the single cutter.

Fig. 141 is an illustration of a three-cylinder machine. The method of driving the cylinders C, C<sup>1</sup>, C<sup>2</sup>, is shown, and is similar to that in a single machine. The first cylinder may be raised off the bed in the usual way, and the second and third cylinders by levers H<sup>1</sup> and H<sup>2</sup>. There are tensioning bars, brush, and guide roller in front of each set of cutting parts, the piece being tensioned as in a single machine, as it passes forward to each bed, which may be hollow, spring, or solid. The first two brushes run against the piece, and the third with the piece. The first cylinder is for rough cutting, the second for the intermediate cut, and the third for the finishing cut. One advantage of the compound machine is great economy in time. In such a three-cylinder machine, the piece may be cut at a speed of 15 to 20 yards per minute.

(105) *Grinding.*

This is not an actual finishing operation but concerns the keeping in good working condition the spiral blades of the cylinder, and of the lower or fixed blade. The work is performed

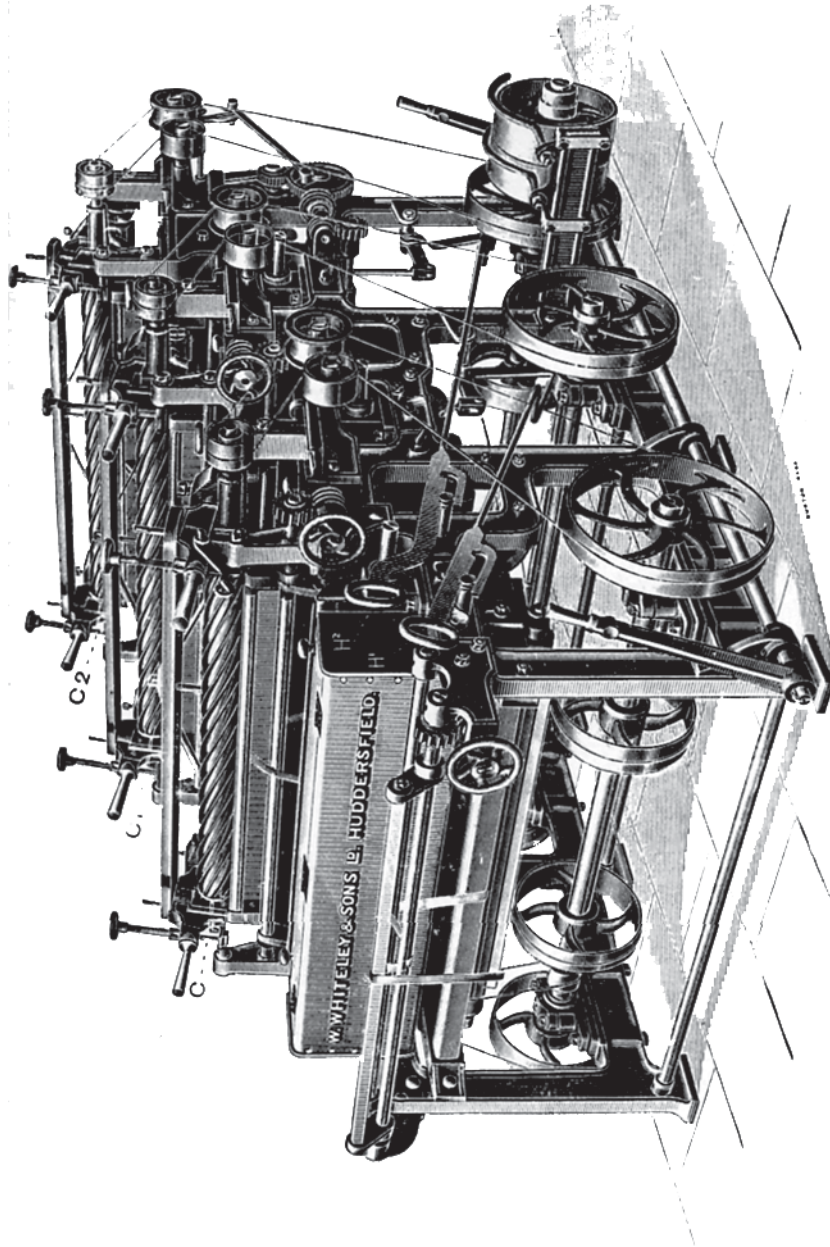


FIG. 141.—Triple Continuous Cutting Machine.



in the grinding frame. Three frames may be used for convenience and economy, namely, Fig. 142, a second frame in which the iron roller for grinding the lower blade is fixed, and a third frame in which the cylinder runs in contact with the lower blade, and in the reverse direction to that when cutting. As a rule, in the factory only one frame, that illustrated, is used, so that the process of grinding, which includes the three parts named, is done on this machine.

The machine consists of suitable bearings for the cylinder, and framing for fixing the lower blade when running in contact

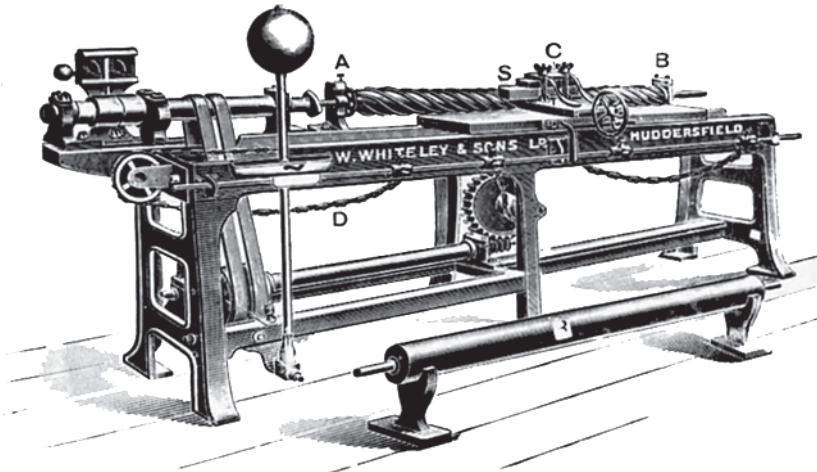


FIG. 142.

with roller R; of the carriage C, in which the strickle S is mounted, and of chain gear drive D, and also of reversing motion for the carriage. The strickle has a rough surface, about two inches across and twelve inches long, composed of a mixture of emery and glue. It is fixed by screw adjustment in contact with the spirals. When the machine is in action, the cylinder makes some 600 revolutions per minute. The strickle is carried from A to B, and a few inches beyond each point, the grinding and sharpening of the blades being effected during the forward and backward traverse of the carriage.

To grind the lower blade it is fixed in bearings on the frame-

work of the machine, and has a sliding movement to and fro. It is placed in contact with roller R, also fixed on the frame, and running at a high speed. For trueing the blade after grinding, it is run with the spiral cylinder, the latter, as stated, revolving in a reverse direction to that necessary in cutting. In the first of these operations, oil and fine emery are applied, and in the second, oil only.

## CHAPTER XI.

### LUSTERING PROCESSES AND MACHINERY.

(106) The Production of Lustre on Woollen and Worsted Fabrics. (107) Steaming and Cooling Machines. (108) Pressing. (109) The Vertical Press. (110) The Rotary Press. (111) Intermittent Pressing Machine.

(106) *The Production of Lustre on Woollen and Worsted Fabrics.*

IN certain classes of woollen and worsted textures, the production of lustre or brightness is an essential of the finishing routine, but this quality should not be obtained to the detriment of the handle of the cloth, nor should it be of a fugitive nature. It is, of course, known, from the simple manual work of ironing, that heat and pressure impart brightness and evenness to a woven surface. The application of these develop and fix the lustre on a sateen lining, but in woollen and worsted finishing, heat and pressure are only two of the causes which produce a smooth, level, bright texture.

Lustre is obtained in finishing by the following :—

(1) Boiling, (2) Blowing with steam, (3) Steaming and boiling, (4) Blowing with steam and exhausting or cooling, (5) Hot Pressing.

Methods 1, 2, 3, and 4 are of a similar nature, but vary as to the degree of lustre they impart. Each method, with its application, requires to be considered separately.

*The Process of Boiling.*—This is the oldest process of producing a permanent lustre on a fine woollen fabric. Doeskins, beavers, and other dress-face cloths, are submitted to this operation. It is not applicable, in the same degree, to “face” cloths in which fancy colours are used in the warp and weft. A

typical doeskin is boiled for several hours both before and after dyeing, a process which would tender the fabric if not made of a sound quality of wool. Thus, a doeskin piece, after the first raising routine, is tightly wound on a smooth wooden roller tail-end first, boiled for the requisite period of time, allowed to cool, and then rewound head-end first, and reboiled. Repeated raising, boiling, and cooling follow until the correct quality of brightness has been obtained. All conditions are induced likely to bring out the lustrous quality of the fibres. Curliness or waviness is eliminated. The fibres are spread on the face of the cloth, and are in a state of compression, due to the tension applied in winding the piece on the boiling roller, when subjected to the boiling process.

*Blowing with Steam.*—This is a simple process for levelling the face of the fabric, and also for developing some lustre. It consists in wrapping the piece on a perforated roller with a cotton wrapper, with the face of the cloth to the wrapper. It is done on the winding-on frame, which has an ordinary roller on to which the piece is wound, with the wrapper in the first instance, and then rewound, well tensioned on to a perforated roller, with several rounds of wrapper both at the beginning and the end of running on to this roller. The ends of the wrapper are secured, and steam is blown through the piece either in the frame and revolving, or fixed vertically on a steam kettle. Cooling follows, and rewinding from the opposite end of the piece, repeating the process of blowing.

It is useful prior to scouring fabrics made of Crossbred or other yarns which might be creased in scouring, and in piece-dye fabrics before dyeing.

*Steaming and Boiling.*—It should produce an even fabric free from creases. Crabbing is a process of mild boiling and steaming used in the finishing of worsted fabrics. The routine consists, briefly, in winding the piece face down, with a cotton wrapper, on a roller, and boiling for a short time, then rewinding on to a perforated roller, where it is blown with steam, allowed to cool, and the operation repeated from the opposite end of the piece.

*Steaming and Cooling.*—This is a compound process, and consists in blowing the pieces with steam, when tightly wound with a cotton wrapper, on a perforated zinc or copper roller. In this condition, cool air is forcibly drawn for some minutes, by means of a pump, from the outer to the inner round of the piece.

A number of yards of canvas or coarse fabric are first wound on to the roller, and then a length of steaming wrapper (well-woven cotton cloth with a smooth face), the operation being completed by running the cloth and the wrapper together on to the roller. This done, a few more rounds of wrapper are applied, and then the ends secured, as in the process of steaming and blowing already described; but here the roller revolves in the horizontal position, as seen in Fig. 143. The process of cooling takes place after blowing, the pump being used for this purpose after turning off the steam supply. In a short time the condensed steam is discharged, and the piece left in a cool and natural condition.

By another system, common in Germany, the piece, after being wound on the perforated roller, is passed into a horizontally fixed cylinder, which is then closed at the ends. Steam is forced through the successive rounds of the piece from the outside to the inside, the condensed steam passing away from the interior of the roller. The process is repeated from the reverse end of the fabric, and the piece again steamed. A pump is also used for cooling and conditioning the piece.

The English system leaves the cloth in a good condition as to handle and brightness. It does not produce an artificial gloss, or an effect which is imparted to the fabric, rather than a quality which it possesses and which is developed by the finishing operation. The theory of the English system may be described. In the first place, there is the winding of the piece, well tensioned, and in contact with a strong cotton texture, on to the perforated roller. This stretching and compressing produces evenness of surface. No creases or marks, or faults due to irregularities in tension either on the warp or weft of the piece, should be possible; in the second place, when the piece is in this condition, steam, at a pressure of 40 or more lb. to the square inch, is forced

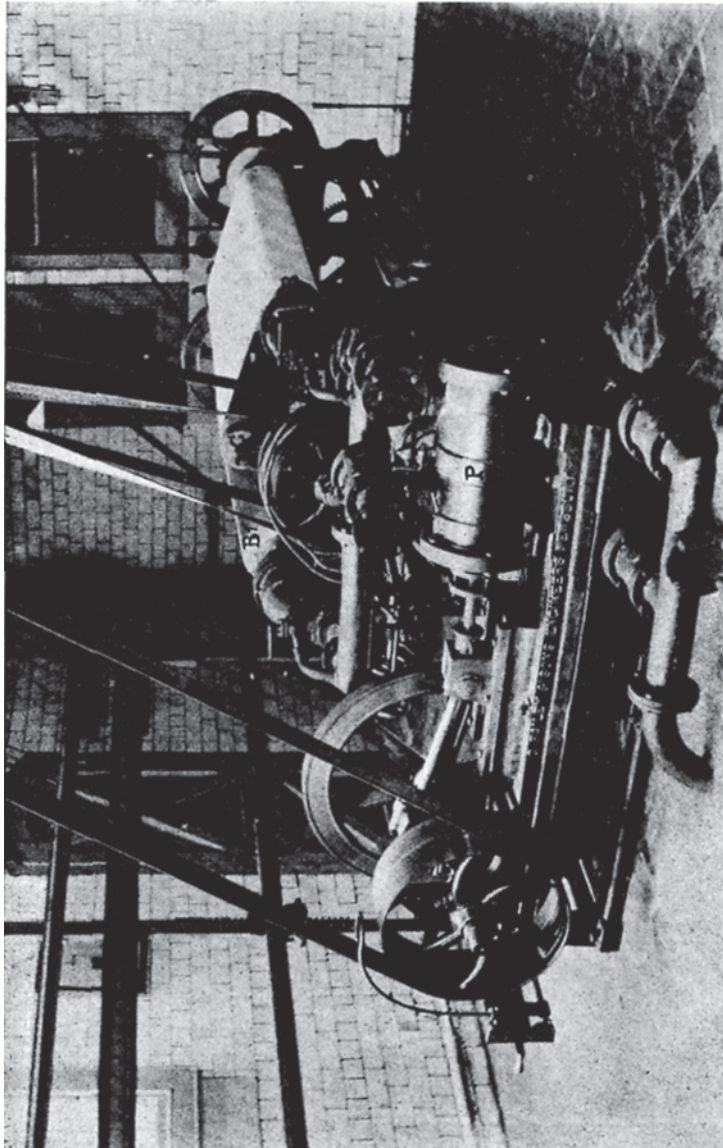


FIG. 143.—Bailey's Steaming and Cooling Machine.



through the fabric, every interstice between fibres and threads being affected, and both the materials and yarns softened and brightened; in the third place, there is the cooling process, which gives condition and quality to the cloth. This system of producing lustre is applicable to all classes of worsteds, piece-dyes and fancy fabrics, and also, according to the finish required, to ordinary Saxony and Cheviot cloths.

(107) *Steaming and Cooling Machines.*

The usual form of these machines is that illustrated in Figs. 143 and 144. It consists of two perforated rollers B B<sup>1</sup>, pump P, and smooth wooden roller and trough for boiling. The perforated zinc or copper rollers are six inches in diameter, and have friction brakes attached for varying the tension on the wrapper and piece, when winding from one roller to the other. On each perforated roller are four yards of canvas, which are a protection to the piece when the steam is first turned on, absorbing any condensed moisture.

In actual working, ten yards of cotton wrapper are first run on to the roller on which the piece is to be wound. The piece is then taken between brake guides A, A<sup>1</sup>, (the angle of which may be altered to give the necessary tension) and run, with the wrapper, on to roller B<sup>1</sup>. This done, a number of yards of cotton wrapper are added, and the ends tied. The piece and the wrapper should be as near the same tension as possible; in winding on, the higher the tension, the greater the lustre developed.

In applying the steam, it is important that the condensed moisture should first be removed. This is done by opening the valve of the perforated steam feed pipe which runs from end to end inside the perforated roller, with the pump also acting for a short time. The outlet valve is then closed, a small escape valve slightly opened, and the steam allowed to circulate through the piece. In this manner the piece is evenly steamed, the process being as effective at the end farthest from, as at the end nearest to, the surface of the roller. After steaming for a few minutes, the steam supply is cut off, and the large valve at



FIG. 144.—Whiteley's Steaming and Cooling Machine.

the end of the perforated roller opened. The pump is also set in motion, drawing air from the outside to the inside of the roller, rapidly cooling and conditioning the cloth. The piece and the wrapper are then taken over roller C, and wound on to roller B, and the process of steaming and cooling repeated. The advantage of the two perforated rollers is, that while one piece is being delivered from the underside of roller B<sup>1</sup>, a second piece and the wrapper are passing over roller C to roller B.

(108) *Pressing.*

There are three distinct systems of pressing: (1) in the hydraulic vertical press (Figs. 145 and 146); (2) in the rotary press (Figs. 147 and 148); and (3) in the intermittent machine (Fig. 149), in which the pieces are pressed in yard lengths.

They differ from each other in essential principles. In the vertical press, the entire piece is pressed when folded or cuttled with press papers at one time, the fabric being in contact with heated paper surfaces; whereas in the continuous machine the pressing takes place in lengths of fabric, either in passing round a heated metal roller, or between flat metal plates. The movement of the piece is constant in the rotary press, but intermittent in the Nussey and Leachman machine.

There is a difference in the result, both as to the handle and lustre given to the texture, by pressing the piece for several hours in contact with smooth card-boards, in which condition heat is imparted by electricity or by hot plates, and by pressing the piece for a brief period between heated metal surfaces; but each system has advantages, which will be indicated.

(109) *The Vertical Press.*

Fig. 145 shows a front and end elevation of the vertical press. It consists of an upper and lower fixed flat metal piece, secured together by four iron pillars. Underneath A, and passing through it, are one or two rams or cylinders carrying the piece table D. The prepared pieces are placed on the table, filling the space between D and B, and then the table is raised by hydraulic pressure.

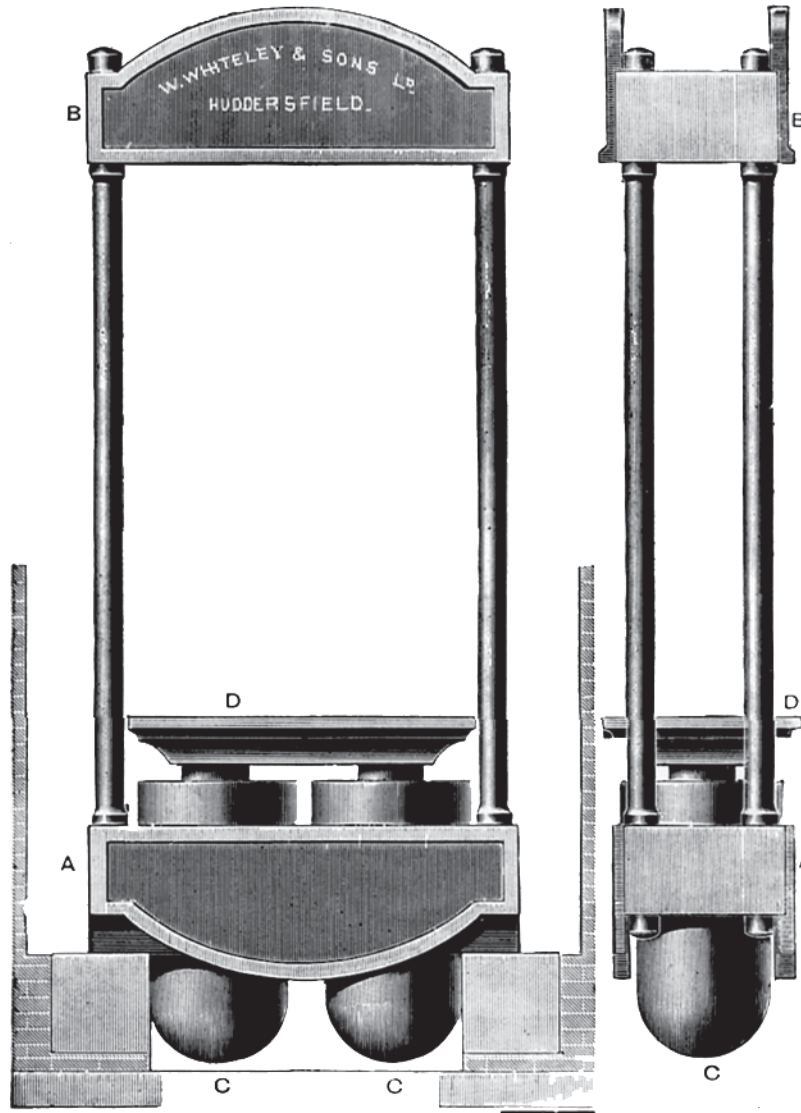


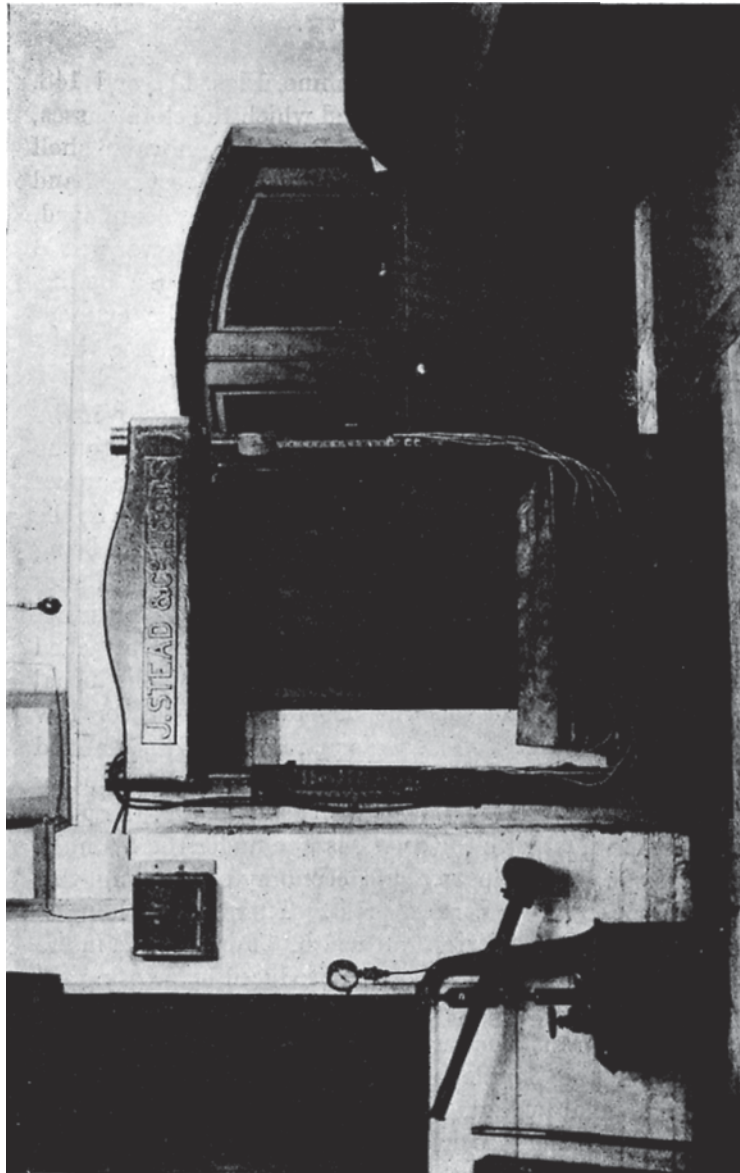
FIG. 145.—Vertical Press.

In preparing each piece for the press, it is folded down the centre. Two kinds of card-boards are used, and also metal fencings. The thinner press papers are inserted between each layer of fabric. When the work of cuttling and papering has been done, a piece is placed in the press, three hot metal plates being first laid on the table D, and on the top of these a metal fencing, a thin strip of iron; then follows another piece, folded in papers as described, and on this are placed card-boards and metal fencings, and three additional hot plates. This is done for every piece put in the press.

The press having its full complement of pieces, the hydraulic pump (A, Fig. 146) is started, and the requisite pressure applied. The pieces remain for the first pressing about two hours, then they are refolded and repapered to take out the cuttle marks across the piece. In the second operation, the pieces remain in the press, usually overnight or until cool. Steaming follows, as a rule, to remove any unnatural gloss and stiffness of handle.

Another system consists in using specially prepared boards having metal pieces at the front edge, by which heat, developed by electricity, can be distributed over the surface. Cuttling and preparing is done in the same way, only the heat distributors or boards are applied after every twelve layers of cloth, or may be, more frequently, if greater heat is required in pressing. It will be seen from the illustration (Fig. 146, section of Finishing Room, Leeds University) that on this principle a switch-board is placed on either side of the press, and, at convenient intervals, an electric current is supplied to the heat generators or boards. In this way a more uniform heat is developed throughout the successive layers of cloth in the press.

By the hot plate arrangement, the ends of the pieces, and layers nearest to them, necessarily receive and retain more heat than the layers approaching the centre folds or cuttles, whereas, by the electric system, the heat is more evenly distributed, with less danger of scorching the ends of the pieces, which sometimes happens in the pressing of light fabrics with the hot press: the charging of the press is also more economically done.



C

B

A

FIG. 146.

A = Hydraulic pump. B = Press. C = Press table.



(110) *Rotary Press.*

This is a continuous Pressing Machine, Figs. 147, and 148. It consists of the main cylinder C, round which the cloth passes, upper and lower dishes or beds A and B, with removable shell of nickel silver, requisite guide rollers, brush or beater E, and cooling arrangement F. Three powerful rams R are employed, connected with a hydraulic pump. These lift the lower bed B and also the cylinder. Pressure on the cloth is applied by lifting the lower dish B against the cylinder, and the cylinder against the upper dish A, these parts being steam heated at a pressure of 50 to 75 lb.

The cloth, as seen from Figs. 147 and 148, passes over the guide G<sup>1</sup>, under G<sup>2</sup>, being brushed by E as it passes to the crimping-board or roller D, under the cylinder C, over the upper part of the cylinder to the front top guide roller G<sup>3</sup>, then over the cooler F to the folding motion, five to seven yards of cloth being pressed per minute. The fan F<sup>1</sup>, which has a high velocity, forces a current of air through the piece immediately after pressing, cooling and conditioning the cloth. The steam gauge attached to the machine indicates the lb. per square inch. The usual pressure on fine worsted goods is 300 lb., and that for low tweeds and union fabrics 700 lb. per square inch. It is claimed that the lustre obtained in this way is permanent. In another form of this machine only a lower dish is used, and the piece pressed once and not twice for each passage under the cylinder.

As regards productive power and economy of working, this machine is superior to the vertical press. There is no folding of the pieces, and they are pressed full width. Perhaps the lustre obtained is not quite so natural as that produced by pressing between press papers. Being so rapidly done, and whilst the piece is in motion, the press is more in the nature of a glaze than a soft lustre, and the handle of the cloth is not of the same character. The chief advantage is that of high productive power, and for this reason, and also on account of the comparative firmness and solidity of texture, it is suitable for the low-class

woollen and the union trade. The older and slower system is generally preferred in the finishing of high-class woollens and

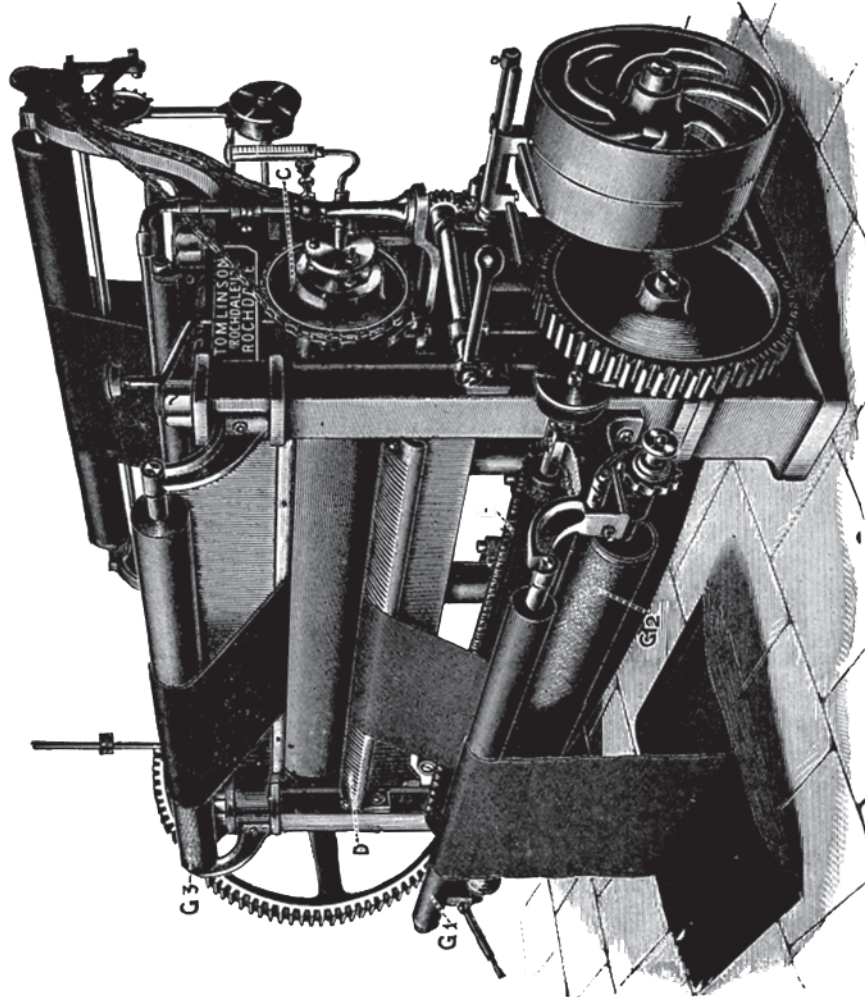


FIG. 147.—Tomlinson's Rotary Press.

worsted. Still, the rotary machine is used in the worsted trade in pressing prior to dyeing, the vertical press being used for final pressing.

(111) *Intermittent Pressing Machine.*

This is constructed in two forms, the smaller type of machine being illustrated in Fig. 149, and the larger type by the sectional drawings (Figs. 150 and 151). The pieces being pressed on a

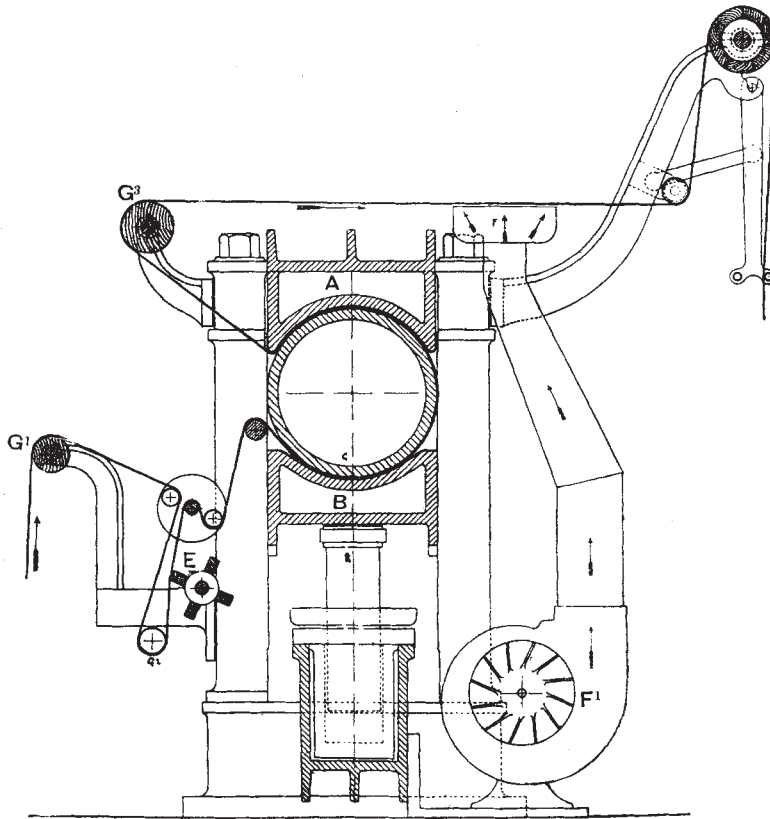


FIG. 148.

flat surface, and not on a cylinder as in the rotary machine, have necessarily an intermittent forward movement, and are pressed four times per minute. The pressure applied is from 350 to 500 tons at each stroke. In the sectional drawings (Figs. 150 and 151) two pieces are shown, one above, and the other below the central and steam-heated plate, which is brought into contact

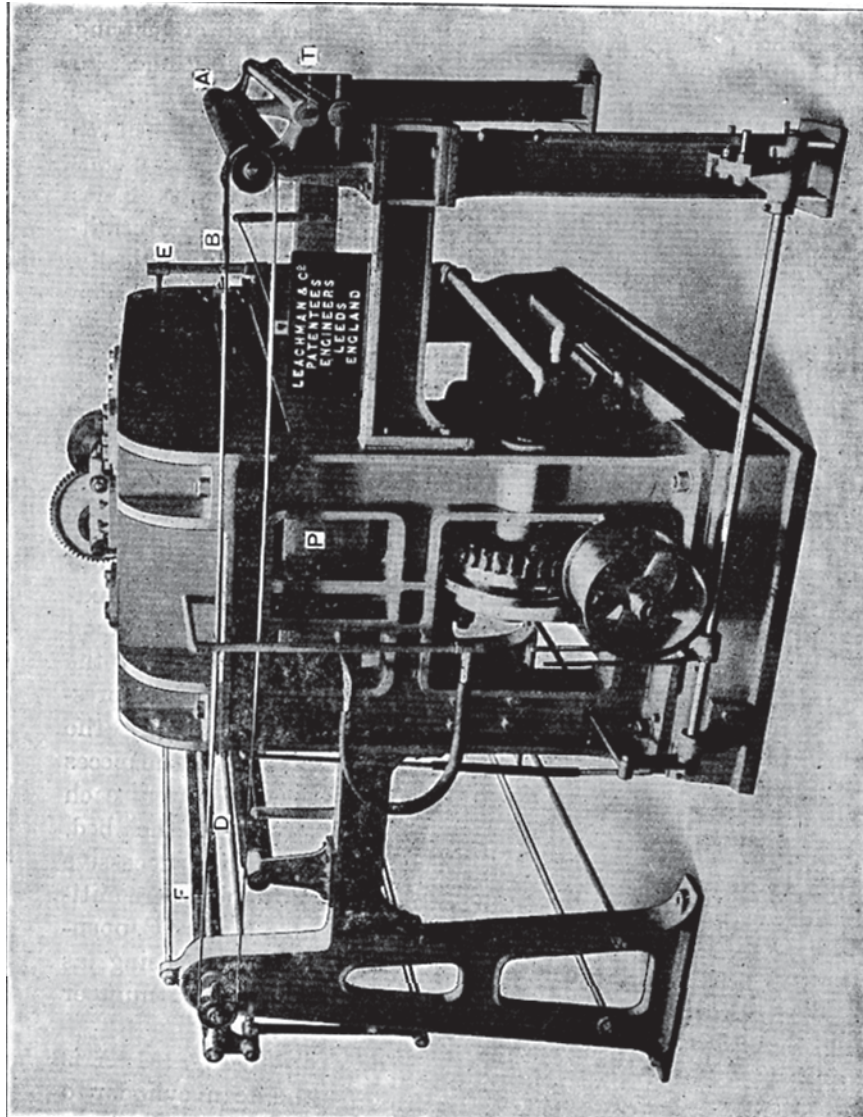


Fig. 149.

with the lower and upper portion of the machine by hydraulic

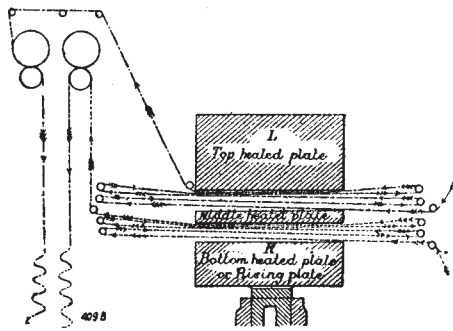


FIG. 150.

pressure, imparting an equal degree of lustring and smoothing effect to each layer of fabric.

The sectional drawings indicate the means for controlling the parts of the press, intermittently and automatically, by the compound cam C; and also the mechanism for producing the conveyance of the pieces from the feed to the delivery rollers.

The cycle of movements comprise, (1) the lifting of the pressure bed K by a small ram inside the large one; (2) the action of the large ram applying the maximum pressure upon the pieces; (3) the removal of the pressure; and (4) the drawing of the pieces forward after each stroke of the bed.

All these successive movements are initiated by cam C, opening and closing, as required, a number of valves.

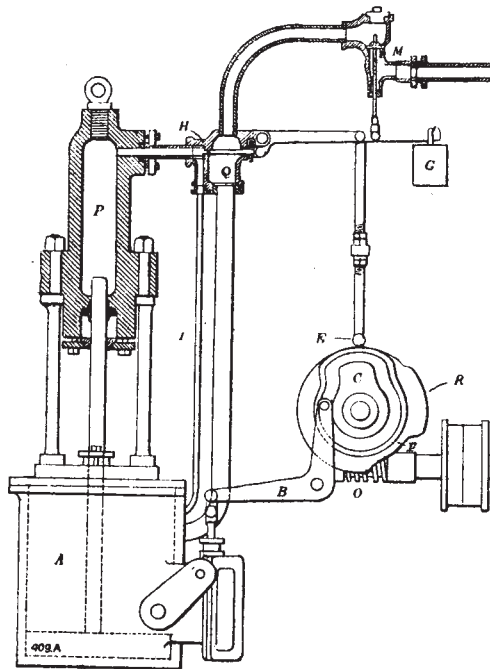


FIG. 151.

In Fig. 151, A is the steam cylinder to which steam is admitted by a slide valve operated by the bell crank lever B. The two steam

valves. In Fig. 151, A is the steam cylinder to which steam is admitted by a slide valve operated by the bell crank lever B. The two steam

pipes Q and I are in connection with the two rams, the smaller of which brings the large ram and the plates up to their work. Communication is opened by valve M, between an elevated tank and the large hydraulic cylinder. The hydraulic pump operates when lever connections come in contact with Q, opening valve H. After the full pressure has, for a brief period, been exerted on the cloth, it is, of course, necessary, in order that the piece may travel forward, that the bed K should be lowered. This is accomplished by the projection lifting the runner E, and by the upright connector raising the valve M, forming an exhaust passage.

The conveyance of the cloth through the machine is shown in Fig. 149. On the lower plate or bed is fixed a stop, which sets the drawing rollers in motion, with the releasing of the pressing of the cloth. The pieces pass between a pair of tension rollers T, over front guide roller intermittently driven, between the lower draft or space B, under the roller D, over the roller, returning through the same draft, round roller A, into the upper draft E to the back roller F, and folding motion.

The intermittent movement of the cloth is controlled by the action of the press bed P. During its pressure on the cloth, by a friction drive arrangement, not shown, the movement of the draw rollers is arrested. The plates between the two drafts B and E are steam heated, and the pressure by means of bed P is also under steam control.



## CHAPTER XII.

### METHODS OF FINISHING.

- (112) Routines of Finishing. (113) Woollen Routines of Finishing.  
(114) Worsted Routines of Finishing. (115) Routines of Finishing for  
*Union Fabrics.*

#### (112) *Routines of Finishing.*

THESE vary with the type of woven manufacture. In the woollen trade, where the whole routine of work is carried out, as a rule, in the same mill, the finish may be diversified, or arranged, to suit the quality of the raw material, and the structure of the yarns and fabric. Or, to put it in a different way, the material may be selected, the yarn carded and spun, the texture set in the reed, and in regard to picks per inch and other technicalities, for a specific routine of finish. This is also done in worsted manufacturing, but the facilities for carrying out the same are in favour of the woollen manufacturer. The worsted trade is distinctly departmental, or sectional, comprising the top maker, the yarn spinner, the manufacturer, and the finisher. The system has, no doubt, economic features. But the textile manufacturer, producing from the wool to the finished cloth, can devise methods and routine which will impart a character to the finished product distinct from the design and colouring which may obtain in similar classes of fabrics made by a competitor.

#### (113) *Woollen Routines of Finishing.*

The following are examples of methods of finishing Saxony and Cheviot fabrics :—

## SAXONY FABRICS.

## No. 1. ORDINARY SAXONY SUITING.

Milled, soft finish, with a slightly fibrous face.

Wool: Sydney.

Warp: 20 skns. left hand twine, 15·3 turns per inch.

Weft: Same as warp.

Set 70 inches wide in the loom, 9's reed 4's, 40 picks per inch.

Finished: 56 inches wide, 15½ to 16 oz. per yard.

Weave:  $\frac{2}{2}$  twill, 36 ends to the right, and 36 to the left.

*Routine of Finish.*—Knot and mend, scour with alkali and soap, mill to 56-57 inches, wash-off, tenter, cut level, brush and steam, blow with steam on the winding-on frame, brush and steam, hot press, steam.

## No. 2. COSTUME CLOTH.

Handle of fabric, soft: surface, lustrous.

Wool: Fine Merino.

Warp: 30 skns. left hand twine, 17·6 turns per inch.

Weft: Same as warp.

Set 74-75 inches wide in the loom, 11's reed 4's, 44 picks per inch.

Finished: 56 inches wide, 12¼ oz. per yard.

Weave: Angled  $\frac{2}{2}$  twill.

In fabrics of this kind, the turns per inch in the yarn are important, especially as they affect the milling and raising.

*Routine of Finish.*—Knot and mend, scour, mill to 58 inches, wash-off, tenter, raise damp, dry beat, cut, hot press, blow with steam, brush and steam, hot press, steam.

## No. 3. CHECKED-BACK JACKETING OR CLOAKING.

Raised on the face, cut clear on the back.

Wool: Cape Merino.

Warp: 30 skns. face yarn, 16·3 turns per inch.

2/30 skns. backing yarn, 12·9 turns per inch.

Weft: As warp.

Set 75-76 inches wide in the loom, 12's reed 6's, 72 picks per inch.

Finished: 56 inches wide,  $23\frac{1}{2}$  to 24 oz. per yard.

Weave: double  $\frac{2}{2}$  twill, weft stitched, arranged 1 face, 1 back, 1 face.

*Routine of Finish.*—Knot and mend, scour, mill to 56 inches, wash-off, tenter, raise wet several times from each end, hydro-extract, brush and steam, tenter, hot press, steam, cold press.

No. 4. BEAVER FINISH.

Wool: Sydney.

Warp: 26 skns. left hand twine.

Weft: 14 skns. right hand twine.

Set 82 inches wide in the loom,  $12\frac{1}{2}$ 's reed 4's, 56 picks per inch.

Finished: 56 inches wide,  $34\frac{1}{2}$  oz. per yard.

Weave: 5-end sateen, weft backed, arranged 1 face, 1 back.

*Routine of Finish.*—Knot and mend, scour with alkali and soap, mill to 57 inches, wash-off, raise from both ends of the piece damp, allow to cool and dry, dry beat, cut, press, boil 3 to 4 hours, cool, rewind from the opposite end, boil from 3 to 4 hours, cool, dye, raise wet on the gig to straighten the fibres, tenter, dry beat, brush, cut, hot press, steam.

No. 5. DOESKIN FINISH.

Wool: Port Philip.

Warp: 26 skns. left hand twine.

Weft: 14 skns. right hand twine.

Set 41 inches wide in the loom,  $12\frac{1}{2}$ 's reed 4's, 35 picks per inch.

Finished: 27 inches.

Weave: 5-shaft warp sateen.

*Routine of Finish.*—Similar routine to the beaver with

certain detail modifications to suit the quality and the weight of the cloth. For example, the boiling process might be repeated three or four times, and the raising and cutting also varied.

No. 6. WOOLLEN VESTING: SOFT FINISH.

Wool: Merino.

Warp: 20 skns. for the face and back; 13·6 turns per inch.

Weft: 20 skns. for the face and back, 11·9 turns per inch.

Set 38 to 40 inches wide in the loom, 14's reed 4's, 56 picks per inch.

Finished: 28 inches wide, 12½ to 13 oz. per yard.

Weave: double cassimere.

*Routine of Finish.*—Knot and mend, scour, mill to 29 inches, wash-off, tenter, raise damp several times from each end, hydro-extract, brush and steam, tenter, cut level, hot press, blow, hot press, steam, cold press.

No. 7. LOW WOOLLEN SERGE: MADE OF EXTRACTED CARD WASTE.

Warp: 10 skns., left hand twine, 13·25 turns per inch.

Weft: 10 skns., left hand twine, 10·9 turns per inch.

Set 76 inches wide in the loom, 12's reed 2's, 24 picks per inch.

Finished: 56 inches wide, 20 oz. per yard.

Weave:  $\frac{2}{2}$  twill.

*Routine of Finish.*—Knot and mend, raise before scouring, scour, mill to 57 inches, wash-off, tenter, blow, dye, tenter, cut, blow, brush and steam, hot press, steam.

No. 8. WOOLLEN RUG FINISH.

Wool: River Plate.

Warp: 15 skns. face and back, 2/40's cotton centre.

Weft: 15 skns. face and back.

Set 68 inches wide in the loom, 13's reed 5's, 52 picks per inch.

Finished: 2 yds. 5 inches; 54 inches wide, weighing 3 lb. 15 oz.

Weave:  $\frac{2}{2}$  twill, double, centre warp stitched, arranged 1 face, 1 back, 1 centre, 1 face, 1 back.

*Routine of Finish.*—Knot, mend, fringe, scour, mill, tenter, raise, cut, brush, steam, cold press.

## CHEVIOT FABRICS.

## No. 9. COSTUME CLOTH.

Wool: Cheviot.

Warp: 15 skns. left hand twine, 8.5 turns per inch.

Weft: Same as warp.

Set 68 inches wide in loom, 13's reed 2's, 26 picks per inch.

Finished: 56 inches wide, 12 oz. per yard.

Weave:  $\frac{2}{2}$  twill.

*Routine of Finish.*—Knot and mend, scour with alkali and soap, mill to 57 inches, wash-off, tenter, brush and steam, hot press, steam.

## No. 10. FINE SUITING.

Wool: Super Lamb Pick.

Warp: 15 skns. and 2/25 skns.

Weft: 15 skns.

Set 66 to 67 inches wide in the loom, 13's reed 3's, 34 picks per inch.

Finished: 56 inches wide, 16 oz. per yard.

Weave: Angled  $\frac{2}{2}$  twill.

*Routine of Finish.*—Knot and mend, scour, mill to 56 inches, wash-off, tenter, brush and steam, cut, brush and steam, hot press, steam.

## No. 11. FRIEZE.

Wool: Highland (Black-face sheep).

Warp: 7 skns.

Weft: Same as warp.

Set 82 inches wide in loom, 8's reed 3's, 28 picks per inch.

Finished: 56-57 inches wide, 38-40 oz. per yard.

Weave:  $\frac{2}{2}$  twill, cut 2's.

*Routine of Finish.*—Scour, mill, press, steam.

No. 12. LINED OVERCOATING.

Wool: Cheviot.

Warp: 15 skns. left hand twine, 11·1 turns per inch.

Weft: Same as warp.

Set 73 inches wide in the loom, 8's reed 6's, 48 picks per inch.

Finished: 56 inches wide, 24½ to 25 oz. per yard.

Weave: Double cassimere twill, sateen warp stitched.

*Routine of Finish.*—Knot and mend, scour, raise damp, mill, wash-off, tenter and blow with steam.

(114) WORSTED ROUTINES OF FINISHING.

Examples are given below in the styles of finish applied to Botanys,—fancy and piece-dye—vestings, covert coatings, cross-bred worsteds, and shawls.

No. 1. WORSTED COATING.

Clear finish, or typical worsted piece-dye finish.

Warp: 1 thread of 2/50's left hand twine, 19·2 turns per inch.

1 thread of 2/50's right hand twine, 16·9 turns per inch.

Weft: Same as warp.

Set 69 inches wide in the loom, 18's reed 8's, 120 picks per inch.

Finished: 56 inches wide, 24·1 oz. per yard.

Weave: Double  $\frac{2}{2}$  twill.

*Routine of Finish.*—Knot and mend, blow with steam to set the piece, scour with soap only, tenter, brush and steam, cut clear, blow, dye, tenter, brush and steam, cut clear, blow, brush and steam, hot press, steam, cold press.



## No. 2. WORSTED SUITING: CLEAR FINISH.

Warp: 2/40's face and back, 16·1 turns per inch.

Weft: Same as warp, 12·1 turns per inch.

Set 66 inches wide in the loom, 14's reed 8's, 112 picks per inch.

Finished: 56 inches wide, 21 oz. per yard.

Weave: Double twill.

*Routine of Finish.*—Knot and mend, scour, tenter, brush and steam, cut, brush and steam, blow, brush and steam, hot press, steam, cold press.

## No. 3. WORSTED SUITING: SINGLE FABRIC.

Warp: 2/30's left hand twine, 9·5 turns per inch.

Weft: Same as warp.

Set 66 inches wide in the loom, 14's reed 4's, 56 picks per inch.

Finished: 56 inches wide, 14 oz. per yard.

Weave:  $\frac{1}{2}$ -<sup>2</sup> twill.

*Routine of Finish.*—Knot and mend, scour with alkali and soap, tenter, brush and steam, cut clear, brush and steam, hot press, steam, cold press.

## No. 4. LINED OVERCOATING: FINISHED ON BOTH SIDES.

Warp and weft: 2/40's face and back.

Set 69-70 inches wide in the loom, 15's reed 6's, 90 picks per inch.

Finished: 56 inches wide, 17 oz. per yard.

Weave:  $\frac{1}{2}$ -<sup>2</sup> twill face, plain back, warp stitched, arranged 1 face, 1 back, 1 face.

*Routine of Finish.*—Knot and mend, scour, tenter, brush and steam, cut, four times on the face and once on the back, brush, blow, cool, steam, afterwards roll up and allow to cool, hot press, steam, cold press.

## No. 5. VESTING.

Warp and weft: 2/50's.

Set 32 inches wide in the loom, 13's reed 8's, 108 picks per inch.

Finished: 28 inches wide, 10 oz. per yard.

Double weave, centre warp for spotting.

*Routine of Finish.*—Knot and mend, scour, tenter, brush and steam, cut, brush and steam, blow, brush and steam, hot press, steam, cold press.

## No. 6. COVERT COATING: CLEAR FINISH.

Warp: 2/40's worsted.

Weft: 30 skns. woollen.

Set 68 inches wide in the loom, 18's reed 4's, 56 picks per inch.

Finished: 56 inches wide, 14 $\frac{3}{4}$  oz. per yard.

Weave:  $\frac{2}{2}$  twill and 4-shaft mat.

*Routine of Finish.*—Knot and mend, scour, mill to 56 inches, brush, cut, brush and steam, blow, steam, roll up and allow to cool, hot press, steam, cold press.

Another method of finishing this style of cloth is to leave the fibre on the face, and this would require that the cloth should be more heavily milled than the one for which the particulars are given.

## No. 7. CROSSBRED WORSTED.

Warp: 2/30's left hand twine, 9·7 turns per inch.

Weft: Same as warp.

Set 68 inches wide in the loom, 12's reed 4's, 46 picks per inch.

Finished: 56 inches wide, 14-15 oz. per yard.

Weave: Angled  $\frac{2}{2}$  twill.

*Routine of Finish.*—Knot and mend, scour, mill to 57 inches, wash-off, tenter, cut level, brush and steam, blow, hot press, steam, cold press.

## No. 8. SHAWL.

Warp and weft: 2/30's worsted.

Set 66 inches wide in the loom, 12's reed 4's, 48 picks per inch.

Finished: 4 yards 22 inches long, 55 inches wide, weighing 3 lb. 6 oz.

Weave:  $\frac{1}{2}$ -<sup>2</sup> twill.

*Routine of Finish.*—Knot, mend, fringe, scour, tenter, cut, press.

## (115) ROUTINES OF FINISHING FOR UNION FABRICS.

## No. 1. COTTON WARP AND WOOLLEN WEFT SUITING.

Warp: 2/30's cotton.

Weft: 20 skns. woollen, 12·2 turns per inch.

Set 74 inches wide in the loom, 11's reed 4's, 48 picks per inch.

Finished: 56 inches wide, 12·8 oz. per yard.

Weave: Angled  $\frac{1}{2}$ -<sup>2</sup> twill.

*Routine of Finish.*—Knot and mend, scour, mill, wash-off, tenter, brush and steam, hot press, steam, cold press.

## No. 2. UNION RUG.

Warp: 2/20's cotton.

Weft: 2/30 skns. Saxony. 17·7 turns per inch.

Set 114 inches wide in the loom, 12's reed 2's, 75 picks per inch.

Finished: 72 inches wide, 31 oz. per yard.

Weave: Backed  $\frac{1}{3}$ -<sup>1</sup> twill.

*Routine of Finish.*—Knot and mend, scour, mill, wash-off, raise four times from opposite ends, tenter, brush and steam.

## No. 3. COTTON WARP BEAVER: FACE FINISH.

Warp: 2/30's cotton.

Weft: 15 skns. mungo, 12·65 turns per inch.

Set 90 inches wide in the loom, 13's reed 4's, 72 picks per inch.

Finished : 56 inches wide, 22 oz. per yard.

Weave : 5-shaft sateen weft reversible.

*Routine of Finish.*—Knot and mend, scour, mill, raise several times, tenter, dry beat, cut, hot press, dye, boil, wash-off, tenter, dry beat, cut, brush and steam, hot press, steam, cold press.

It is, of course, understood that these routines of finish are, in practice, varied according to the structure of the fabric, and the exact degree or nature of finish required.

THE END.

## INDEX.

- ADVANTAGES of the open scourer (see Scouring), 57.
- Application of milling apparatus to the rope scourer (see Milling), 154.
- Artificial compression, milling with-out, 154.
- BACKED cloths and felting, 100.  
 -- and single weaves, relative shrink-age of, 100.
- Beaver cloths, 10.  
 -- finish, 250.
- Bedford cords, 9.
- Billiard cloths, 4.
- Binding of compound cloths and felt-ing (see Stitching).
- Blowing, process of, 233.
- Boiling, process of, 41, 232.
- Border Cheviot wool, felting property of, 78.
- Box cloths, 10.
- Brushing and steaming, 213.
- CARD-WIRE raising, 199.  
 -- -- machines, 201.  
 -- -- -- types of, 202.
- Check-backed cloakings, finish of, 249.
- Cheviot fabrics, 1.  
 -- wool, shrinkage of, 63, 78.
- Cloakings, golf, 14.
- Cloths (Saxony), types of and raising, 167 (see also Fabrics and Finish-ing, Routines of).  
 -- Saxony and Cheviot, 1.  
 -- fancy and piece-dye, 3.  
 -- heavy woollens, 5, 10.  
 -- union, 6.  
 -- whipcord, buckskin, cord and Venetian, 8.  
 -- box, beaver, pilot, melton, 10.
- Cloths, friezes, Shetlands, and naps, 11.  
 -- overcoating, 13.  
 -- golf cloaking, 14.  
 -- vesting, 15.  
 -- types of double and varied felting, 111.  
 -- reversible, 111.  
 -- double, with face and back dis-similar, 112.  
 -- -- arranged two face and one back, 113.  
 -- -- worsted face and woollen back, 113.  
 -- -- -- face warp, woollen face weft, and woollen backing, 113.  
 -- -- -- -- and weft, cotton backing warp and woollen weft, 113.  
 -- -- single woollen yarn for face, and two-fold woollen yarn for back, 114.  
 -- -- with a pile of fibre on both sides, and raising, 167.  
 -- -- -- soft finish, and raising, 167.  
 -- -- -- dress-face finish, and rais-ing, 167.  
 -- raising of, in which fancy yarns are used, 184.  
 -- costume, vesting, and mantle, in which fancy yarns are used, and raising, 186.  
 -- Cheviots and flannels, and cutting, 217.  
 -- clear-faced woollen and cutting, 217.  
 -- soft finished woollen and cutting, 217.  
 -- pile and cutting, 218.  
 -- woollen and worsted, production of lustre on, 232.

- Combing, process of, and lustre, 41.  
 Composition of the yarn and felting, 75.  
 Condition of the cloth in milling, 27.  
 Continuous cutting machine, 220.  
 Cooling and steaming operation, 234.  
 Cord-weave fabrics, 8.  
 Corrugated rollers in the milling machine, 133.  
 Costume cloth (Saxony), finishing of, 249.  
 — — (Cheviot), finishing of, 252.  
 Covert coatings (worsted), finishing of, 255.  
 Crabbing, process of, 41 (see also Steaming and Cooling, 234).  
 Cropping or cutting, 215.  
 — — effects of, 217.  
 — — Cheviots and flannels, 217.  
 — — clear-face woollens, 217.  
 — — soft-finish woollens, 217.  
 — — Botany worsteds, 218.  
 — — Crossbred worsteds, 218.  
 — — pile cloths, 218.  
 Crossbred fabrics, 2, 18.  
 — — worsted, finish of, 255.  
 Crosset & Debatisse, milling machine of, 143.  
 Cross-thread raising, 40, 181.  
 Curl fabrics produced in milling, 73.  
 Cutting machines, types of, 219.  
 — — routine of the piece in, 224.  
 — — setting of the parts of the, 224.  
 — — form of bar or "bed" of, 226.  
 — — with two or more cylinders, 228.  
 — — operation of grinding cutting parts, 228.
- DEBATISSE & CROSSET, milling machine of, 143.  
 Defects in fabrics, cause of, 19.  
 — due to imperfect washing-off, 52.  
 Detergents used in scouring, 21.  
 Dewing, process of, 40.  
 Doeskin cloths, 4.  
 — finish, 162.  
 — — routine of, 250.  
 Double cloths, types of, and felting, 111.  
 — — stitching of, and felting, 116.  
 Drying and tentering, 24.  
 Dry raising, 160.
- EFFECTS of the process of boiling (see each process), 232.  
 — — — cutting, 217.  
 — — — felting, 27.  
 — — — raising, 30.  
 — — — scouring, 21.  
 — — — steaming and cooling, 234.  
 — — — pressing, 42, 238.
- FABRICS, Cheviot, 1.  
 — Saxony, 1.  
 — Botany worsted, 2.  
 — Crossbred worsted, 2.  
 — fancy woollen, 3.  
 — piece-dye woollen, 3.  
 — fancy worsted, 4.  
 — piece-dye worsted, 4.  
 — union fancie, 7.  
 — — piece-dye, 7.  
 — two-ply in the warp and weft and felting, 100.  
 — structure of backed and felting, 104.  
 — three-ply in the weft and felting, 105.  
 — compound in the warp and felting, 109.  
 — double, varied in structure and felting, 111.  
 — — effect of stitching on felting, 116.  
 — — production of lustre on woollen and worsted, 232.
- Felting or milling, effects of (see Weave), 27.  
 — — qualities of wool and, 61.  
 — — of Merino and Cheviot wools, 63.  
 — — of Merino and Southdown wools, 68.  
 — — and yarn structure, 75.  
 — — — composition, 75.  
 — — — methods of yarn construction, 80.  
 — — of fabrics made of re-manufactured materials, 82.  
 — — and degree of twine in the yarn, 83.  
 — — and folded yarns, 90.  
 — — of standard-weave fabrics, 92.  
 — — and weave intersections, 93.  
 — — effect of variation in wefting, 95.  
 — — of irregular-weave fabrics, 96.



- Felting or milling, of two-ply warp and two-ply weft fabrics, 100.  
 — — of single and backed fabrics, 100.  
 — — three-ply weft fabrics, 105.  
 — — of fabrics compound in the warp, 109.  
 — — of compound weave fabrics, 110.  
 — — of double cloths, 111.  
 — — and stitching of compound weaves, 116.  
 Finishing, routines of, 248.  
 — of Saxony suiting, 249.  
 — — costume fabric, 249.  
 — — check-back jacketing or cloaking, 249.  
 — — beaver cloth, 250.  
 — — doeskin cloth, 250.  
 — — vesting cloth, 251.  
 — — low woollen serge, 251.  
 — — woollen rug, 251.  
 — — Cheviot costume fabric, 252.  
 — — — fine suiting, 252.  
 — — — frieze overcoating, 252.  
 — — — lined overcoating, 253.  
 — — — worsted coating, 253.  
 — — — suiting, 254.  
 — — — — (single fabric), 254.  
 — — — lined overcoating, 254.  
 — — — vesting, 255.  
 — — — covert coating, 255.  
 — — Crossbred worsted, 255.  
 — — worsted shawl, 256.  
 — — union fabrics, 256.  
 — — — rug, 256.  
 — — cotton-warp beaver, 256.  
 Flannels, 3.  
 Flannel suitings, 3.  
 Friezes, 12.  
 Fulling, term of, 120.  
 — stocks, 122.  
 — — Tomlinson's, 124.  
 GIG, operation of raising on the, 193.  
 — raising, two-cylinder machines, 194.  
 Golf cloaking, 14.  
 Greasy pieces, impurities in, 45.  
 Grinding, operation of, 228.  
 Grosselin's milling machine, 148.  
 HAND raising, 190.  
 Hemmer's milling machine, 140.  
 Hydro-extracting, 23.  
 INKING, process of, 20.  
 Intersections in weaves, influence of, on felting, 93.  
 — — various weaves, 93.  
 Irregular weaves and felting, 96.  
 KILBURN'S improved milling machine, 142.  
 Knotting, 19.  
 LUSTRE due to yarn construction, 41.  
 Lustring process and machinery, 232.  
 Loom qualities of woven fabrics, 16.  
 MELTONS, 10.  
 Merino wool, shrinkage of, 63, 68.  
 McLardie's compound milling machine, 149.  
 Milling (see felting) and scouring machine combined, 60.  
 — without artificial compression, 154.  
 — machines, 124.  
 — — with two or more upper rollers, 135.  
 — — belt method of driving rollers, 136.  
 — — with corrugated guide rollers, 133.  
 — — duplex (Whiteley), 138.  
 — — — (Hemmer), 140.  
 — — without flanged roller, 141.  
 — — with fulling device applied in the spout, 141.  
 — — Kilburn's improvements, 142.  
 — — Crosset and Debatisse, 143.  
 — — with stampers in the spout, 146.  
 — — Grosselin's compound, 148.  
 — — McLardie's compound, 149.  
 — — Preston's combined, 152.  
 — — Tinker and Arran's, 154.  
 — apparatus, application of, to the rope scourer, 154.  
 Moss finish, 209.  
 APPED fabrics, 11.  
 OIL applied in blending, effect of, on piece scouring, 22.  
 Overcoating cloths, 13.  
 — — (Cheviot), finish of, 253.  
 — — (worsted), finish of, 254.  
 — — covert (worsted), finish of, 255.

- PERIODS of milling, 29.  
 Perpetual cutting machine, 220.  
 Pieces, routine of, in card-raising, 210.  
 — greasy impurities in, 45.  
 — causes of loss in weight in scouring, 46.  
 Pilots, 10.  
 Plain and other weaves, shrinkage of, 64.  
 Press, vertical, 238.  
 — rotary, 242.  
 — intermittent, 244.  
 Pressing, 238.  
 — operation of, 42.  
 — difference in effect of the cold and hot processes, 43.  
 — effect of moisture and humidity, 44.  
 Preston's combined milling machine, 152.  
 Prunelle twill, shrinkage of, 64.  
 Pulled waste, felting quality of, 83.
- QUALITIES of wool and felting, 61.  
 — — — raising, 33.
- RAISING, effects of (see Weave), 30.  
 — and textural conditions, 33.  
 — theory of, 34.  
 — and fabric structure, 35.  
 — kinds of, 39.  
 — treatment of the cloth, 158.  
 — condition of the cloth in, 159.  
 — dry processes of, 160.  
 — damp and wet processes of, 162.  
 — determined by degree of felting, 163.  
 — quality of the material and, 164.  
 — weave structure and, 168.  
 — yarn structure and, 172.  
 — of fabrics made of Cheviot, Saxony and Mohair, 174.  
 — of fabrics in which fancy yarns are used, 184.  
 — hand method of, 190.  
 — gig, 190.  
 — operation on the gig, 193.  
 — two-cylinder gig, 194.  
 — by teazles, 196.  
 — teazle and card-wire, 199.  
 — card-wire machines, 201.  
 — horizontal machines, 205.  
 — rotary machines, 207.  
 Relative shrinkage of backed and single weaves, 104.
- Ribs, woollen, 9.  
 Rinsing or washing-off, 51.  
 Routine of finishing, 248.  
 — — (woollen), ordinary Saxony, 249.  
 — — — costume cloth, 249.  
 — — — jacketing or cloaking, 249.  
 — — — beaver, 250.  
 — — — doeskin, 250.  
 — — — vesting, soft finish, 251.  
 — — — low serge, 251.  
 — — — rug, 251.  
 — — — Cheviot, costume cloth, 252.  
 — — — — fine suiting, 252.  
 — — — — frieze, 252.  
 — — — — lined overcoating, 253.  
 — — (worsted), piece-dye coating, 253.  
 — — — suiting, 254.  
 — — — suiting, single cloth, 254.  
 — — — lined overcoating, 254.  
 — — — vesting, 255.  
 — — — covert coating, 255.  
 — — — Crossbred worsted, 255.  
 — — — shawl, 256.  
 — — (union fabrics), suiting, 256.  
 — — — rug, 256.  
 — — — beaver, 256.
- SATARA, 3, 4.  
 Saxony fabrics, 1.  
 — suiting, finishing of, 249.  
 Scouring, detergents used in, 21.  
 — German electrical system of, 21.  
 — machines, 47.  
 — rope machine, 47.  
 — points in the use of the rope machine, 52.  
 — application of milling apparatus to the rope scourer, 154.  
 — open or full-width machine, 55.  
 — advantages of the open machine, 57.  
 — machine with flanged roller, 58.  
 — combined scouring and milling machine, 60.  
 Serge (low woollen), finishing of, 251.  
 Shawls (worsted), finishing of, 256.  
 Shearing (see Cropping or Cutting).  
 Shetlands, 11.  
 Shrinkage of backed and single weaves, 100.  
 — effect of single stitching on, in compound weaves, 116.

- Shrinkage, effect of double stitching on, in compound weaves, 118.
- Soap, analyses of, 23.  
— effect of potash and soda in milling, 28.
- Soft finish vesting, 251.
- Southdown wool, shrinkage of, 68.
- Steaming and brushing, 213.  
— — — cooling, 234.  
— — — machines, 236.
- Stitching or tying of double and compound weaves and felting, 116.  
— of compound weaves (warp and weft methods) and felting, 118  
— effects of, on shrinkage or felting, 116, 117, 118.  
— of double cloths with centre warp and felting, 119.  
— — — — — weft and felting, 119.
- Stocks, fulling, 121.  
— construction and working of, 122.  
— automatic, 123.
- Structure of the fabric and raising, 35.  
— — backed weaves and felting, 104.
- Suiting (piece-dye worsted), finishing of, 253.  
— (piece-dye woollen), finishing of, 252.
- TAPESTRY fabric, raising of, 182.
- Tasmanian wool, felting quality of, 68.
- Teazle gig, 190.  
— — operation of, 193.  
— — with two cylinders, 194.
- Teazles, raising with, 196.  
— and card wire, 199.
- Tentering, 24.
- Textural conditions, influence of, on raising, 33.
- Three-ply weft fabrics and felting, 105.
- Tinker and Arran's milling machine, 156.
- Twine in the yarn and raising, 34.  
— degree of, in the yarn and felting, 83.
- Tying of double and compound cloths and felting (see Stitching).
- UNION fabrics, 6.  
— — loss in scouring of, 46.  
— — finishing of, 256.
- Union fabrics, rug, finishing of, 256.  
— — beaver, finishing of, 256.
- VENETIANS, 9.  
— raising of, 168.
- Venetian weaves, check patterns, composed of, 170.  
— and cord weaves, stripes, 170.
- Vestings, 15.  
— (woollen), finishing of, 251.  
— (worsted), finishing of, 255.
- WASHING-OFF, process of, 51.
- Weave, weft sateen and raising, 36.  
— warp sateen and raising, 37.  
— plain sateen and raising, 38.  
— on double five-end sateen base and felting, 98.  
— angled five-end twill mat and felting, 98.  
— cut five-end twill check and felting, 99.  
— ten-shaft twill mat and felting, 99.  
— ten-shaft weave on sateen base and felting, 99.  
— backed swansdown and felting, 104.  
— weft backed five-end sateen and felting, 104.  
— three-ply in the weft and felting, 105.  
— three-ply in the weft, sateen face and back, and plain weave centre and felting, 108.  
— warp-backed and felting, 109.  
— three-ply in the warp and felting, 110.  
— double five-end sateen (warp stitched) and felting, 116.  
— — — — (warp and weft stitched) and felting, 116.  
— double five-end sateen face and five-end twill back (warp stitched) and felting, 117.  
— double five-end twill (warp stitched) and felting, 117.  
— — — — (warp and weft stitched) and felting, 118.  
— double ten-end twilled mat (warp stitched) and felting, 119.  
— five-end weft sateen, wave effect due to raising of, 160.

- Weave, checked (warp and weft sateen), and raising, 168.  
 — stripe (buckskin twill and weft cord), and raising, 170.  
 — cord, and raising, 170.  
 — check (backed  $2-2$  twill and weft cord), and raising, 170.  
 — backed  $2-2$  twill weft spotted and milling, 173.  
 — —  $3-1$  twill and raising, 176.  
 Weaves, standard weaves and felting, 92.  
 — intersections in, and felting, 93.  
 — irregular, and felting, 96.  
 — structure of, and raising, 168.  
 Welsh wool, shrinkage of, 78.  
 Whipcords, 8.  
 Whiteley's milling machine, 124.  
 — — — (duplex), 138.  
 Wool, shrinkage of (see Felting), 28.  
 — qualities of, and raising, 33.  
 — — — — felting, 61.  
 — Merino and Cheviot, and felting, 63.  
 — — — Southdown, and felting, 63.  
 — different felting properties of, 72.  
 — Welsh, and felting, 78.  
 Woollen cloaking, finish of, 249.
- Woollen cloths (see also Fabrics and Finishing routines of),  
 1.  
 — — fancy and piece-dye, 3.  
 — — heavy, 10.  
 — — qualities of unfinished, 16.  
 — — production of lustre on, 232.  
 Worsted fabrics (see also Fabrics and Finishing routines of),  
 Botany and Crossbred, 2.  
 — — fancy and piece-dye, 4.  
 — — effects of finishing on, 17.  
 — — Botany and Crossbred, and cutting, 218.  
 — — production of lustre on, 232.  
 — — steaming and cooling of, 234.  
 Woven surface, and raising, 35.
- YARNS, twine in, and raising, 34.  
 — structure of, and felting, 75.  
 — composition of, and felting, 75.  
 — methods of construction, 80.  
 — degree of twine in, and felting, 83.  
 — folded, and felting, 90.  
 — characteristics of, in compound weft fabrics, 106.  
 — structure of, and raising, 172.  
 Yorkshire wool, felting quality of, 79.