The AMERICAN WOOLEN MANUFACTURER.

A PRACTICAL TREATISE.

PRICE 6.50.

THE

AMERICAN WOOLEN MANUFACTURER.

A PRACTICAL TREATISE ON THE

MANUFACTURE OF WOOLENS,

IN TWO PARTS.

Part First gives full and Explicit Instructions upon Drafting, Cross Drawing, Combining Weaves, and the correct arrangement of Weights, Colors, and sizes of Yarns to produce any desired fabric,

ILLUSTRATED WITH DIAGRAMS OF VARIOUS WEAVINGS, AND TWELVE SAMPLES OF CLOTH FOR EXPLANATION AND PRACTICE.

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GIVES FULL AND PRACTICAL INFORMATION IN DETAILED ORDER, FROM THE STOCK DEPARTMENT TO THE MARKET, OF THE PROPER SELECTION AND USE OF THE VARIOUS GRADES AND STAPLES OF WOOL, WITH THE ADMIXTURE OF WASTE, COTTON AND SHODDY; AND THE PROPER APPLICATION AND ECONOMICAL USE OF THE VARIOUS OILS, DRUGS, DYE STUFFS, SOAPS, BELTING, &C.

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Examples and Calculations on the Circular Motions of Wheels, Pinions, Drums, Pulleys and Geers, How to Speed them, &c.

THE TWO PARTS COMBINED FORM A WHOLE WORK ON THE AMERICAN WAY OF MANUFACTURING MORE COMPLETE THAN ANY YET ISSUED.

BY GEORGE C. BURNS.

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PREFACE.

OUR advancement in the art of manufacturing, as well as in any of the other arts, depends in a great measure if not entirely on our faculties, and the helps and opportunities afforded us. That much of the required assistance and information may be obtained from good books all must admit. It was not the design of the author to introduce novelties, but to form a practical digest of rules and facts, and to explain them clearly and accurately. And though he has taken the liberty to think and write for himself, he trusts that few have excelled him in diligence of research, and in the plain and concise manner in which he has defined and exemplified the work under consideration.

It is the learner's diction that is to be improved, and this book will be found well calculated to effect that object, and perhaps there are few, however learned, who, on a perusal of this work, will not be furnished with many important rules and facts, which had not occurred to their own observation. Practice is considered a better pilot than theory, but there is always a theory connected with practice; and by a happy combination of theory and practice, the most perfect results are obtained. Ambitious of making not a large, but an acceptable book, he has compressed into this work the most essential parts of a mass of material, from which he could as easily have formed a folio. Ten years of careful observation and experience under favorable opportunities, has enabled him to obtain a clear knowledge of the most important connections of the business. How far he has succeeded in the execution of his design, is willingly left to the just decision of those qualified to judge.

GEORGE. C. BURNS.

The American Woolen Manufacturer.

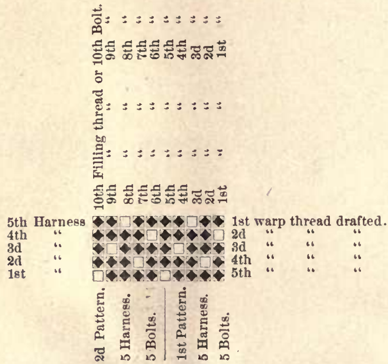
PART FIRST.

HOLD SIDEWAYS TO DRAFT.

COMMENCE IN THIS CORNER TO DRAFT. ☞

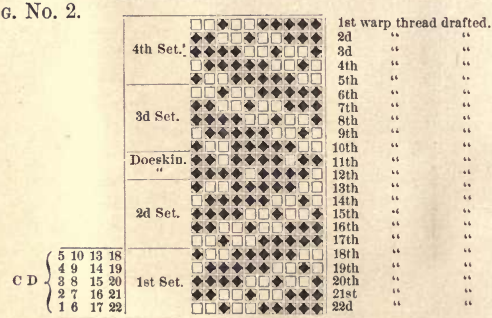
The above sample of cloth represents a Doeskin weave (for the ground), combined with a herringbone stripe. The doeskin is made with 5 harness, 10 bolts; the herringbone is made with 5 harness, 10 bolts, but is CROSS DRAWN from 20 harness. Each of the two weaves of the combination are made with separate harness and chain motions.

DIAG. NO. 1.



DIAG. 1. Represents the design from which to build the chain, to weave the doeskin (or ground work) of sample of cloth.

DIAG. NO. 2.



DIAG. 2. Represents the design from which to build the chain to weave the herringbone, and the two threads of orange and black twist which pass through its center, before it is cross drawn, showing that it would require 20 harness, 10 bolts for the herringbone, and 2 harness for the orange and black twist.

DIAG. NO. 3.

□	□	◆	□	□	◆	◆	◆	◆	◆	
◆	◆	□	□	◆	□	□	◆	◆	◆	
◆	◆	◆	◆	□	□	◆	□	□	◆	
□	◆	◆	◆	◆	◆	□	□	◆	□	
◆	□	□	◆	◆	◆	◆	◆	□	□	

FRONT.

Same as 4th Set of Diag. No. 2.

DIAG. 3. Represents the design from which to build the chain to weave the herringbone, and is the same design the chain was built from to weave it in the sample of cloth. And also represents Diag. No. 2. as it appears after it has been cross drawn and reduced to 5 harness, 10 bolts.

DIAGRAMS.

All the diagrams in this book represent the harness, and the designs from which to build, and arrange the chain, to operate the harness, for the Crompton, or any other loom operated by a chain motion.

THE HARNESS CHAIN.

The component parts of the harness chain are divided and known as Cylinder, Bolts or Bars, Rollers, Tubes and Links. The cylinder is that part which is attached to the loom, and which revolves the chain; it also has the check wheel attached to it for reversing the chain, &c. The bolts or bars carry the rollers and tubes. The rollers are usually employed to elevate the harness, and the tubes for depressing them, and keeping the rollers in place, and the bolts arranged and connected with the links at each end form the chain. Some of the Crompton improved looms have the peg chain attachments, and for those chains the pegs answer for rollers and the holes for tubes. And Mr. Crompton has an improved loom operated by a chain, and for which the rollers depress the harness, and the tubes elevate them. The dark squares in the diagrams are to represent the rollers (or the elevation of the harness), and the blank squares the tubes (or the depression of the harness.) Designers usually read dark squares as risers, and the blank squares as sinkers, when calling off their designs. And to build a chain for the Crompton improved last mentioned, or for the Greenhalgh loom, then read and make the designs the reverse of those in this book, reading rollers as sinkers, and tubes as risers.

HOW TO DRAFT THE PATTERNS FROM A SAMPLE OF CLOTH.

NOTE.—The following instructions upon drafting and designing, are intended for those persons who have had a limited knowedge of the motions and changes of a loom, as well as those who have had some practice in weaving. But all who intend to learn the art thoroughly, should acquire some practical knowledge of weaving, so as to fully understand the changes of the harness as produced by the harness chain, and also the filling changes which take place in connection with the warp to form the patterns; the instructions given are clear and explicit, and should be read carefully, and understood thoroughly, and with the aid of the samples of cloth which are to be used for practice, and with the diagrams of weaves hereafter explained, it would seem that any person of ordinary intelligence, ought to learn the theory of the art, and apply the theory to practice without any difficulty.

For writing down the draftings, you will require a few squares of design paper or have a slate marked off in small squares similar to those in diagrams. And for picking up and separating the threads in the cloth, a coarse needle with a small handle attached, is the best instrument for the purpose. You then take the sample of cloth you intend to draft the pattern from, hold the face toward you, with warp and filling reversed, that is, have the warp to run from right to left, which will cause the filling to run up and down (see directions on the side of first sample of cloth.) Hold the cloth between the thumb and forefinger of left hand, ravel and pull out some ten or more threads of the warp, or enough to allow the ends of the filling threads to appear about three-eighths of an inch above the remaining warp threads, so that they will be free from each other, and can be easily separated; ravel and pull out some of the filling threads from the right hand end, which gives you a good chance to get hold of the remaining warp threads, so that they may be pulled up and loosened one at a time, and easily traced as they pass over or under the filling threads. Each one of the remaining warp threads used in drafting will determine one harness motion, showing the several changes of the harness upon which that thread was drawn in the pattern. And each filling thread as it passes over and under that warp thread, directs you how to build the chain for that one harness; whether you are to put on the bolts, a roller, or a tube, so that you will observe that each filling thread as it passes over and under each warp thread, denotes either a roller or a tube on the chain bolts, consequently it is very essential that you should be careful and take and use each warp and filling thread in rotation, as they appear in the pattern from which you are drafting. I will suppose an example, and Diagram No. 4. will explain the example, and show the manner of writing the risers and sinkers as mentioned. After all is ready, proceed as follows: Loosen the first remaining warp thread a little, not enough to clear it from the ends of the filling threads, but enough for the eye to detect which of the filling threads pass over and under it. Observe the first filling thread at the right hand; does it pass over or under the warp thread? Suppose it to pass under the warp thread, then we will mark down one riser, (and in marking down risers and sinkers, commence at the right hand and pass to the left, same as when drafting from the cloth), as that denotes the warp thread was up, when the filling thread passed it, or it would not be found under the warp thread, and indicates that we want a roller on that chain bolt, and we will make a little mark in that square to indicate a roller. To dispose of this filling thread which we have used, and which passed under the warp, turn the thread over back and press it between the cloth and forefinger, and retain it there till you have used the warp thread which allows the next or 2d filling thread all clear to observe. And we will suppose the 2d filling thread to pass over the same warp thread, then we will call that a sinker, as the warp thread in this change was depressed to allow the filling thread to pass over it, and indicates a tube on the second bolt, and we will leave the 2d square on the same line and directly to the left of the riser a blank, which indicates a tube. To dispose of this filling thread which we have used, and which passed over the warp, turn the end over front and press it between the cloth and thumb and retain it same as first filling thread, which allows the next or third filling thread all clear to observe.

Suppose the 3d filling thread to pass under the same warp thread, then mark another riser same as for the first, and in the next square directly to the left of the 2d, indicating a roller, and put the thread over back same as first. Suppose the next or 4th filling thread to pass over the warp same as the 2d, we will call this another sinker, indicating a tube on the 4th bolt. Suppose our next three filling threads 5, 6 and 7, to pass under the warp thread successively, we will then write down three risers successively, indicating a roller upon each of the three bolts 5, 6 and 7 respectively. Suppose our next three filling threads 8, 9 and 10, to each pass over that warp thread successively, we will then write three sinkers successively; we have now one harness motion, (and which we will suppose to be one pattern for one harness) which will have 10 changes; one change for each filling thread (or bolt), thus showing the changes of one warp thread for the 10 filling threads we have used.

DIAGRAM No. 4 represents the order in which the filling threads appear as per the example just given, and the method for writing the draftings as they are taken from a piece of cloth when drafting. Commence at the right hand where we commenced marking down, and read to the left as follows: 1 riser, 1 sinker; 1 riser, 1 sinker; 3 risers, 3 sinkers, and represents the motion of one harness which carried the warp thread we have used in the example as follows: (turn the book sideways, the top towards the right hand), once up, once down; once up, once down; three times up, three times down; and if we had only one harness operating, and a chain was built from Diag. No. 4, it would work the harness in that order.

DIAG. NO. 4.

10	9	8	7	6	5	4	3	2	1	
□	□	□	◆	◆	◆	□	◆	□	◆	Warp Thread.

FRONT.

Supposing we had drafted far enough to be sure we had all the chain bolts required, we would then pull out the warp thread we had used and also straighten up the ends of the filling threads, and proceed with the next warp thread same as with the previous thread, and mark down the draftings of each of the succeeding warp and filling threads in rotation, and be sure and have the filling threads Nos. 1, 2, 3, &c., to 10, appear in the squares directly under where they appeared when using the first warp thread. By refering to Diagrams 1 and 2, you will observe how each filling thread passes from top to bottom in a straight line, and how each warp thread passes in a straight line from right to left.

The foregoing example will be sufficient for the learner to understand the method of drafting and the requirements; and for practicing purposes, cut off from the bottom of the first sample of cloth about one inch, holding the cloth sideways as directed, and commence with the upper right hand corner as directed, and draft from the doeskin first, and use 15 filling threads and 10 warp threads, and if you draft each thread right, the design will correspond with Diagram No. 1. Should you commence to draft with a different filling thread than was used for diagram draft, your design will commence reading from the right a little differently, but by passing towards the left you will find a beginning which will correspond with the diagram; or, if you should commence with a different warp thread it will read differently from the top of your design; but by passing towards the bottom you will find a beginning which will correspond with the diagram. The best plan would be for you to follow the warp thread which you happen to commence with towards the left, till you find two filling threads which pass under the warp thread, and the next or third filling to pass over the warp thread, and ravel out the preceeding filling threads, so as to commence to draft with those filling threads which passed under the warp; in that case your design would read the same as Diagram No. 1, and you would understand the idea much better. But providing your draftings were correct, it would not make any difference where or with what warp or filling thread you commenced, as it would weave the doeskin. You will also observe after you have drafted to the 6th filling thread, that it repeats the thread which you commenced with and so on. Also the 6th warp thread will repeat the first; the 7th, the 2d; and so on, providing you have made no mistakes; and that tells you that 5 warp and 5 filling threads will make a pattern of the doeskin, and consequently would make the goods same as the sample. And that is the way designers usually know when they have drafted a pattern by the repetition of the harness and bolts, unless we are dealing with a cross draw; and when we have an idea we are dealing with them, we keep drafting till there is a repetition which must come sometime. And if we have a cross draw to work out, we then commence to work it out as will be explained hereafter. Experience enables a person to judge very correctly whether a pattern is a cross draw or an ordinary weave.

EXPLANATION OF DIAGRAM No. 1.

Diagram No. 1 represents the chain for operating the harness to produce the doeskin weave of the sample of cloth. Observe it is separated into two patterns. It is a 5 harness weave, and 5 bolts will make it; but diagram represents 5 harness, 10 bolts; the 2d 5 bolts repeat the first 5, and thus it effects no change in the cloth. The same could be extended to 50 or more bolts in length, providing that each set of 5 bolts repeated the 5 preceding. 10 bolts are represented in the diagram, because the herring-bone requires 10 bolts for each pattern; and as the two weaves are combined, we must have the same number of bolts for each weave of the combination. Some cloths are made by combining several weaves; and when combining weaves we are not usually restricted to any definite number of harness, for each weave of the combination; but they must be combined so as to have the chain work for each weave of the combination of the same number of bolts; this can be arranged sometimes by the drawing of the threads into the harness, (which is explained under that head.)

By holding the book sideways, the top towards the right hand, and looking at the diagram, the view then represents the chain as it appears when hanging on the chain cylinder of a loom, with chain work on the right hand end, and as you stand at the front of the loom, the

1st bolt	which is	the bottom,	says	harness		1, 2 and 3 rise, 4 sinks, and 5 rise.
2d bolt	"	"	"	"	"	1 rise, 2 sinks, 3, 4 and 5 rise.
3d bolt	"	"	"	"	"	1, 2, 3 and 4 rise, and 5 sinks.
4th bolt	"	"	"	"	"	1 and 2 rise, 3 sinks, 4 and 5 rise.
5th bolt	"	"	"	"	"	1 sink, 2, 3, 4 and 5 rise.

And the next 5 repeat the above, and so on as the chain is revolved. Each bolt represents one pick of filling, and thus each bolt shows how the filling passes over and under the warp in one pattern. In this weave, 4 threads are up to one down in each change; consequently, four-fifths of the filling is upon the back at all times. This is the original, and in fact is the only doeskin weave: there are so called, 6, 8, 10, 11 & 12 harness doeskins; in the 12 harness doeskins there is still more filling upon the back, and the twill is longer than for the other doeskins; but the 5 harness is the weave usually applied to make the black doeskins, made by the Slaters, of Webster, Mass., and others who have the reputation of making the best.

Why I commence to read the changes at the bottom and read up, is because the chain revolves towards you when in motion; and if the ends were linked together and the bottom bolt placed to commence the first harness motion, the second bolt would make the next and so on. You also observe this and all other diagrams, have marked under them the word "front;" that word denotes that the diagrams are intended to represent the harness of the looms as they appear when standing to the front of the loom, facing the harness; and by holding the book sideways, the diagrams represent the chain as it hangs upon the cylinder when operating the harness; and to hang the doeskin chain on a loom which carries the chain on the right hand end as you stand to the front, put the left hand end over the cylinder; and to hang the same chain on a loom which carries the chain on the left hand end as you stand to front, put the right hand end of the chain over the cylinder, turning the chain completely over, bottom side up with the ends reversed. These instructions are for making a right twill same as the cloth sample; for a left twill hang them the reverse. But should you hang the chain for any pattern, and they do not work as wanted, it is a very easy matter to change the ends of the chain and make them work right.

EXPLANATION OF DIAGRAM No. 2.

Diagram No. 2 represents the chain for operating the harness to produce the herringbone weave of the sample of cloth with the two threads of orange and black twist, which pass through its centre; and it now represents 22 harness, 10 bolts, and shows just how many harness and how large the chain would have to be built, providing there was no method of cross drawing. When the learner has drafted several patterns of the doeskin weave, and understands how the threads run and how to write them correctly, then commence to draft the herringbone, and use about 20 filling threads making your design of 20 bolts, and 22 warp threads will be required to complete it; 20 threads for the herringbone, and 2 threads for the orange and black twist. You will notice in your drafting, that the 2 orange and twist threads draft the same as two of the threads in the doeskin weave, which tells you they were used on the doeskin harness and not on the herringbone. After drafting the herringbone, if done correctly, it will correspond with Diagram No. 2; and to understand more easily, you had better erase those parts which do not correspond with the diagram; say erase from the right towards the left till the top thread or harness reads 5 risers, same as design, and providing you have drafted correctly, the balance of your design will correspond with the diagram.

By holding the book sideways, the top towards the right hand, the view then represents the chain as it would appear upon the loom, providing we could not cross draw it; it appears to be operating 22 harness, and with the 5 harness doeskin combined, we should have 27 harness, and as we have no 27 harness looms, we must manage to cross draw some way to make some of the harness carry some extra threads, and thus bring the harness into closer quarters.

You will observe there are several repetitions in the diagram. The repetitions are divided and called setts; 1st set, 2d set, and so on to the 4th set; the second set of 5 warp threads or 5 harness Nos. 6, 7, 8, 9 and 10, repeat the first set Nos. 1, 2, 3, 4 and 5; the 11th and 12th harness are the same as Nos. 4 and 5 of the doeskin set; the 3d set, Nos. 13, 14, 15, 16 and 17, are also a repetition of set No. 1, only they seem to run backwards; also the 4th set, Nos. 18, 19, 20, 21 and 22 repeat the 1st set, and run the same as the 3d set; at all events, sets Nos. 2, 3 and 4 all repeat the first set. And now the idea is proposed to reduce the 22 harness, so that we can dispose of a part of the harness and still make the cloth, and now to carry out the proposed idea.

22 HARNESS CROSS DRAWN AND REDUCED TO 5 HARNESS.

See Diagram, No. 2, "C. D." Commence with the bottom harness called No. 1, the next No. 2, next No. 3, next No. 4, next No. 5. I will say draw the first thread intended for herringbone on first harness, 2d thread on 2d harness, 3d thread on 3d harness, 4th thread on 4th harness, 5th thread on 5th harness, and which is straight drawing; we find harness No. 6, the same as harness No. 1; we will come back and put thread No. 6, on that harness.

Har. No. 7, same as harness No. 2, we will put 7th thread on that harness.
Har. No. 8, same as harness No. 3, we will put 8th thread on that harness.
Har. No. 9, same as harness No. 4, we will put 9th thread on that harness.
Har. No. 10, same as harness No. 5, we will put 10th thread on that harness.

Here we find a little change; Nos. 11 and 12 are not similar to any of the herringbone harness. But we see in the doeskin set, two harness which are just like them and which are Nos. 4 and 5; so that those two threads may be used on those two harness, when we draw them into the harness, and proceed with No. 13, which belongs to the herringbone.

13 same as Harness No. 5, and we will put the 13th Thread on that harness.
14 same as Harness No. 4, and we will put the 14th Thread on that harness.
15 same as Harness No. 3, and we will put the 15th Thread on that harness.
16 same as Harness No. 2, and we will put the 16th Thread on that harness.
17 same as Harness No. 1, and we will put the 17th Thread on that harness.
18 same as Harness No. 5, and we will put the 18th Thread on that harness.
19 same as Harness No. 4, and we will put the 19th Thread on that harness.
20 same as Harness No. 3, and we will put the 20th Thread on that harness.
21 same as Harness No. 2, and we will put the 21st Thread on that harness.
22 same as Harness No. 1, and we will put the 22d Thread on that harness.

What are the conclusions? Well, we have disposed of the 22 threads, and which represented 22 harness by a cross draw, so that 5 harness will make the same herringbone stripe which 20 harness would make, and combined with the 5 harness doeskin for the plain weave, gives only 10 harness to be operated to make the cloth. By refering to the diagram, it shows for itself how the threads are to be drawn into the harness, which are 5 threads straight through twice, making 10 threads for one side of the stripe; then the 2 threads of orange and black twist are drawn into the doeskin harness; then the next 10 threads of the stripe are drawn backwards, 5 threads twice through, and the drawing in of the herringbone is accomplished. Then draw in those threads intended for the doeskin on the doeskin set straight through.

We could have commenced with the 4th set and cross drawn as well as first set. Also any one of the 4 sets can be used, and the same drawing of forward and back, would make the stripe. In this case the first set has been used, but the chain of the first set would make a left twill, while the doeskin chain represents a right twill, so that we will use the chain of the 4th set, and thus have the twill for both run the same way, so that sets Nos. 1, 2 and 3 may be cancelled. Set No. 4, you observe is the same as set No. 1, turned over, not end for end, but side for side directly over. And that suggests an idea, that in case a chain should be attached to make a right twill, and it should be wrong and make a left twill, by turning it over we get the right twill. To make the stripe in the sample, the 4th set was used same as Diagram No. 3. Also the doeskin set was used in front, as the doeskin is to be the principal or ground weave of the combination, containing nearly four-fifths of the warp threads.

REMARKS ON HERRINGBONE TWILLS, TWISTS, &c.

You will notice the herringbone could not be made with 5 bolts as a coarser twill is wanted than 5 bolts could make. The width of the twill to herringbone can be regulated by the number of threads used, by using the same set as is represented by Diagram No. 3, and use only 10 threads; say 5 threads over and 5 back, the width of the stripe, would be less than in cloth sample. By drawing 15 threads over, (5 threads 3 times), and 15 threads back, the width would be increased. A whole piece of 27 or more inches wide, could be made into one herringbone with the point in the center of the cloth, by drawing the first one-half of the warp threads straight through, and the other one-half backwards through. Another cross draw could be made so that the herringbone and doeskin could both be made on the doeskin set of 5 harness, in which case the doeskin chain would weave both at the same time. But such a cross draw would make the weaving difficult, and in case of threads breaking, and wrong drawings by the weaver, we should be apt to have imperfections. Also, there would be too many threads crowded upon one harness; the more simple the weaving the better, as with complicated weaves the weavers are apt to get threads mixed by wrong drawings when the warp breaks badly, and thus spoil our patterns. Again, the more simple the weaving, (other things favorable), the more yards from the looms; and the more yards from the looms, the less will be the average cost per yard for labor and manufacturing generally.

Herringbones can be made upon 3, 4, 6, 7, 8, 9 or more harness, the number of harness depend somewhat upon the number of threads wanted, but a 5 or 10 harness make about the best size.

We have another weave which may justly be called related to the herringbone, and which is called a Feather, and which require the threads to be drawn forward and backward through the harness, the same as for herringbones; and they may be made upon various setts of harness, the number of harness to be used, usually depend upon the size of the feather wanted; also the width and size of the feather, depends upon the number of threads used upon each side of the point.

There are two twills called right twill and left twill, and the herringbone stripe in the cloth sample will answer for an illustration. The left side of the stripe is a left twill; the twill running from right off to the left; while the right side is a right twill, the twill running from left off to the right, and is the same as the doeskin weaving. For further remarks upon twists and twills, see Part Second, Spinning Department.

EXPLANATION OF DIAGRAM No. 3.

Diagram No. 3, represents the chain for operating the harness, to produce the herringbone stripe, after it has been cross drawn and reduced to 5 harness; and is the same as the 4th set of Diagram No. 2, which set was used to make the cloth of page 5. By writing a copy of Diagrams Nos. 1 and 3, with Diagram No. 1, at the front, the design then represents an exact copy of the design from which the chain was built to weave the cloth, (Doeskin and Herringbone stripe.) And also represents the harness as they appear in the loom (while weaving), as you stand at the front.

Questions to be Considered in Originating Patterns, as well as Making Goods from a Sample.

The cloth sample on page 5, is employed to explain more clearly, the ideas to be obtained from some of the answers to the following questions:

Question 1. What weave is the sample, or if a combination of weaves, what are they?

Ques. 2. How many threads in the warp, and what size of yarn, and how are the colors arranged?

Ques. 3. How many threads per inch of filling, what size of yarn, and how are the colors arranged?

Ques. 4. If composed of patterns how many in the piece, and divide the patterns to spool and dress correctly?

Ques. 5. What weight per yard is the sample, and what weight is wanted?

Ques. 6. Is the cloth to be of one color or shade, or a mixture, or a combination?

Ques. 7. What grade of goods does the sample appear to be, or what grade is required?

Ques. 8. Propose the stock for the goods.

Ques. 9. Form an estimate of what will be the cost per yard if made of the proposed stock.

Ques. 10. Make out the spooling and dressing draft.

Ques. 11. Make out the number of harness required, and the heddles required for each harness, and the size of the reed.

Ques. 12. Make out the draft for drawing the threads into the harness, the reed, and build the harness chain.

Ques. 13. Make out a memorandum of the cost of one yard of the goods for stock, labor, manufacturing, &c., &c. (See Part Second, estimating cost of goods.)

Answer to Question 1st.—Suppose the goods are to be made an exact copy of the sample on page 5. By drafting the sample, two weaves are found to be combined, which are a doeskin (for the ground weave), with a herringbone stripe.

NOTE.—There are many practical designers who can form an opinion at a glance, of the probable weave of a piece of cloth. But those persons usually draft a few threads, to be sure they are correct. There are but a few designers, who are as positive of their knowledge and sound judgment, as was a manufacturer, (who is well known to the author), who had partially engaged a designer by correspondence; and when Mr. Designer appeared at his office the manufacturer took some samples of cloth from his pocket, and said: "Can you tell me of what weave these samples are?" "I think I can," said Mr. Designer. "I should wish to draft a few threads from one of them to make a positive reply." "Oh," said Mr. Manufacturer, "any d——d fool can draft a pattern, I want a man who knows all about it without having to draft the patterns." Mr. Designer bids him "good morning, sir," not wishing any further acquaintance with the Manufacturer, or the expected position. The question of weaves is then decided, and we pass along to the

Answer to Question 2d.—To ascertain the number of threads in the warp by a sample, measure off one inch across the warp threads, and count the threads found in one inch; and if making $\frac{3}{4}$ wide goods, say 27 inches wide when finished, multiply the threads found in one inch, by the width 27 inches, or by any other width wanted. Thus 70 threads per inch, and 27 inches wide, gives 1890 threads, which I will call even 1900 threads.

By an examination of the warp threads, they are found to be not far from four runs fine, and well twisted, and they are all single, excepting the few threads of orange and black twist. The yarn appears to be somewhat coarser than four runs, but it is necessary to allow a little for the coarseness, as our sample is finished goods, and the yarn for a finished piece is somewhat coarser than before it is finished.

As the fulling and scouring processes full the goods a little and increase the size of the yarns somewhat, thus changing the appearance of them. Also goods which are flocked heavily, the yarn will appear somewhat coarser, so that an accurate decision of the size of a yarn from a finished cloth sample cannot be obtained. But for the size of yarn to use, we shall have to be governed somewhat by the grade of goods usually made, that is, the number of threads we usually put in our warps. Also the qualities of stock usually used; also what weight the goods may be wanted when finished; also what weave is wanted, as if we were to try to imitate a cloth which had yarn of some nine runs fine, we should not try to make a yarn equally as fine of 60 pr. ct. 4th quality fleece mixed with 40 pr. ct. coarse, short, shoddy; but we might be able to make a fair imitation of colors, weave, and the general style of the sample from a coarser stock. If we were intending to make a good Tricot, Broadcloth, or Doeskin, a good warp would be required, with plenty of threads in it, in which case we should want the size of yarn finer in proportion to the number of threads to be used.

The arrangement of the colors can be ascertained by counting each warp thread, and noting the colors as they appear in a pattern. The sample of cloth on page 5th, is a shaded stripe in the warp of the doeskin weaving, and by counting the threads and noting each color in the respective order in which they appear from the point of one herringbone across to the other, the shading can be traced, so that a copy might be made which would be a perfect imitation; should you trace out the shading to prove you are correct, by referring to a subsequent page, the order in which the threads are used in the sample is printed.

Answer to Question 3d.—To ascertain the number of threads of filling in a given inch, measure off one inch across the filling, and count the number of threads per inch, and you have the number of threads required; (the usual expression would be the number of picks to the inch.) And in making calculations for size of yarn for filling, we shall have to be governed same as for making warp calculations, and by the number of picks we wish to put in to regulate the firmness; the less picks put in, the more yards from looms, at a less cost for weaving and general expense of manufacturing. But picks enough should be put in to make a firm cloth, which will handle well when finished, and not be sleazy and stretchy. Goods are generally handled in market by men of practice and good judgment; and there are other and better means to employ for practicing deception, than to leave out too many picks, or too many warp threads. Sometimes inferior stock in goods is partially overlooked, when made to handle firm and strong. The arrangement of the colors can be ascertained, by an examination of the filling threads. Usually, there are not so many changes, or such a variety of colors in the filling as in the warp. Sometimes the filling is of the shaded pattern, same as the warp of the sample on page 5, where a shaded plaid is wanted; and in that case, a filling chain is required to operate the shuttles, or the box motion, and such a chain would require the reverse motion; and some of the various tappet sections which are used with the Crompton loom, as for instance, the tappet section, No. 27, plate 9, Crompton's illustrated catalogue of looms, with a reverse motion, might be made to make almost any shading, and which works of itself without any reverse, 1, 2, 3, 4, 3, 2, 1, respectively. When there is no shading in the filling, the manner in which the filling should be introduced, may be determined by drafting the pattern from a piece, and noting how each pick was introduced. The bolts will show whether it predominates upon the face or back. (See cloth samples and their respective designs.)

Answer to Question 4.—Should our cloth be what is termed a plain piece of only one color, it would not be necessary to mention about patterns, and would only be necessary to make out spooling and dressing draft, and only mention the number of sections to be dressed, and number of threads in a section. Should the cloth contain patterns, same as the sample on page 5, then get the measure of one pattern, say from the inside of one orange twist thread to the outside of the other, or from one green stripe across to the other; and as per the sample, the measure is found to be about $1\frac{1}{8}$ inches for a pattern; divide the width the goods are to be when finished, by the size of one pattern, say for a ($\frac{3}{4}$) wide, (27 inches), divided by $1\frac{1}{8}$ inches, the quotient is about 25; thus the piece was made and contained 25 patterns. The sections to be employed in the warp, will be determined by the number of threads (as a general rule), we want in the warp, and the sizes of the reed we have for the dresser, and the number of patterns wanted in the goods. We have previously ascertained that the warp of the sample contained 1900 threads, and that the finest reed for the dresser will not carry over 500 threads for a section, so that we cannot have over 500 threads in a section. We have coarser reeds which will carry less threads for a section, and also less threads may be used in the 500 reed. Now, if the patterns in the goods were only 20, we could dress in 4 sections by using 475 threads in a section, and 5 patterns in a section; in this case 25 patterns are wanted, and the 25 patterns cannot be divided evenly by 4, so that it cannot be dressed in 4 sections and have the patterns come evenly; but the 25 patterns can be divided by 5, so that the warp may be dressed in 5 sections of 380 threads in a section' (giving us the 1900 threads for the warp), and gives us the 5 patterns in each section, with 76 threads for a pattern. 76 threads multiplied by 5 patterns, gives 380 threads in a section;

and 5 sections gives 1900 threads for warp. It is not always very necessary to have the threads come so even; a few threads may sometimes be dropped from one pattern and added to another, and no material change can be seen.

Answer to Question 5th.—Experience in handling goods enables a person to judge very nearly the probable weight per yard of a piece of goods. But when the number of threads in the warp is known, and the size of the threads, and the number of threads per inch of filling, and the size of the threads, very close calculations of the weight from the loom can be made. For finished weights, further and different calculations will be required. And judgment will be required, as to the fulling and probable quantity of flocks applied, though some goods are not flocked, and (the back will usually show whether flocked or not), in that case, the calculations as presented in Part Second, Spinning Department, will explain fully.

Answer to Question 6th.—Should we intend to make a plain piece of goods, (that is all one color or shade), it would be an easy matter to decide the coloring; or should a copy be desired from a pattern which contained only a few colors or shades, it would then be an easy matter to decide the coloring and arranging. But suppose we had, or wanted to produce two or more shades in our cloth, and those shades were produced by mixing different shades or colors in certain proportions in the wool, then there would be a chance to exercise your faculties in the system and science of colors. Here the Apothecary scales will assist very much in mixing and shading. (See remarks on mixtures, Spinning department, Part 2d.) No table will answer for making mixtures generally speaking. As in order to have a table that would answer, we should want samples of the colors, as mentioned in the table. Some manufacturers never use any white wool; using it either colored, stained, or in a mixture.

If a combination of colors or shades is required, as a general rule, a dyer is the person to be referred to. To make a "happy combination," requires a person with a faculty for discerning colors, and who knows the results of placing one color or shade nearly in contact with another. It is in short, the systematic arrangement of colors, according to their natural order, that the most perfect results are obtained. No other fault which can be applied to a piece of cloth, will so far spoil its good impression and favorable effect, as a poor combination, even if the colors are bright.

Answer to Question 7th.—Some idea of the grade of goods may be formed, by observing the number of threads in the warp and filling, and by the size of those threads; and whether those threads are single fine stock, or double and twist, or three ply, &c. Also by testing the strength of the yarn, whether it may be strong and elastic, or weak and short. If many threads are found in a warp, they will be apt to be fine; and if fine, they must necessarily have been made of fine stock. A coarse, large thread may be made of fine stock, but the rule won't work both ways, as a fine thread cannot be made of a very coarse stock. The same remarks will apply to filling. If the tension of the thread is strong and elastic, we would infer that good stock had been used, and that the goods were not injured in the process of manufacturing. Generally the matter of deciding the grade of goods, is very easy to a person who has had some experience in handling various grades. Manufacturers generally make their goods a certain grade, i. e, that generally use about a certain grade of stock, and get about a certain price in market, so that when copying patterns govern yourself accordingly. There are not many mills, if any, where they make a good cloth and a poor cloth also, as an even grade of goods has been found to be more profitable in a long run. A well made fabric will usually show for itself, and good stock properly handled and manufactured will show for itself, and an inexperienced person will be able to perceive the fact.

Answer to Question 8th.—A few remarks will be necessary before a direct answer can be made to this question.

When proposing the stock for goods, it is expected that the other expenses connected with the business are known, such as labor, manufacturing and general expenses, i. e. the general average cost per yard. And in this case to explain and answer the question so as to be fully understood, we will suppose that we have been in business a while, and kept the necessary books, and a close run of the business, and are enabled to estimate the average cost per month, and consequently the average cost per yard for all expenses of the business outside of the stock.

The cost per yard for stock we estimate, when any change has been made in the stock, or when we are paying more or less for stock generally used. Should we intend to use more colors in a few pieces, or more costly colors, we must then add a little to the cost of manufacturing; or if we put in more picks of filling, then add a little more for labor per yard; and more picks will reduce the production of yards from the looms, and a falling off in the production will make a corresponding rise in the cost per yard throughout the whole business. The expenses outside of the stock is fully explained in part Second. (Estimating cost of goods, &c.)

Proposed Stock to be used to make the Goods we have so far been Calculating and Designing.

By referring to the table of weights of warp and filling yarns, Spinning Department, Part 2d, we find that a warp of 1900 ends of four run yarn, will give for the first calculation, about $4\frac{3}{4}$ ozs. per yard, and with the addition for take up in the process of weaving, which will be about three-fourths of an ounce, we then have $5\frac{1}{2}$ ozs. per yard as the weight of the warp yarn, and there is to be another addition to this weight for the allowance of waste which will be made from the stock while in the process of manufacturing, and as the stock is pretty good, not much short stock, the waste will not be much, but will add one-half an ounce to each yard for waste, and which will make a yard of the warp 6 ozs, for calculating the cost of the stock; and for the filling, the cloth is to be slayed thirty-five inches wide in the loom inside of lists, and with the three-fourths of an inch on each side for lists, making $1\frac{1}{2}$ inches, so that the cloth will be $36\frac{1}{2}$ inches wide in the loom, and with 40 picks per inch of filling, we get the following, $36\frac{1}{2}\text{x}40=1460$, and the filling which is to be $2\frac{1}{2}$ runs fine, by referring to table of warp and filling yarns, we have 55 and eight-tenth ozs. per yard for filling, and with an allowance for the take up which will not quite equal the warp, we will add two-tenths which will make 6 ozs. of filling stock per yard; and as the filling is to be mixed wool and waste, will allow more for waste in process of manufacturing, and for which will allow one ounce;

making 7 ozs. to calculate as the filling weight of one yard to estimate cost of stock; thus the weight of one yard from the loom will be 11½ ozs. and the weight of one yard for calculating the cost, and the stock to be used will be 13 ozs. And the percentage of filling to warp will be as follows:

Warp,	6 ozs. or	46 per cent. of the stock per yard.		
Filling,	7 " "	54 "	"	"
Total,	13 ozs. or	100 per cent. proof.		

To find the rate per cent. of stock of warp and filling contained in one yard of cloth, the separate weights of each having been calculated and known.

RULE.—Divide the weights of the warp and filling, each taken separately, and expressed decimally by the sum of their weights, the quotients will be their given rate per cent. of one yard.

EXAMPLE.—The weight of warp yarn per yard is 6 ozs.
The weight of filling " " 7 "

13 ozs.

13)6.00(46 per cent. of warp. 13)7.00(54 per cent. of filling.
598 712

We find we have a little over 46 per cent. of warp and not quite 54 per cent. filling, a little fractional part only, and not enough to use in calculations, so that if we were to use all one kind of stock for both warp and filling we could determine very easily how the proportions would read, in which case we could say take 46 lbs. and 54 lbs. of each 100 lbs. used.

We will propose the stock as follows, and estimate about how much will be the cost per yard:—We will have little more than one-half of the warp No. 4 Fleece,

Say 26 per. cent. the balance of the warp (the other one-half) No. 4. Cal.
20 " we will have about one-third of the filling, No. 3 Fleece.
18 " " " " Extra Pulled.
18 " " " " Shoddy.
18 "

100

Now we wish to know what will be the relative proportion of the weights of each of the qualities mentioned in the stock, to each other, and to the whole weight of one yard.

When a combination of stock is used in making a yard of cloth, and the rate per cent. of each of the combinations is known, to find the relative proportion of weight of each of the component parts of the combination.

RULE.—Multiply the total weight of one yard by the rate per cent. of each of the component parts forming the combination, the product will be the relative weights of that part of the combination taken.

EXAMPLE—26 per cent. is to be No. 4 Fleece.
Multiply 13 ozs. total weight of one yard, by the rate pr. ct. of the component (26 per cent.) part taken, which is 26 per cent., and we get 3.38 ozs. of the one yard is No. 4 Fleece.

EXAMPLE—20 per cent. is to be No. 4 California.
Multiply 13 ozs., total weight of one yard, by the rate per cent. of the component (20) part taken, which is 20 per cent., and we get 2.60 ozs. of the one yard is No. 4 California.

Proof,	3.38 ozs.	No. 4 Fleece.
	2.60 "	" 4 Cal.
	5.98 ozs.	Warp.

Proceed with each of the component parts of the filling stock as with the warp. We then have the stock of each of the combinations for one yarn, reduced to ounces and fractional parts, so that we can extend the price per ounce for our stock, and make our estimates. The stock as proposed for one yard will appear as follows when all carried:

Answer to Question 9th.—Example.

Warp.	26 pr. ct.	or 3.38	ounces of	4th qual. Fleece,	at 5c.	per oz.,	16.90	cents.
	20 "	" 2.60	"	4th " Cal.	" 4	"	10.40	"
Filling.	18 "	" 2.34	"	3d " Fleece,	" 5	"	11.60	"
	18 "	" 2.34	"	Extra Pulled	" 4	"	9.36	"
	18 "	" 2.34	"	Shoddy,	" 1¼	"	3.51	"
	100 pr. ct.	or 13.	ounces proof.				51.77	cts.

The prices per ounce for the stock as carried out in the above example, are to show the form of the statement, when the actual price is known; and shows that at those prices, the cost per yard for the stock would foot up fifty-one cents and seventy-seven hundredths, or about three quarters. And in proposing stock in this manner, we have a chance after making estimate as above, to sometimes reduce some of the qualities of wool, or work in a little more shoddy, as you will observe that a reduction of even one-half a cent per ounce makes an item for a company, where perhaps the production of yards will foot up 1000 or more per day; and most any practical manufacturer could tell at a glance (of the proposed stock in example), whether it would work and make the grade of goods for which it was proposed, or whether a little cheaper stock might be worked in and still make good work and good cloth. The prices per ounce as they appear in the above statement, are the prices of clean stock, that is from the actual cost of the wool after it has been scoured, and the exact per centage of shrinkage obtained.

These calculations will be explained and carried still farther hereafter, in Part Second.

Answer to Question 10th.—To Calculate for Spooling and Dressing.—As before decided, we are to have 1900 threads in the warp, and 25 patterns in the goods, which gives 76 threads for each pattern. (Divide 1900 threads by 25), we have 20 drab threads for each herringbone or pattern; we have 2 green threads in each pattern; we have 2 orange and black twist threads in each pattern; the balance, or 52 threads we will call brown, and makes the balance of one pattern. We then have the threads for one pattern as follows:

One pattern,	20	threads	Drab.
	2	"	Green.
	2	"	Orange Twist.
	52	"	Brown.

Total, 76 threads.

We can now divide these threads and commence the pattern next to the listings, as we may desire. We will now pass along and calculate for Spooling. (Before we can decide spools, we shall have to decide the sections, and we have already decided to have five sections.

We have 2 green threads in each pattern, and 25 patterns in the goods, making 50 threads of green as the total; 20 drab threads in each pattern, making 500 threads of drab as the total; 2 orange twist threads in a pattern, 50 threads total, and 52 brown threads in each pattern, 1300 total. The total threads in the warp of each color, are as follows:

500	threads	Drab.
50	"	Green.
50	"	Orange twist.
1300	"	Brown.

Total, 1900 threads.

We will now determine the spools we shall want of each color of yarn. We will calculate on 40 thread spools.

The 500 threads of drab we will divide by the number of sections, which are 5, making 100 threads for a section; which 100 threads divided by the number of threads we put on a spool, which are 40, and we have 2½ spools.

50	thds.	Green,	calculated as above,	and we have		¼	Spool, or 10 thds.
50	"	Orange twist,	"	"	"	¼	"
1300	"	Brown,	"	"	"	6½	"

The total spools and parts of spools for the several colors, will appear as follows:

2	Spools	and 20	threads	of	Drab.
0	"	but 10	"	"	Green.
0	"	but 10	"	"	Orange twist.
6	"	and 20	"	"	Brown.

Total, 8 Spools and 60 threads, equal to 9½ Spools.

PROOF.—1900 threads divided by 5 sections, gives 380 threads in each section, divided by the threads put on each spool (40) gives 9½ spools.

2 Spools might be saved in the above, by Spooling the 20 thds. of Drab, and the 20 thds. of Brown, on the same Spool, together equals 1 Spool.

Spool the 10 thds. of Green, and the 10 thds. of Twist, on the same Spool, together equals ½ Spool.

The spools as above given, show that 9½ will be required in the dressers' rack, if the yarn is spooled in the order above given. But the number of spools required for making the goods intended, will depend entirely upon the number of yards of yarn wanted in a warp, and the size of the yarn. 40,000 yards of one run yarn would make more spools than the same yards of 10 run yarn, because the coarse yarn would fill the spools so much more, as there is such a great difference in their size and weight.

Suppose we wish to make a warp only, and we wish to have 10 cuts of 30 yards each, but will dress the cuts to contain 33 yards each, as the take up in the process of weaving will shorten them, so that they will come from 2 to 4 yards less when woven, than when dressed. 10 cuts of 33 yards, equals 330 yards required in the warp, and multiplied by the 5 sections, equals 1650 yards as the yards to be put on each spool, or as the total yards of yarn required. The 5 sections denote that we shall run off the yarn from the spools in the dressing rack 5 times, and shall take 330 yards, the length of the required warp 5 times from one spool, and thus the clock on the spooler will be set so as to put 1650 yards on a spool. The calculations will be obtained in the same way for any number of warps of any length.

We must now decide how we intend the colors to be arranged, for the purpose of producing the patterns in the goods. Should we wish the orange twist threads to appear next to the listing, we would commence to tie in the dresser with those threads. Should we wish the herringbone to come next to the listing, we would commence by tying in the drab threads. Should we wish to have the patterns come the same as those in the first sample of cloth, we would commence with a green thread, and thus there would be a green thread next to the lists on each side. And we will commence with one green thread next to the listing as follows:

1	thread	of	Green.
26	"	"	Brown.
10	"	"	Drab.
2	"	"	Orange twist.
10	"	"	Drab.
26	"	"	Brown.
1	"	"	Green.
76 threads in one pattern.			

We will now give the summary of the Spooling and Dressing to the person having charge, as follows:

SPOOLING AND DRESSING DRAFT FOR STYLE No. 1.

Spool—6	spools and	20	threads of	brown single	(lot	1)	260	threads.
2	" "	20	"	drab	" "	2	100	"
0	" "	10	"	green	" "	3	10	"
0	" "	10	"	orange & blk. twist,		4	10	"
				Threads in 1 Section,			380	
				Five Sections,			5	
				Total threads in the Warp,			1900	

In some mills they have different sizes for guides to the spoolers, so that they can make spools with various threads on each spool as may be wanted, and thus are enabled to make more even spools. And supposing we had several guides, we could make the spooling more even for the above, and save a little in cost of spooling, and not have so many parts of spools. Spoolers would have to exercise care and not tie on from the wrong bobbins.

Spool—5 Spools,	48 Guide	of	Brown,	single		(lot 1)	240 threads.
2 "	40	"	Drab,	"		" 2	80 "
1 "	40	"	Brown,	"	20 thds.	1	40 "
			Drab,	"	20 "	" 2	
1 "	20	"	Green,	"	10 "	" 3	20 "
			Orange twist		10 "	" 4	

Threads in 1 Section, 380

Thus making even spools. The guides as mentioned above indicate to the person having charge of the spooling, the threads to put on a spool. Care must be taken when using guides of different sizes, to have them vibrate correctly, the smaller the guide the more vibration required. But the spools should be wound so as to have a small rib. Spools that are wound smooth and even, the threads are apt to be overlapped, and will not wind off well in dressing. A few threads may be added to patterns when being dressed by winding them off from bobbins, and save spools or parts sometimes.

Tie in the Dresser (providing there was no shading.)

1	thread,	Green, single,	1 Pattern. Repeat 25 times.
26	"	Brown, "	
10	"	Drab, "	
2	"	Orange and Blk. Twist.	
10	"	Drab, single,	
26	"	Brown, "	
1	"	Green, "	

76 Threads in a Pattern, 25 Patterns in the Warp.

The order in which the threads are tied in the dressing to make the shading as per sample, No. 1.

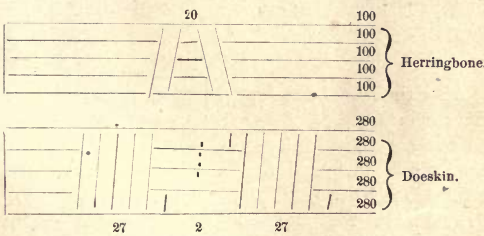
1	Thd. of	Green,	then	1	Thd. of	Slate Drab,	1 Pattern. Repeat 25 times.
4	"	Brown,	"	1	"	"	
3	"	"	"	1	"	"	
2	"	"	"	1	"	"	
1	"	"	"	2	"	"	
1	"	"	"	3	"	"	
1	"	"	"	4	"	"	
1	"	"	"	10	"	"	
2	"	Orange twist,	"	10	"	"	
1	"	Brown,	"	4	"	"	
1	"	"	"	3	"	"	
1	"	"	"	2	"	"	
1	"	"	"	1	"	"	
2	"	"	"	1	"	"	
3	"	"	"	1	"	"	
4	"	"	"	1	"	"	
1	"	Green,	"				
30		and		46	equals 76 threads 1 pattern.		

Answer to Questions 11*th and* 12*th*.—We have decided in our previous drafting, that 10 harness will be required to make the goods same as sample, 5 harness for Herringbone and 5 harness for Doeskin.

We will decide the number of Heddles to put on each shaft of the harness, the 50 green, the 1300 brown and 50 threads of orange twist are to be used on one set of 5 harness, the Doeskin; the 500 threads drab are to be used on one set of 5 Harness for Herringbone. The Doeskin is all straight drawing, (that is) the threads are drawn separately one in a heddle, one on each Harness one after the other successively, so that we require the same number of Heddles on each of the 5 Harness. Thus we have 1400 threads to be used on 5 harness, gives us 280 for each harness, consequently we shall require 280 Heddles on each shaft. We have 500 threads to be used on 5 Harness for the Herringbone, and these we have found (from the cross drawing as before explained), are to be drawn into the Heddles, 10 straight through, 5 twice over same as Doeskin, and 10 backwards, 5 twice through, so that in reality, one thread is used in each Heddle, and on each harness, successively; consequently we will divide the 500 threads to be used, by the 5 Harness to be used, and we get 100 as the number of Heddles for each shaft of Herringbone. There are usually a few extra heddles put on each shaft.

And we will make a Diagram for the number of Harness to be used, number of Heddles for each Harness, and the manner in which the threads are to be drawn in.

DIAGRAM No. 5.



The figures 100 and 280, indicate the number of Heddles required for each harness for the Harness builder. Each horizontal line indicating one Harness, the angular lines crossing them indicate the drawing of the threads into the harness. And when running towards a right angle, indicate straight drawing. And when running a left angle, indicate a back draw, same as right hand side of Herringbone. The one who draws in would read the above above as follows:

1 thread of green and 26 of brown, or 27 threads on the first set of 5 harness, which is the doeskin straight through; then 10 threads on the second set of 5 harness which is the herringbone, (5 threads twice through;) then 2 twist threads on the first or doeskin set, putting them in the heddles next after where we left off with the brown; then 10 threads on the second set for the herringbone, commencing with the back or 5th harness and draw backwards 5 threads twice through, then the 26 threads of brown and 1 thread of green on the doeskin set, commencing with the next harness where we left off with the twist threads, and we have one pattern of 76 threads drawn into the heddles and harness correctly, to be repeated till all are drawn in. By refering to diagram 5, it will be easily seen that the two twist threads are to pass between the points of the herringbone, (as the doeskin set is in front), which are separated a little.

The same style diagram would answer, supposing we were to use more harness and cross draw and take different harness; it will be found more safe to make a diagram of similar design, when any cross drawing or skipping is required, so that mistakes may be avoided. In this case, each harness of the doeskin works alike, so that by drawing right along straight through one thread in each heddle and on each shaft respectively, the weaving will be right.

REEDING.

After the warp has been drawn into the heddles, we must then draw it into a reed. Suppose we wish to put our warp of 1900 ends into a reed with 5 in each dent and wish to set the warp in the loom 35 inches wide. We will first divide the 1900 by the 5 threads per dent, and that quotient by the desired width, and determine the reed required.

Threads in dent, 5)1900 ends in the warp.

Width in Loom, 35)380 dents required.

$10\frac{6}{7}$ size of the reed.

As there are no reeds made of such a size, and as it is almost a 11 reed we will say in a 11 reed, and will decide just how wide the cloth will be in the loom, providing we use a 11 reed.

Dents per 1 inch, 11)380 dents required.

$34\frac{6}{11}$ inches wide in the loom.

So that in a 11 reed the cloth would be over $34\frac{1}{2}$ inches, if we would prefer to have it over 35 inches than under, by using a $10\frac{3}{4}$ reed we should produce $35\frac{1}{3}$ inches wide, or if in each inch of the 35 we should put in one of the dents 4 threads, we should get 35 threads in the whole width, with 5 in a dent would give 7 dents, which with the $34\frac{6}{11}$ will bring it to a little over 35 inches wide.

HARNESS CHAIN.

For building the harness chain, we will give a copy of the draft as we found it in our drafting from the sample, and will be the same as Diagrams 1 and 3 combined, (with the Diagram 1 to the front), and we will make a copy upon design paper for the chain builder, and be careful to avoid wrong copying; put the word "front" under the Diagram as it should be (for a right or left twill, &c.,) so that the builder may know how to hang his chain on the right or left hand loom, as it may happen Give the boss weaver instructions as to the picks wanted, the lot the filling was made from, and be careful to notice whether the cloth is being woven as ordered, and answers all purposes. Will propose 40 picks per inch of $2\frac{1}{2}$ run yarn, one shuttle work, *and the summary will read as follows:*

Style No. 1, 5 Harness shaded striped Doeskin for ground weave combined with a 5 harness herringbone stripe, 10 Bolts, 20 drab threads for the herringbone, 2 orange and black twist threads pass through its center.

25 Patterns in the goods, Warp 1900 ends of 4 run single yarn, (except 50 of twist), Filling 40 picks of $2\frac{1}{2}$ run single yarn, 5 threads in a dent in a 11 Reed, $34\frac{6}{11}$ inches wide in the loom, to weigh about $11\frac{1}{2}$ ounces from loom.

HINTS ON LAYING OUT STOCK, &c.

We will proceed to lay out the stock, putting in the same percentage of each quality, &c., as we have previously proposed. Say lay out for about 40 pieces. We wish the cloth to come about 30 yards from looms, so that for dressing we will calculate on about an average of 33 yards for each piece. The 3 yards difference is caused by the taking up of the yarn in process of the weaving, as taking in between the warp threads, some 40 or more threads of filling to each inch used, there must be more or less taken up. 40 pieces of 33 yards each gives 1320 yards, as the total yards required. With the usual calculations for taking up in process of weaving, and the allowance for the waste of stock in process of manufacturing, we have to use about 13 ounces for the weight of 1 yard. 1320 yards at 13 ounces gives 17160 ounces—1074℔s. as the clean or actual pounds of stock required for the 40 pieces of 33 yards each, and the several percentages of the different qualities of wool with waste, were as follows:

Warp,	26 pr. ct. of 4th quality Fleece,	279℔s.	clean,	430℔s.	in the	grease.
	20 pr. ct. of 4th quality Cal.,	215 "	"	390 "	"	"
Filling.	18 pr. ct. of 3d quality Fleece,	193⅛"	"	297 "	"	"
	18 pr. ct. of Extra Pulled,	193⅛"	"	321 "	"	"
	18 pr. ct. of Waste, . . .	193⅛"	"	193⅛"	"	"
		1074℔s. Proof.				

We will fill in the pounds of stock of each of the above qualities as follows:—Total pounds required 1074, of which 26 per ct. is 4th quality Fleece, and that percentage of the total pounds must be the pounds which will be required of that quality.

EXAMPLE.

1074℔s.	1074℔s.
26 pr. ct.	20 pr. ct.
279¼℔s. of 4th quality Fleece.	215℔s. 4th quality Cal.

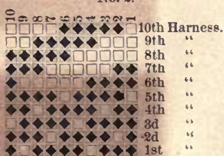
And so continue with the filling qualities, and we get the pounds of each of the combinations of stock as above.

As said before, the pounds of stock of the several qualities as filled in, are called clean stock calculations, so that if we had those qualities already scoured and dry, we could commence and take the several pounds as carried out. But we are to suppose as is generally the case, that the wool part of the combination will have to be taken from the wool-room in the grease, and that we shall have to make the calculations from what the probable shrinkage of those qualities may be; for the purpose of filling out the stock statement, a supposition of the probable shrinkages of the wool will be given. (The calculations for shrinkages will be better understood, by carefully reading remarks under head of "Remarks on Wool," Part Second.) We will say the 3d and 4th qualities of the fleece wool averages 35 per cent. shrinkage, or loss in scouring, leaving 65lbs. of clean wool to the 100lbs. in the grease, (see rule of wool shrinkage, Part Second,) so it will be necessary to take of wool in the grease 430lbs. to get the 279lbs. clean. The California shrinks 45 per cent., and it will be necessary to take 390lbs. in the grease, to get the 215lbs. clean. The 3d quality fleece is of the same lot as the 4th quality in the warp, and shrinks 35 per cent., and we will take 297lbs. in the grease, to get the 193lbs. clean. The Extra Pulled will shrink about 40 per cent., and we will take 321lbs. in the grease, to get the 193lbs. clean. The 193lbs. of Waste can be put in as it is, there being no shrinkage. Supposing these shrinkages to be the actual rate, we should only need to know the cost in the grease, and make out the cost when clean, and reduce the calculations of the relative weights of the several qualities, to the whole weight per yard in ounces and fractional parts, as we observe the statement on page 23, answer to Question 8,—and fill in prices same as example, answer to Question 9, page 26.

In Part Second we will form another example and make out the total cost per yard for the stock, and all other expenses which arise in the business, as they are made out by some of the First Class Manufacturers.

DIAGRAMS FOR SAMPLES.

DIAGRAM FOR SAMPLE
No. 2.

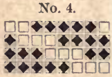


FRONT.

No. 3.

F.

No. 4.



F.

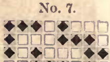
No. 5.

F.

No. 6.

F.

No. 7.

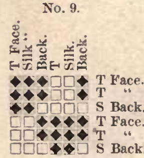


F.

No. 8.

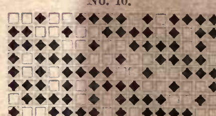
F.

No. 9.



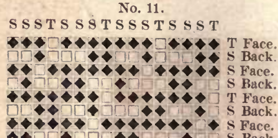
F.

No. 10.



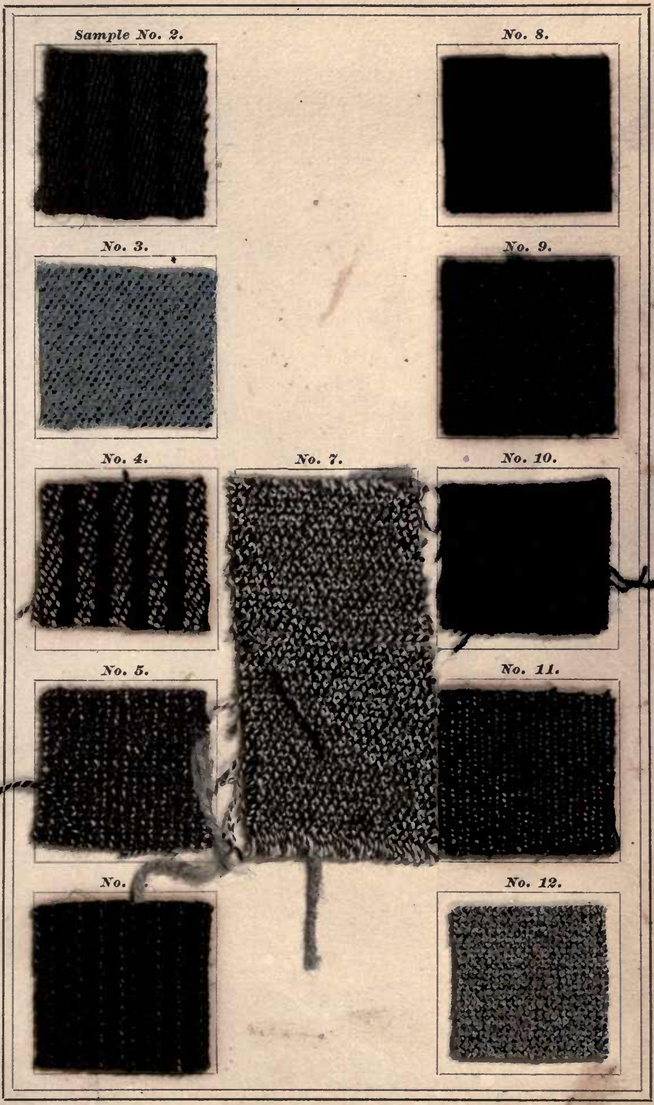
F.

No. 11.



F.

No. 12.



Sample No. 2.
No. 8.
No. 3.
No. 9.
No. 4.
No. 7.
No. 10.
No. 5.
No. 11.
No.
No. 12.

Explanations of the Cloth Samples and their Respective Designs.

Note.—As has been previously mentioned, the bottom line is to be the first harness, reading No. 1, 2, &c., from the front to the top, and the bolts run from right to left, the first bolt at the right is No. 1, the next No. 2, and so on. When holding the book as when reading, the designs represent the harness in a loom when you are standing at the front of it; by holding the book sideways, the top towards the right, the view then represents the chain when attached to the loom. If the motions and changes of a loom are well understood (as they ought to be by a designer), by a little practice in the art of drafting and designing, a person will soon become as familiar with the risers and sinkers, and the respective patterns they will produce, as the musician is familiar with the notes of a piece of sheet music, and knows what tune is produced by them.

Sample and Design Nos. 1, 2. Represents a combination weaving of a 5 harness Doeskin, and a 5 harness Cord. 10 bolts are used for weaving the Doeskin, because 10 bolts are required to make the cord of such a large twill; 10 threads are used to produce the cord, 5 threads straight through twice. By drawing the threads backwards, the same design would make a right twill, the same drawing (backward) would make the Doeskin a left twill, and will apply the same to all twills. Hundreds of styles may be produced with a doeskin weave for ground work, by combining different colors and shades of Cords, Herringbones, Feathers, Furrows, &c. The warp contains 1900 ends of 4 run yarn. Filling 40 picks of 2¾ run yarn.

No. 3. Represents a Cassimere or Flannel twill. An endless variety of styles plain or fancy, may be produced by the changing of colors and sizes of yarns. This weave is employed to make suitings, flannels, blankets, &c.

No. 4. Represents a Cassimere with a back, the face appears the same as No. 3. But the backs are different, every other pick appearing upon the back. The back pick is employed to produce weight, and for practicing deception (sometimes). This pick is usually made from coarse stock. There are no back warp threads in this weaving. Bolts 2, 4, 6 and 8 for back pick and the others for face. The warp for sample is 8 threads of single, and 8 threads of double and twist yarn, dressed 8 and 8, (8 single and 8 twist.) Twist a 6 and 7 run with 18 holes per inch to the right, 1728 threads, 12 reed, 4 in a dent, 36 inches wide in the loom. Filling back pick 3 runs, face pick $4\frac{1}{2}$, 44 picks. About 9 ozs. yarn weight, $11\frac{1}{2}$ to 12 ozs. from the Loom. Perhaps 8 harness would avoid crowding threads, two, 4 harness, same as design.

No. 5. Represents a Hair Line, 3 harness, 4 bolts, being an uncommon and peculiar weave. The sample appears as though coarse and inferior stock was employed. A very pretty hair line could be produced by using fine stock with more threads for warp and filling. The warp is 2 and 1, two single threads and one twist. Draw in the two single on the first and second harness respectively, and the twist on the third. The filling is pick and pick, a pick of single and a pick of twist. Bolt one for single pick, No. 2 for twist pick. 6 or 9 Harness may be used by having each three repeat those in the design.

No. 6. Represents a Combination Weave. A floating rib with a furrow. The weaving in the furrow is the so called Elastic weave. In the largest furrow there appears to be only three threads, while there are 10 double and twist threads. Next to the rib there are 4 green twist threads, each are on the same shaft one in each heddle respectively, which makes them appear as though the 4 were in the same heddle, and they could as well be all drawn into one heddle. The two brown twist are on another shaft, one in each heddle respectively, then 4 green twist threads same as the other green twist and on the same shaft. In the small furrow there are two brown twist threads, one twist on first harness, the other on the second. The two first harness are for furrow, and which is a plain or cotton weave. More harness may be used if necessary. The 3d and 4th harness are for the rib. Observe as per design the first pick (bolt No. 1), floats under the rib and so with every other pick. It is the pick which floats under which forms the rib, but the rib is not formed till the cloth is fulled; the fulling process contracts the filling threads, and thus the floating pick throws up the rib. (Some ribs are produced by using twist yarns with single.) More harness may be employed for the rib as well as the furrow, if required.

No. 7. Represents a Double and Twist Face with a back, and is made with 4 harness, 8 bolts. The warp is all twist, the filling is one pick of twist and one pick of single, the single pick is thrown upon the back, the twist upon the face. Bolts 1, 3, 5 and 7 for face twist pick, the others for the single back pick. Some of the sample is intended to be used for drafting or practicing. Cut off two inches from the bottom of sample and proceed as per the previous instructions. 4 warp and 8 filling threads make a pattern.

No. 8. Represents a Tricot, usually called a two and two, as two picks are used for the back and two for the face. Bolts 1 and 2 are for the face picks, 3 and 4 for the back picks, &c. The sample is made with about 2400 threads of 6 run yarn for the warp, and 100 picks of filling per inch; the two back picks are about 5 runs, the two face picks 6 runs. Perhaps 8 harness would be better than 4. The sample is a production of the Lippitt Woolen Co., Woonsocket, R. I.

No. 9. Represents a small Basket Weave, and is a silk mixture, 6 harness 6 bolts. The warp is two twist threads for face, and one single for back. The single threads are drawn in on the first and fourth harness, and which as per design are down 4 times to twice up in the 6 changes, and thus are mostly thrown on the back, while the two succeeding twist threads are up 4 times to twice down in the six changes, and thus appear mostly upon the face. The 2d and 3d harness are alike, which makes those two twist threads appear as though they were in the same heddle, and which helps to form the basket. The filling is all twist, two picks for face, one for back. Bolts one and four for the back pick, two and three and five and six for face picks. One of the face picks are to be a silk twist, as per sample; the 2d and 5th picks are silk twist. The 2d and 3d bolts are alike, and thus we obtain two picks alike, and which will be called two picks in a shed. And this is the method used for obtaining two or more picks in the same shed. By building two or more bolts alike, the listings which are usually a plain weave, catch the filling at each side so that any number of picks may be put in one shed. By using different colors of silk, green, blue, &c., a very desirable and good looking fabric is produced. The sample is a production of the well known Lippitt Woolen Co.

No. 10. Represents a nice Twill for coatings or suitings, 8 harness, 16 bolts. The sample warp is about 1680 threads of 6 run yarn. Filling 60 picks of 5½ run yarn, weighs about 7 ounces finished. For heavier weight use heavier yarn and more threads in the warp, and about the same number of picks of filling, and by changing colors, a variety of desirable patterns may be made.

No. 11. Represents a very nice Hair Line in heavy weights, 8 harness and 16 bolts. Warp is three single threads and 1 twist. The 1st harness is for a back thread, the 2d for a face, the 3d for a back, the 4th for face, and is a black and white double and twist, containing about 24 holes to the inch. The filling is also 3 single and 1 twist. The first pick represented by the first bolt is for the twist, the three following are single, the 4th is for twist and so on. It may be easily seen how the twist thread in the warp, with those in the filling form a line. Observe the twist thread. 8th harness it is up 14 picks in 16, and when it is down the twist pick of filling passes over it, and thus it is not broken.

When drafting patterns containing different colors and shades, and single and twist threads, some of which are for back, some for face, by noting each color or thread of warp and filling as per the design, it may be easily observed how to draw the threads into the heddles, and how to set the filling boxes to introduce the right pick of filling, to produce the pattern. The sample is from a firmly woven, well felted fabric. About 2200 threads in the warp, with about 60 picks of filling per inch.

No. 12. Represents a Double and Twist face with a back, 12 harness, 12 Bolts. The warp is one single thread and one twist, the filling the same. The single threads of both warp and filling are woven to appear upon the back. They each occasionally connect with the warp threads to hold the face and back together. Observe the first harness motion, which carries a twist thread, it appears up 9 times in the 12 changes of a pattern, and when it sinks, a twist filling thread passes over it, and thus the twist face remains unbroken, and each of the twist warp threads changes the same. Observe also, when the single picks of filling pass through, most all the warp twist threads are up so that they do not appear upon the face. The warp contains about 1600 threads. There are about 54 picks of filling per inch. The three last samples are a production of the well known Edward Harris, of Woonsocket, R. I.

Should any of the subscribers for this work wish for more light or information in relation to the samples, designs and general instructions as given in this book, it will be cheerfully furnished gratis by the author. And will also draft any other patterns, &c., for the small consideration of one dollar to pay for time, &c.

MISCELLANEOUS DESIGNS.

The following Diagrams of Weaves, are illustrations of actual weaving, by and with which cloths have been actually made by the contributor. (No imaginary weaves, or imaginary rules for making cloths are here given.) And with the explanations of yarns to be used, and the general instructions as given, a chain can be built from them for weaving the goods for which they are intended.

No. 1.

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4 Harness, 8 Bolts.
FRONT.

DIAG. 1, is what is called a Plain Weave; the same number of threads appear above the filling, as also under the filling at each change of the harness. No definite number of harness, or bolts need to be mentioned, only that they will have to be in even numbers, as 2, 4, 6, 8, and so on. An endless variety of goods are made with this simple weave, by making changes in colors of the warp and filling. We get flannels, blankets, and even fancy plaids, &c.

No. 2.

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□◆◆
◆□◆

3 Harness.

No. 3.

□□◆
◆□□
□◆□

3 Bolts.

FRONT.

DIAGS. 2 and 3, are 3 Harness Twills. Diagram 2d, represents that two thirds of the warp is above the filling, consequently, two thirds of the filling is under the warp. A very good Broad cloth can be made with this weave. Have 3080 ends of 4¼ runs, with 48 picks of 5 run filling, 19 reed, 2 in a dent, 80 inches wide in the loom, weight about 16 ounces; or have the same ends in the warp of 5 runs, filling 5½ runs, and 60 picks, weight about 16½ ozs. from loom. Weave white and piece dye. Diagram 3d, represents that two thirds of the warp is under the filling; consequently, two thirds of filling is above the warp, and is a good weave for a cotton warp Kentucky Jean; the most of the warp being upon the back. Jeans are not finished, all that process being done in the loom. Weave, say about the width wanted, take to finishing room, roll on a round iron, slip the iron out when rolled, and ship to market. Good oil is generally used on the stock, so as not to give them an offensive smell. Many other goods are made on 3 harness, such as water proofs, herringbone twills, &c. To make a herringbone on 3 harness, requires rather too much cross drawing, and mixing threads.

No. 4.

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3 Harness, 6 Bolts.
FRONT.

DIAG. 4. Makes a good weaving for spring light weight goods.

No. 5.

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3 Harness, 14 Bolts.
FRONT.

DIAG. 5. Makes a good cross Cord.

No. 6.

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3 Harness, 6 Bolts.
FRONT.

DIAG. 6. With warp one color, have filling pick and pick, and we get a very pretty pattern.

No. 7.

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4 Harness, 8 Bolts.
FRONT.

DIAG. 7. A Kersey Weave with 2 picks in a shade. The read will observe how two picks in a shade are obtained. As there are two bolts built alike, and as each bolt in the chain indicates one pick of the filling: If we have two bolts in succession

2 exactly alike, we must necessarily get two picks of filling exactly alike, and consequently two picks in the same shed. And our listings which are usually on separate harness, and which are plain weaves. They change at each pick, and thus hold the filling at each side of the pick; with a twist warp a very heavy and substantial cloth can be made. The following will make a very desirable pattern. Warp 1600 ends of two twist threads, one a black and 7 runs, and a white 9 runs twisted, the other an orange 7 runs, and a black 8 runs twisted. Dress a thread of one twist, then a thread of the other. Filling all single black or brown 3½ or 4 runs, from 40 to 50 picks; draw straight through, 12½ reed, 4 in a dent, about 34 inches wide. The colors of yarn can be changed in the warp and filling, and a variety of patterns made. Perhaps 8 harness would be better than 4, (say repeat the 4 in diagram,) as the threads would be somewhat crowded on 4 harness.

No. 8.

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4 Harness, 8 Bolts.
FRONT.

DIAG. 8. Represents a Broken Twill, and which makes a cloth which resembles a plain weave, and is quite as good a weave as can be produced for making a light weight. By using drop boxes, and various colors, any style plaids can be obtained, or any style fancies or shaded plaids and stripes; or for obtaining a velvet finish where a plaid or shaded stripe is wanted. To make heavy weights, there would have to be used some double and twist yarn.

No. 9.

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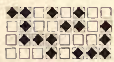
4 Harness, 8 Bolts.
FRONT.

DIAG. 9. Represents a very good weaving for a double and twist broken hair line, and makes a substantial piece of cloth, as well as a pretty pattern. The following makes a very good style. Warp 1760 ends, 2 black single threads 4 runs each, and one twist, (a black 7 runs, a white 8 runs.) Dress 2 black single and 1 twist, filling one black and white twist threads same as warp; one black thread 2½ runs, and one black thread 4½ runs; the black filling thread $2\frac{1}{2}$ run goes on the back, the other two on the face, say 1 pick of twist, 1 pick of back $2\frac{1}{2}$ runs, 1 pick black $4\frac{1}{2}$ runs, then the $2\frac{1}{2}$ again—requiring three shuttles, put in about 60 picks, perhaps 8 harness (two 4 harness same as diagram) would crowd the threads less.

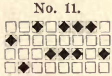
No. 10.



4 Harness, 8 Bolts.
FRONT.

DIAG. 10. Represents a Tricot weaving, with one pick face and one pick upon the back, and is called a very good weave.

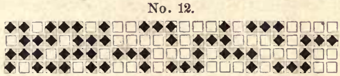
No. 11.



4 Harness, 8 Bolts.
FRONT.

DIAG. 11. Represents a Broken Crossing, and makes a very pretty figure pattern.

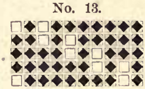
No. 12.



4 Harness, 25 Bolts.
FRONT.

DIAG. 12. Represents a Cross Rib design, and makes a very good rib across the piece.

No. 13.



5 Harness, 10 Bolts.
FRONT.

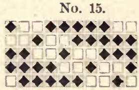
DIAG. 13. Represents a Cord with a recess, and is only intended to be used in combination with another weave (for the ground work). As you will observe every other pick of the filling passes under without weaving into the threads of the diagram, and that thread which floats under makes the cord, and the next pick will make a little recess. The process of fulling is what makes the cord, as that pick which passes under will full and shorten in length and thus raise up the cord, and that is the principle of all ribs and cords, as a general rule, the floating threads shorten in fulling and thus raise the warp producing the rib or cord. So that we must necessarily have another weave for the ground work between our cord or rib.

No. 14.

5 Harness, 9 Bolts.
FRONT.

DIAG. 14. Represents a Raised Feather, and is only intended to be used in combination with another weave, and by drawing straight through we get a twilled cord, and by drawing through and back same as for herringbone we obtain a raised rib with a point, and is very much the same as a feather, and something like a herringbone.

No. 15.



5 Harness, 10 Bolts.
FRONT.

DIAG. 15. Represents a Twill something like a cassimere when the threads are drawn straight through, and with threads drawn through and back produces a feather something like herringbone in sample of cloth only it will make a coarser twill; with 10 threads say 5 drawn straight through and 5 backwards, we obtain a small very good styled feather, and by using more threads same as explained for herringbone we can make a feather stripe of any size. When used for a feathered stripe, it should be combined with another weave say a tiger or a doeskin.

No. 16.

6 Harness, 6 Bolts.
FRONT.

DIAG. 16. Represents a Doeskin; the same calculations for warp and filling as we found in the sample of cloth on page 5 would answer and make a good cloth, and in fact there would not be much if any difference in the goods. We could not make the sample with six harness as the chain would not come right in the combination. We wish to make a 5 harness 10 bolt herringbone, and we can combine a 5 harness doeskin with it as we can use 10 bolts as well as 5. But in a six harness doeskin we cannot use 10 bolts, must have 6, 12, 18 and so on. As was said before we must have the chain for each weave of a combination same length.

No. 17.

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```

6 Harness, 6 Bolts.
FRONT.

DIAG. 17. Represents a weaving for a Coarse Twill. Have a warp of about 1600 ends, with one twist thread and one single, with filling one color, and put in from 40 to 50 picks, and it will make a twill with about 10 to the inch. This calculation is for a light weight; for heavy weight, increase warp threads to about 2000, with same number of picks of filling, of from 4½ to 5 run yarn.

No. 18.

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6 Harness, 6 Bolts.
FRONT.

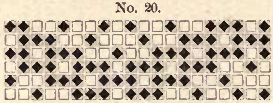
DIAG. 18. Represents a very good Twill. Have a warp of about 1600 ends all twist, which may be black and white, brown and white, drab and white, or any twist desired. Have the single threads for the twist about 7 runs each; have the filling one color single yarn, either a drab, brown or black, about 3 runs. 12 reed, 4 in a dent, 33⅓ inches wide. Perhaps 12 harness would avoid crowding the threads; two 6 harness same as the diagram, put in from 45 to 50 picks, makes a substantial cloth for weaving, and a very pretty pattern, and weighs about 12 ounces from the loom.

No. 19.

6 Harness, 24 Bolts.
FRONT.

DIAG. 19. Represents a weaving for a Raised Feather, to be used in combination with another weave for the ground work. Would look well with a tiger weave or doeskin, and for the feather we should want at least 12 threads for a small one, and more threads for a larger one, and would require a drawing same as for herringbones, say 6 threads straight through and 6 threads backwards. Threads for feathers and herringbones usually require a single yarn, unless we wish to raise them considerable, when a twist thread will do better; and for the feather in this case, use twist yarn all one color or more than one, as you may desire.

No. 20.



6 Harness, 24 Bolts.
FRONT.

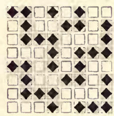
DIAG. 20. Represents a good Zig Zag pattern; can be used in a combination or alone; makes a very pretty and rather an odd pattern, and I think it is the only pattern of the kind that has ever before been printed for the public, as it is an original weaving for this country, having lately come from Scotland. Warp yarn for this weaving would make the best appearance, dressed 6 and 6 or 8 and 8, (i. e) 6 of one color with 6 of another, or 8 of one color and 8 of another. Filling of one color, or more, or same as the warp.

No. 21.

6 Harness, 9 Bolts.
FRONT.

DIAG. 21. Represents a very good Tricot for fine stock, and makes a splendid weave for a silk mixture; have the silk in the warp and we have 2 picks for back and 1 for face. Bolts 1, 3, 4, 6, 7 and 9 for face; bolts 2, 5 and 8 for back, and in which case we can have two five picks for face and one coarse for back.

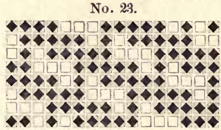
No. 22.



8 Harness, 8 Bolts.
FRONT.

DIAG. 22. Represents a very good Tricot, and for a piece of goods of fine stock, it makes rather more of a distinct figure than the preceding; although either are about as good as can be made. This is woven pick and pick, a pick for face, and a pick for the back. Bolts 1, 3, 5 and 7 for back, the others for face. The sample which the writer has which was made by the above weave, is a middle blue, (i. e., not a very dark nor yet a very light shade), and is the best I ever saw.

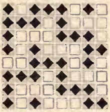
No. 23.



8 Harness, 16 Bolts.
FRONT.

DIAG. 23. Represents a very good weave for showing as though made from all double and twist, and which has a face and back, the backing not showing upon the face, and gives a chance to use a coarse stock for the back filling; the face shows a fine twill. The following will make a very good piece of cloth: Warp 1840 ends, $13\frac{1}{2}$ reed, 4 in a dent, 34 inches wide, single 5 run yarn, slate, drab or a brown drab. Filling, one thread a twist, made from a tan drab $6\frac{1}{2}$ runs, and a stone drab $6\frac{1}{2}$; the other filling thread a light mixture $2\frac{1}{2}$ runs for the back, wove pick and pick, 2 shuttles, about 60 picks; bolts 1, 3, 5, 7, 9, 11, 13 and 15 back picks, the others for face twist thread.

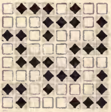
No. 24.



8 Harness, 8 Bolts.
FRONT.

DIAG. 24. Represents a weave commonly called a tiger, and is a very good plan for making plaids; shows a plain face, and has a coarse back. Any styled plaid can be made, or a very good looking plain cloth, or a mixture. Weave, pick and pick, a coarse pick for back and a fine pick for the face; bolts 2, 4, 6 and 8 for back pick, the others for face. For plaiding, dress the warp with colors arranged as desired, and arrange the colors in the face pick for the filling part.

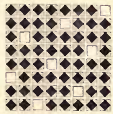
No. 25.



8 Harness, 8 Bolts.
FRONT.

DIAG. 25. Represents another tiger weave, and is woven pick and pick, fine pick for face with a coarse for back, and will make a very good plain silk mixture; have the silk twisted with the face pick of filling; also a variety of patterns can be made with this weaving, by dressing the warp with some twist threads, say 4 threads single black, brown, or a mixture, and two threads of black and white, brown and white, brown and olive, or any desired twist; have filling 5 single and one twist, same colors as for warp, and we get a small pretty check pattern; bolts 1, 3, 5 and 7 back pick, the others for face.

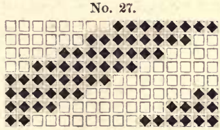
No. 26.



8 Harness, 8 Bolts.
FRONT.

Diag. 26. Represents a Doeskin weaving. By dressing warp 2 and 1, say 2 light mix and 1 blue threads, and 2 black and 1 blue, we get a very good diagonal.

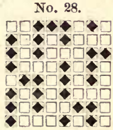
No. 27.



8 Harness, 16 Bolts.
FRONT.

Diag. 27. Represents a weaving that will make a very fancy black and white pattern, or a black and olive, or a black and blue. Dress warp 8 black and 8 white single threads, making 16 threads, have two threads in each heddle or on each shaft; filling, 8 and 8, same as warp, 16 threads and 2 picks in a shade; the above dressing and weaving makes a large figure. Dress 16 black and 16 white for warp, have filling 16 black and 16 white, and a larger figure is obtained.

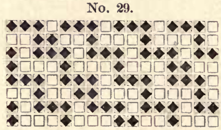
No. 28.



8 Harness, 8 Bolts.
FRONT.

Diag. 28. Represents a good Chinchilla weaving; they are always made double width. Warp about 3000 ends about 5 or 6 runs fine and white, (some are made with white cotton warps, though they are not so nice and will not bring the price of wool warps in the market), woven pick and pick, the back filling from 3 to 4 runs white, the face filling from 1 to $1\frac{1}{2}$ runs, and very slack twisted, put in from 80 to 100 picks to the inch, and have cloth weigh about 2 pounds per yard double width. Cloth will not want to be woven much wider than the finished width required, as they do not want only a little fulling. The peculiar finish is obtained by a machine made purposely for finishing them. They are made of various colors and shades, and some white. All the coloring required is for the face pick of filling. Bolts 1, 3, 5 and 7 are for face picks, the others for back picks, straight drawing.

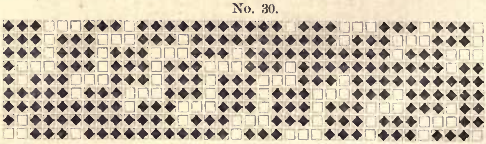
No. 29.



8 Harness, 16 Bolts.
FRONT.

DIAG. 29. Represents a good weave for a double and twist face with a coarse back, and is intended for backing threads in warp as well as back filling. The following will make a good looking cloth: Warp 1632 ends, 12 reeds, 4 in a dent, 34 inches wide, dressed 1 and 1, one twist (made from an olive brown 8 runs and a black 8 runs), the other single black 4 runs. Filling, one twist thread same as for warp, the other single black about $2\frac{1}{2}$ or 3 runs for the back; the twist threads in both the warp and filling are for the face, the single threads of each for back. Bolts 2, 4, 6, 8, 10, 12, 14 and 16 for back filling, the others for the face. Harness 2, 4, 6 and 8 for the twist thread of face of warp, the others for the black single threads. Commence to draw in with black on first harness, next twist and so on. Put in about 48 picks.

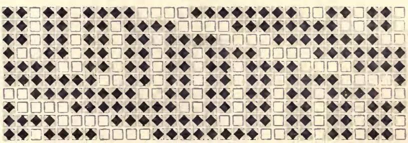
No. 30.



9 Harness, 36 Bolts.
FRONT.

Diag. 30. Represents a Twill weave design, and will produce a large distinct twill, by dressing the warp 12 threads of double and twist, two 8 runs twisted (either black and dark green, red brown, and green, or black and brown), and 24 threads black single, 4 runs, with about 1944 ends, and have the filling all one color or more than one of $3\frac{1}{2}$ runs, 50 picks per inch, with yarn in the warp as above mentioned; the twills will be about one-eighth of an inch apart or 8 twills per inch. The filling might be coarse and fine with the coarse upon the back, as every other bolt 2, 4, 6, &c., weave more upon the back than face.

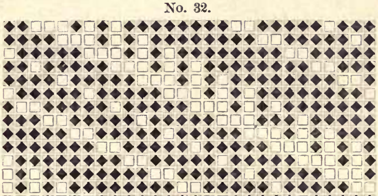
No. 31.



10 Harness, 30 Bolts.
FRONT.

Diag. 31. Represents another Twill, and will not be quite as large as the preceding twill, and would make a very good coating similar to some of the Lippitt coatings. In the sample the draft was taken from the warp and was all double and twist, and the face pick of filling was also twist, with two single upon the back. Bolts 2, 3, 5 and 6, &c., are for back picks, the others for face.

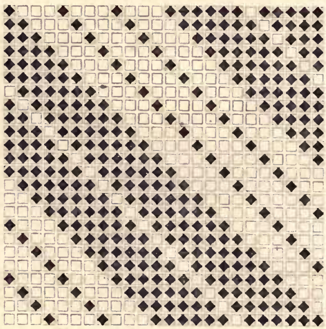
No. 32.



14 Harness, 28 Bolts.
FRONT.

Diag. 32. Represents a Diagonal and will make a large diagonal line with two smaller between, with a white warp and black filling, would make a very pretty black and white diagonal. A plaid may be made with a black ground work and have the plaid white, with a thread of green or red each side of the white, and the white would also show diagonal lines of black.

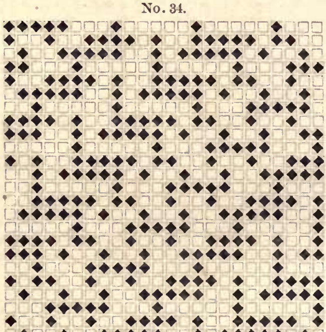
No. 33.



24 Harness, 24 Bolts.
FRONT.

DIAG. 33. Represents a Raised Rib Diagonal design, and will make two distinct ribs, with a space as wide as the two ribs occupy between them; the space between the ribs will show most all filling, while the warp will make the ribs.

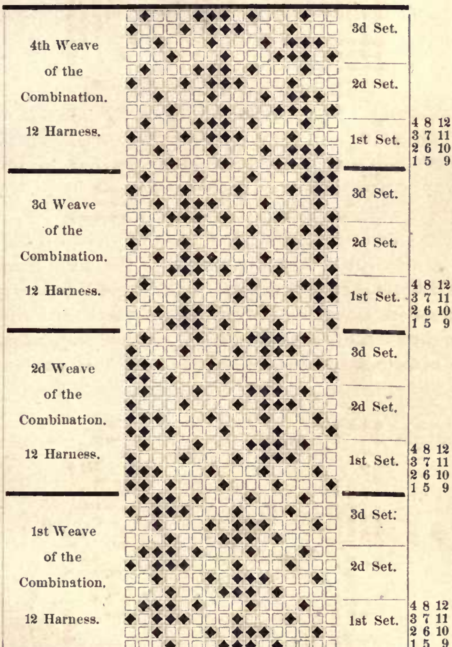
No. 34.



24 Harness, 24 Bolts.
FRONT.

DIAG. 34. Represents a large Diagonal Rib with a small cord between. By having the warp and filling one black twist, and two blue single each, a handsome pattern is produced; have the black twist coarse, say two three runs twisted, dress the warp 2 and 1; 2 blue single and one twist, draw the 2 blue on the first and second harness, with the twist on the 3d and so on. Bolts 1, 4, 7, 10 and so on for black twist, the others for the blue single.

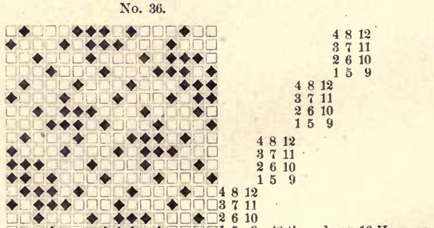
No. 35.



48 Harness, 16 Bolts.
FRONT.

DIAG. 35. Represents a design which is to explain another kind of a weave which may be cross drawn, and which we might also say contains a combination of 4 different weaves; although the weaves are not common weaves, the design produces a very odd and pretty pattern. Observe it is separated into weaves, 4 weaves forming the combination or whole. Also observe each weave of the combination is composed of 3 repetitions of 4 harness in each set. Thus we have 4 different weaves in the combination of 12 harness each, or 48 harness in all; and thus 48 warp threads are used for a pattern, and only 16 filling threads, as it is 16 bolts for the whole; generally there are as many or more bolts than harness. By careful observation, it is observed that each of the 3 setts of each weave are repetitions, and thus one sett will answer as well as to have 3 setts alike, and thus we will commence with the first sett of the 1st weave and draw 4 threads straight through harness number 5 same as number 1, and will put the 5th thread on 1st harness; harness number 6 same as harness number 2, and will put the 6th thread on 2d harness and so on, and we find the first sett of 4 harness will carry the 12 threads by drawing them straight through 3 times, and so we cancel the other two setts of 1st weave and pass to the 2d weave, and we find the same repetition as with the first weave, and that the same drawing of 4 threads 3 times over will dispose of 12 threads, and that it may all be done by using the 1st sett, and so on with the 3d weave and the 4th, and the cross draw is all accomplished; and we have found out that 16 harness will carry the 48 threads, and produce exactly the same pattern as the 48 harness would, and after the 2d and 3d setts of each weave have been cancelled, then the 1st setts brought together gives us a design same as the following.

No. 36.



16 Harness, 16 Bolts.

FRONT.

DIAG. 36. Represents diagram No. 35 cross drawn, and reduced to respectable dimensions for weaving. And to draw the 48 threads as per the previous diagram, we will commence and draw 12 threads on the first 4 harness, by drawing 4 threads 3 times over, then the next 12 threads on harness 5, 6, 7 and 8, 4 threads 3 times over, then the next 12 threads on harness 9, 10, 11 and 12, and the last 12 threads on the last 4 harness same way, and one pattern is drawn in, and then come back to the first 4 harness again. But the same cloth woven as above, will draft 48 harness again. The cloth sample I have which was made by this design is as follows: Warp one and one, all single, 1 brown, and 1 black thread. Filling, all single, 2 dark brown, 2 black and 2 dark green, 3 colors, and the pattern is a very uncommon and pretty one.

I might add several hundred more designs, but I hope and expect the reader will be able to learn to draft patterns without much difficulty. Care, close attention and practice are required after the theory is fully understood, to enable a person to be a good draftsman.

The American Woolen Manufacturer.

PART SECOND.

WOOL ROOM.

THIS department must be acknowledged to be the primary department of the business, consequently it is a very important branch. (The saying is), when a good beginning has been made, one-half of the undertaking has been accomplished. Wrong calculations made in this department, either in having made an unprofitable purchase of stock, or in many other ways hereafter mentioned, the whole or some part of the business will be affected by the miscalculation. It will hardly be considered within the province of this work to attempt to give rules or instructions for assorting the different qualities of wool, or to write a lengthy article explaining the staples, or the superiority of one particular quality or grade, as compared with another for general use.

I propose to make a few remarks upon the general management of this department, and give some rules by which calculations can be made, and thus the stock may be arranged systematically, and the estimations of the cost of goods may be made, so far as this department is interested, very accurately. The same rules and calculations are constantly employed by our first class manufacturers.

Textile fabrics as well as all manufactured articles, are arranged and classified; their respective class being determined somewhat, by the grades and qualities of wools and other stocks from which they are made. When the very best of stock has been taken from the wool room, sometimes such stock as ought to make a first class fabric; by an improper treatment in some of the subsequent departments, the cloth is made to appear as though it was intended for a second or third class article; yet with all the improper treatment, a person skilled in manufacturing is generally able to discern, that good stock was literally ruined by improper treatment in some one or more of the various processes necessary to produce the manufactured article. This remark in relation to the improper treatment of stock, is given to show that the stock is not always to be blamed for not producing a finished fabric, equal to what it indicated it would in the raw material. Each manufacturer usually makes a regularly established grade of goods to be sold at an average price, and sometimes has regular customers for his goods, and as said before the stock employed decides the grade. Skillful managers usually have pretty correct ideas as to what stock it is for their advantage to employ to allow a fair profit, and make about an equivalent article.

It will be found necessary also to make some calculations by figures, of the cost for labor, stock, manufacturing, &c., to keep our business on the safe side; not allow the affairs to be carried on by guess work mainly, and wait till thousands are lost before we are aware that the business is running at a loss. One of Sir Walter Scott's sayings was, that " Whatever might be said of luck 'tis skill that leads to fortune ?" I should say a person who is in the habit of carrying on business on the guess work plan, is trusting to luck—while the person who has a fair knowledge of the business, and has each of his departments supplied with a skillful and prudent manager, to produce the best possible fabric from the stock, and has a regular system in each department, and not the least of all who has the necessary books kept in each department, to furnish the necessary figures, by which estimations may be furnished, so that he may have full, and complete control of, and understand the situation of his business; such a person is doing business in a skillful manner, and will attain a station of eminence, that is, " fortune."

Unless a very inferior class of goods are made, the cost for the stock material, will be far higher than for any other material or expense connected with the business, the fact of which presents the idea that it is a very important department, as some of the stock when ready for use, is worth from 4 to 5, and sometimes it gets up to 6 cents per ounce, and 6 cents per yard, clear profit, on a large production of yards will foot up a comfortable yearly income. Manufacturers usually obtain their wool from wool commission houses, where they have a choice of selection from all grades, as produced from this and other countries. One and perhaps the greatest principle of this department is to be able to form a nearly correct opinion upon the probable shrinkage of the wool when buying it, also the length, and strength of the staple; as upon the shrinkage of the wool, we form a basis of its cost, and upon the length of the staple, we judge of the probable amount of short stock may be used in connection with it, and still make a strong, smooth, and elastic yarn; as all the wool must pass through the process of scouring, or cleansing, and upon the scouring and the loss in weight thereby, we determine the cost of our stock, so that the market price of the wool is not altogether the principal question for consideration, but it is the percentage of grease, sand and other matter it contains, which are of no use to the business and consequently are a dead loss, and when this loss is actually known, then and not till then, can we decide the actual cost of the stock. As was said before, all the estimations of the cost of goods for the stock part have to be made from clean stock calculations; no positive rule can be given of the probable shrinkage of different wools, as the same sorts of fleece wool, are found to vary in their shrinkages, when obtained from different localities. The following are called the average shrinkage for the wools mentioned.

Washed No. 1 X and XX fleece, shrinks on an average from 33 to 40 per cent.

Unwashed No. 1 fleece shrinks on an average from 40 to 50 per cent.

A. 1, A. 2, Cal. shrinks on an average from 45 to 55 per cent.

No. 1, X, Mestiza shrinks on an average from 50 to 60 per cent.

Tub washed fleece, shrinks on an average from 15 to 25 per cent.

Pulled wools, shrinks on an average from 33 to 40 per cent.

The above figures are sufficient to show that there is quite a variation in the shrinkage, and a little variation in the shrinkage makes quite a difference in their cost. A very good way to obtain the average shrinkage, is to sort some 10 or more sacks of a lot, and weigh the several sorts separately, and keep separately, then take about 50 lbs. for a trial, divided in proportions as it is sorted, say where running mostly in the 3rd and 4th qualities, with some 1st, 2nd, 5th and 6th, take the relative proportions of lbs. of those sorts, taking more of the 3rd and 4th qualities and so on. Some manufacturers take 100 lbs. for a trial, taking the fleece or wool just as it happens to come in the sack or bale without giving any attention to the sortings in which case the wool taken might happen to be far from the average of the lot. The writer has seen both plans tested, and prefers the former, as it must be evident that that plan will bring the fine and coarse grades together as they are actually found to average. A little time given to this matter is time well and profitably employed.

Another principle of this department, is to have an overseer who is careful and particular as to sorting the wools, keeping them nearly uniform in sorts, and who is particular to have all the small bits of strings, sticks, &c., picked out before leaving his room, as a small piece of a string left in the wool and which passed along to the cards has been found to cause considerable damage. Also the person at the head of the manufacturing, should know just how he should have the wool sorted, so that he can take the various qualities and use them to the best advantage for the purpose intended, as when short stock, such as cotton, cotton waste, and the various stapled shoddies are used in connection with wool, sound judgment well be necessary to make the proper selections of sorts, and staples to carry the desired quantity of such stock and which will card well and not make an unreasonable waste in carding, make a good even and strong yarn, and which will pass through all the departments without causing any unnecessary delay in the production of goods. The production from the looms is of great importance, as the more yards produced the less will be the average cost per yard for labor, and nearly all the other expenses of the business outside of the stock, as upon the production of yards woven, we make our estimations of the cost of goods, that is, all expenses outside of the stock. No rule can be given for working wool with cotton or shoddy as it depends altogether upon the length of their staples, and all manufacturers know what a variety of staples we find in shoddies as well as wools; long stapled wools usually are employed to carry short stapled shoddies, &c. (See card room.)

SCOURING WOOL.

Care should be taken when scouring wools to have them well scoured, and well washed after scouring, they can never be too clean—and when scoured for obtaining the shrinkage, it should be well dried, so that we shall not be misled in our calculations. Most all dyers know what a bad effect greasy wool has upon their colors, being as you might say a deadly obstacle to the coloring. Most all carders know what a bad effect greasy wool has upon their cards, and so on through to the finishing department where perhaps it is felt as seriously as anywhere, for highly finished face cloths which are piece dyed, as the Doeskin and Broadcloth, no even color or lustre can be obtained upon such cloths, when they have any particle of greasy wool in them. And for fancies some of the color which might have been applied a little in the Dye house, such as it was, will here be apt to take leave of absence and pass from the scouring machine into the trench, i. e. if strong enough soap has been applied to start the natural grease which was in the wool—and in fact providing the color should be retained, and also the grease, in either can we have a spoiled fabric. When wool has been properly scoured, and the suds effectually washed out it will appear as follows: it will drain very rapidly, and when the water has pretty well drained from it, it will commence to swell up and appear somewhat springy—will look white and clear, and when handled and shaken apart will be feathery, will smell clean, and will not be gummy or sticky; and when improperly scoured it will feel weighty, and greasy, and will show very quick that it has been improperly managed.

The following rule will be found to be a short and effectual method for obtaining the shrinkage of wools.

Rule. — *From the pounds taken in the grease, subtract the pounds got back after scouring (and well dried), and divide the remainder with two ciphers annexed by the number of pounds taken in the grease; the quotient will be the rate per cent. of shrinkage.*

Example.—Taken for a trial, 50lbs. (10lbs. 2d, 10lbs. 3d, 20lbs. 4th, 5lbs. each of 5th and 6th.)
Got back, 35lbs.

15

50)1500(30 pr. ct. ans. (Rate per cent of shrinkage for 100lbs.)
1500

There are some mills where they have ample scouring facilities in which they sort their wools, scour the sorts separately, dry, and return to the wool bins already for use; in which case the actual shrinkage is obtained and the cost is known. And where they make the goods of perhaps several different qualities and kinds of wool, they have a chance to calculate very closely, as to about the pounds required, and take just the weight wanted for making the goods; and when making fancies of various colors they can use the stock economically, and avoid having an innumerable number of parts of spools and bobbins lying about. As by understanding how to calculate for warp and filling as explained in part first, calculations can be made to work very closely.

Some Superintendents and Agents will say it is no use to try to calculate to have warp and filling work up evenly, as it is impossible; and you will generally find those persons cannot calculate, and make any correct estimation upon the cost of their goods, and carry on business without many books, and very loosely, most of their calculations being guess work. It must be admitted, that no calculations can be made which will bring both warp and filling to work up together at all times, and yet they can be made to work very nearly together.

Most of the mills take the wool from the Wool Room as they say by the tub or vat; such tubs or vats usually have a capacity capable of holding from 200 to 300 lbs. of scoured wools, and when of that size they would be called 400 or 500 pound tubs or vats (as speaking of the wool in the grease), and their scouring facilities will not allow them to cleanse any more from day to day than is generally used. And when they use different sorts and kinds of wool, they generally make their calculations for stock to be used from the probable shrinkage of the wool, and thus take more or less of one kind or the other in the grease, according to their respective shrinkages, and the proportions in which they wish the wools to appear in their respective lots. The following rule and example will explain the best method for calculating in this case:

NOTE.—There has been taken from the wool room 400 lbs. of 1st quality fleece wool, which we have previously ascertained shrinks 40 per cent. and we will get of clean stock 240 lbs; and we wish to add to this the same number of pounds of 1st quality Mestiza wool, and which shrinks 55 per cent. How many pounds of Mestiza shall we be obliged to take in the grease, to just equal the 240 lbs. of clean fleece? The Mestiza shrinks 55 per cent, so that 45 lbs of clean wool will be obtained from each 100 lbs. in the grease.

RULE.—*Divide the pounds of clean wool wanted, with two ciphers annexed, by the pounds of clean wool obtained from each* 100 lbs. *of the wool we wish to take out; the quotient will be the pounds required in the grease to obtain the pounds of clean wool wanted.*

EXAMPLE.

Lbs. of clean Mestiza wool from 100,)45)240,00 the lbs. wanted clean wool.

533⅓ lbs. ans. as the number of lbs. of Mestiza wanted in the grease, at 55 per cent. shrinkage, to obtain the 240 lbs. clean stock. This rule works both ways, or the reverse of above example.

Again, suppose we had a lot and we wish to add a certain percentage of cotton, or shoddy, or wool.

NOTE.—Suppose we have a lot of 856 lbs. of wool, and we wish to add to it 20 per cent. of cotton, what will be the weight of cotton required?

RULE.—*Divide the pounds already known, with two ciphers annexed, by* 100 *per cent. less the per cent. we wish to add, the quotient will be the total weight of the lot, from which subtract the pounds already known, their difference will be the pounds to be added.*

EXAMPLE.

100 per cent. less 20 per cent.=80 per cent. for a divisor, 856 the pounds already known as the dividend. 80)856,00(1070 lbs ans. as total pounds with
85600 20 per cent. added.

1070 less 856 lbs.=214 lbs. the pounds of cotton required for the lot.

To find the cost of clean wool when the market price and the rate per cent. of shrinkage are both known.

RULE.—*Divide the market price with two ciphers annexed, by the pounds of clean wool obtained from* 100lbs. *the quotient will be the cost per pound for clean wool.*

EXAMPLE.—The market price is 40 cents per pound; the wool shrinks 30 per cent. per 100 lbs. giving us 70 lbs. of clean wool per 100 lbs.

Clean wool from 100 lbs=70)40,00 market price.

57 1-7 cts. per pound for the clean wool.

The following table will be found very useful as a ready reference, for obtaining prices of scoured wool.

TABLE SHOWING COST OF WOOL AFTER SCOURING.

Find the price in the left-hand column, and at the right, in the column headed by the per cent. which the wool shrinks in cleansing, will be found the cost of the cleansed wool.

Prices.	PER CENT. OF SHRINKAGE.											
	10	15	20	25	30	35	40	45	50	55	60	65
10	11	11	12	13	14	15	16	18	20	22	25	28
12½	14	14	15	16	18	19	21	22	25	28	31	35
15	16	17	18	20	21	23	25	27	30	33	37	43
16⅔	18	19	20	22	23	25	27	30	33	37	41	47
20	22	23	25	26	28	30	33	36	40	44	50	57
22½	25	26	28	30	32	34	37	41	45	50	56	64
25	27	29	31	33	35	38	41	45	50	55	62	71
27½	30	32	34	36	39	42	46	50	55	61	68	78
30	33	35	37	40	43	46	50	54	60	66	75	85
32½	36	38	40	43	46	50	54	59	65	72	68	93
35	39	41	45	46	50	53	58	63	70	78	87	100
37½	41	44	47	50	53	57	62	68	75	83	93	107
40	44	47	50	53	57	61	66	73	80	89	100	114
42½	47	50	53	56	60	65	71	77	85	94	106	121
45	50	53	56	60	64	69	75	81	90	100	112	128
47½	52	56	59	63	68	73	79	86	95	105	118	135
50	55	58	62	66	71	77	83	91	100	111	125	143
52½	58	61	65	70	75	80	87	95	105	116	131	150
55	61	64	68	73	78	84	91	100	110	122	137	157
57½	64	67	72	76	82	88	96	104	115	127	143	164
60	66	70	75	80	85	92	100	109	120	133	150	171
62½	69	73	78	83	89	96	104	113	125	139	156	178
65	72	76	81	86	92	100	108	118	130	144	162	185
67½	75	79	84	90	96	103	112	122	135	150	168	193
70	77	82	87	93	100	107	116	127	140	155	175	200
72½	80	85	90	96	103	111	121	131	145	161	181	207
75	83	88	93	100	107	115	125	136	150	166	187	214

DYE HOUSE.

To manufacturers who employ colored stock, the coloring may be considered one of the most important applications connected with their business. For upon the excellency of the colors, their proper combination, and the economical use of the various drugs and dyestuffs, depends the reputation, as well as a large share of the profits of the establishment; defective colors combined, or a defective color or shade in a fabric, spoil its favorable effect and good impressions quicker than most any other defect. That the beauty, brilliancy, and brightness of the colors depend very much upon the purity of the drugs and dye stuffs employed, and their proper application, all must admit. The idea that some manufacturers entertain, that a cheap article of drugs and dyestuffs by using a larger quantity of them, will equal a prime article, and produce as good colors, at a less cost, is positively a wrong idea. And no first-class dyer will say I am not right. In the first place use the best drugs and dye stuffs. Secondly, employ a skillful dyer who is capable of judging the qualities of his materials, as to the quantity of pure coloring matter they contain, and thus he will be able to use them prudently, and avoid unnecessary expense, and also who knows how his materials should be applied to produce the desired color or shade without extra boiling. Boiling wool is no process by which it is benefited for any purpose in any fabric. A little boiling does not appear to have any material bad effect, but an excessive boiling not only extracts the life from the fibers, but causes them to full, and mat, and tangle together and thus it will not card or work as well in any of the subsequent departments, consequently will not make as good cloth, thus the idea is presented that the least boiling the wool is subject to in this process, the better it is for it, and a skillful dyer will not subject the wool to the boiling point, for any longer time than is actually necessary. There are many of the so called "receipt dyers" and who lack a knowledge of the chemical qualities and affinities of the parts of drugs and dye stuffs, and providing there should be a variation in the drugs, &c., which they were using from those given in their receipt, and thus cause a variation in the color or shade, then comes the boiling, they must throw in a little more of some article and boil, providing that article don't produce the shade, throw in some other article and boil, and so on till the expected shade is perhaps obtained, or perhaps not obtained. And if not obtained, when asked the reason, he would respectfully say the fault was in such an article used or offer some other excuse. Such workmen not only damage the stock, but cannot be called profitable for manufacturers, but still are of some profit to dealers in drugs and dye stuffs. Thirdly–have the dye house constructed with a view to convenience, and supplied with all the proper apparatus to facilitate the operations. These three requisites fully complied with and there are no just reasons for defective colors from the dye house. Sometimes there are other agencies which the colors have to contend with, in some one or more of the succeeding departments, and which will operate against them somewhat, when they are produced from the dye house bright and beautiful. Among these agencies we find the admixtures of various kinds of wastes, shoddies, cotton and flocks, and the improper treatment in fulling and scouring. Shoddies, generally are a dull mixture, if not a mixture, are a faded color or shade, being usually made from old rags, cast off garments, &c. Wastes are also usually a mixture, though some wastes are pretty good colors. When a mixture is desired in a cloth, some wastes may be used with a proper stapled wool, and produce a good mixture and a good fabric. Usually, the more wastes and shoddies which are mixed in with our good colors, the more we decrease their brightness and fullness. Some wastes can be dyed and the color appear tolerably well, and when used to produce a mixture, may be made to appear quite well, if not used to excess and thus overbalance the better color. Also cotton has no natural affinity for fast colors; although it can be colored quite bright and bloomy, it has a very small power for retaining it, so that for mixing with bright wool colors it has a tendency to tone them down somewhat, and if not fast will stain them. A few flocks properly applied to the backs of closely woven cloths, do not have any material bad effect upon the colors. Quite often the person who is intrusted with the flocking and fulling is neglectful, and some of the flocks get upon the face of the cloths, and thus produce a bad effect upon the colors; also when applied to cloths of an open and slack weave, they are quite apt to work through on to the face. Judgment and skill are required in the flocking and fulling. Sometimes the cloths are woven too wide (probably the designer's fault), and thus they require to be exposed to the friction of the fulling mill too long before they are reduced to the desired width; the exposure is apt to cause the colors to be started, so that in the subsequent process of scouring, they are usually spoiled.

In these two processes of fulling and scouring, the colors are generally subject to their severest tests. Sometimes the soap is applied too hot, or too strong; (continued in finishing dept.) there are also the natural elements of air, light, and water, so that from these conclusions we learn that our dyer is not always to be blamed for imperfect colors. But if they are not produced right from the dye house, I know of no effectual method for helping them in the other departments, except the cloth may be returned after fulling and washing, and colored in the piece. Besides, the injury to the wool which may be caused by excessive boiling.

Caution should be exercised when using such chemicals as copperas, oil and blue vitrols, and the various tin and iron solutions, as they injure wool if not used very sparingly. A small quantity too much is sure destruction. Some of the destructive influences mentioned with which the colors have to contend, may be over come somewhat, by having the colors fixed, that is, made fast by the so called mordant or preparation process.

Materials to be dyed, of whatever nature, are seldom found to have such an affinity for the dyes, &c., used that they will retain them, and thus the necessity of applying the "mordant" or remedy. Chemistry has discovered that there are certain substances, which will fix themselves permanently upon the fibre, and then by uniting chemically with the color, fix that permanently also; and this application is called as above, the "mordant." It is sometimes the case that in thus combining with the colors, the mordant modifies or alters their tones, and when having that effect are usually called "alterants;" but the most permanent colors are produced by applying the mordant before the coloring principles. A skillful dyer understands the chemicals necessary to produce those changes. The variations which may be produced, and the multiplicity of shades which arise by mixing the portions of the various dyes and mordants, gives a wide field for the study of cause and effect.

For those colors which contain alkali in the excess, soaps of a fair strength have a tendency to brighten them, and when acids are in the excess, the soap has a tendency to injure them; and when acid colors are not totally spoiled, they may be restored somewhat, by running them in a bath of oil of vitrol (sulphuric acid), and water. Have the bath to taste a mild sour. This can be done the best usually in the scouring machine or washer in the finishing room. Let off all the soapy water, and rinse out the washer well, then let in the fresh water and add the acid as before mentioned, and run the cloth in it a few minutes. I have seen Nicolson blues, and some other analine shades (completely spoiled apparently by strong soap), completely restored by this bath.

The art of fixing colors a id dyeing, is one of the most progressive connected with manufacturing in America. What a progress since the days of Daniel Webster as he relates it, who, while he was on his way to a new school in a new suit of homespun blue, was overtaken by a shower, and the color washed from his coat into his shirt. With the lapse of time the art will be better understood than now.

CARDING ROOM.

As all manufacturers desire to make the best possible fabric from the stock employed, and as it is subject to its first mechanical operations in this department, it is very evident the result of these operations will bear seriously upon the subsequent operations, and thus upon the fabric. Upon the uniformity of the roving, depends the uniformity of the spun yarn; upon the proper intermixing, straightening and connecting of the fibers for the roving, depends the smoothness, strength and elasticity of the spun yarn. If the stock is minced and improperly mixed, the roving will be short, uneven and nubby, and will not draw out in spinning, and will make a fuzzy, uneven, and feeble yarn (which is not desired ;) thus stock which has passed through this department, literally speaking, begins to assume the appearance of yarn. And upon the quantity of yarn produced, depends to a great extent the quantity of yards which will be produced from the looms. And upon the quality of the yarn, depends to a great extent, the quality and appearance of the fabric. Thus the relations and dependencies bearing upon this department, are of much importance. The first important step is the preparation of the stock, oiling, mixing, picking, &c., which takes place in the

PICKER ROOM.

The preparing of the stock, previous to its transfer to the carding room, should usually be considered an important operation, although some are not inclined to so consider it. Our best carders usually give this branch of their department a reasonable share of their attention, especially when various shoddies, wastes and cotton are employed with better stock, or when two or more colors are to be mixed to form a desired shade or mixture, or when some of the shorter stapled wools, as some California or Mestiza are to be used with longer staples. To mix the shorter staples of stock in a proper manner, is almost an art; any ordinary workman may be able to card the various sorts of fleece wools, but to mix and card the various admixtures of short and long staples, and make good work, and not make an unreasonable amount of waste, is almost another occupation.

When short and long staples are to be used together, they should be well mixed in the picking process; besides the regular picker which is found in all woolen mills, some have a willowing machine, which is a very good machine to help in mixing. Long stappled stock is employed to carry short stock; but do not have the longer stapled stock too coarse and hairy, as it will not carry the shorter (staples) stock, as well as the middling or finer grades.

The best and most even mixtures are produced by mixing a shorter with a longer staple, providing neither are a very coarse stock. Some will say, that a long coarse stapled wool will carry more short stock than a finer staple; I should say not, as the coarser the stock is, the nearer it approaches the hair and is apt to be curly. There will also be a less number of fibers in a yard of yarn of the coarse, than if finer and not quite so long; and the more fibers of fair length, the more short stock will be carried, and make a strong, smooth yarn, as there will be more fibers of the long stock to connect, as well as wind around the short stock, and thus there will be less waste; still, there is such a thing as overloading a lot of fair stapled stock with shorter stock, the result of which will be a large percentage of waste, (and waste is waste), the waste thus obtained is not worthless stock, but it does not form a profitable production, and the less of it is made the better. The fourth and fifth qualities of fleece wools which have a pretty long staple, will carry more short stock than any stock in the market.

Colored wools which are dyed with chip or ground woods, should be run through the duster till the dyestuffs are effectually cleaned out. When wool is to be mixed with colored cotton, they should each be passed through the picking process before mixing. Colored cotton is always very much matted and stuck together, which is caused by its being so thoroughly wet in the dyeing process. White cotton does not usually require to be picked before mixing; also in applying the oil to lots in which cotton is to be mixed, apply the oil to the wool part of the mixture, and whip it in thoroughly, and avoid oiling or wetting the cotton. If cotton is to be used in a medium grade of goods, I think it is best to use as much of it colored as possible; for when white cotton specks get into a piece of goods which contain one, or two or more colors, they show very conspicuously; and cotton specks show off to a better advantage than wool specks. Colored cotton is said to contain about 50 per cent. more combustive properties, than the white or raw material, and thus requires careful watching—keep from the sun's rays and steam pipes.

As is mentioned in the Dye House remarks, cotton has no natural affinity for fast colors, thus it has a very small power for retaining them, so that cotton when colored and employed in a fabric with the white, the color is apt to run from the colored and unite with the white, just enough usually to stain it, so that unless the color is fixed upon the cotton, a very difficult operation, it is best not to use much white cotton in the same fabric. Wool is not stained usually by cotton colors. When two or more colors or shades are to be mixed in the stock to produce a certain shade, the finer the stock employed the more even and better the mixture. A 1, and A 2, California and Mestiza wools, mixed with the 1st, 2d, 3d and 4th qualities of No. 1, X, or XX fleece wools, usually make good mixtures as well as good yarn and cloth. The Spring clip of California is usually a longer staple than the Fall clip, and will make good cloth of itself; Fall clips being shorter, will not work as well alone, and thus require the assistance of longer staples. A 1, is the best, A 2, is the next, B next, and so on. Mestiza wool is also known by A 1, A 2, &c., is somewhat similar to California, as regards the length of staples, the latter is usually the finest, and thus is heavier and will shrink more in scouring, and the market price is usually lower, but the great loss in scouring usually makes it the most costly wool in the market for fulled cloths.

Cape of Good Hope wool is sometimes employed for a fabric upon which a thick fine nap is desired, or a velvet finish. Its staple is usually not very strong. The finer grades of California and Mestiza, are equal to any wools usually employed for fulled cloths, for producing a velvet finish, or a thick nap, or a glossy finish.

The first quality of A. 1, Mestiza, of a fair staple, mixed with the first quality of X or XX fleece, about half and half, makes about the best stock for a black doeskin warp, thus showing that a good yarn can be made, as good yarn is required for such cloths, especially the black, glossy doeskin. There are also the burry and very burry California and Mestiza and Texas wools; the two former usually contain the small ring bur, the latter the large plum bur. Of these two species the ring burs are the worst; they resemble a coil, as they may be unrolled and form a thread from one to two inches in length, and if not separated from the stock in the subsequent process of carding, will usually unroll and unite with the yarn, and thus make bad work in spinning and weaving. No manufacturer should attempt to use such wool, unless supplied with a good bur picker. The burring process is by no means of any assistance to the stock or staple; its tendency is to tear the fibers. Wools which are very burry will usually lose from 5 to 15 per cent. in this process, which advances their cost so much more. Wools to be burred should be bone dry, so as to make the bur hard; thus it will be more easily severed from the stock, than when wet and soft.

Texas and Oregon wools are noted for their coarse long staples; the finer qualities make good Scotch tweeds, and blankets, and will do for back filling to medium and low grades of cloth.

OILING WOOL.

The matter of oiling wool is of much importance. Good oil, correctly applied, will be found to be a valuable assistant, through all the departments. In the carding process, its tendency is to straighten the fibers and thus help to connect them, and make a strong smooth yarn; it also helps to make the strands even and thus strong, also less flying or waste is made, also it keeps the teeth or wires of the card clothing clean, thus good yarn is more apt to be produced, with less waste, and which yarn will spin well and weave well. And in the finishing room, the oil will be easily washed out of the fabric, without excessive application of strong alkaline soap, which will neutralize and thus injure the colors, especially those which are produced by acids, and some delicate alkali colors or shades. An inferior oil will be found to operate contrary to what is above mentioned.

Olive Oil stands highest in the ranks of wool oils, as well as highest in price. Usually, a less quantity will answer for the same amount of wool, than the lower order of oils, so that the cost may be materially reduced nearly to the cost of a No. 1 lard oil, which stands second in rank to the olive. And a really No. 1 lard oil is quite good enough to apply to any grade or quality of wool; also a No. 2 lard oil if fully up to that number will not be much inferior to the No. 1. We have another lard oil called the Saponified Red Oil, and I think it is quite as good as a No. 2 lard. A very good soap is easily made with it, thus showing its saponifying qualities, and that it will work well in the fulling and scouring processes; also it works well in the carding process, and is cheaper than a No. 2 lard. Use about 1 gallon to the 100 lbs. for colored sorts from 4th quality and coarser, and finer qualities when white; for finer than 4th quality colored, use 5 or 6 quarts to the 100 lbs. This oil will not smell as well upon the stock while in operation,as the olive and No. 1 and 2 lard oils; but when scoured and finished properly, no bad smell will be found. I also think as an average it is more uniform than other lard oils, i. e., it is not so often stuffed with inferior compounds, as is the case with the higher grades.

Uniformity in oils is of very much importance, especially to the finisher, who is able to regulate his soaps to a certain degree with the hydrometer, and always produce clean cloths, without injuring the colors, or giving the cloths the harsh and wiry feeling produced from a use of excessive alkali. An inferior No. 1 or 2 lard oil, is a poor article indeed; they may work tolerably well in all departments except the finishing, when a soap will be required to clean the cloths, strong enough to neutralize the colors, and make the cloth feel harsh and wiry as stated above.

For using a No. 1 lard oil, apply about one quart to the 100lbs. less than for Saponified Red Oil, or it may be reduced still more and make good work, with the following mixture:

3 or 4lbs. of Borax, (the red preferred.)
2 lbs. Sal Soda,
1 Barrel soft water.

Boil 45 minutes, and use about three quarts of the mixture well mixed with three quarts of oil for 100 lbs. of clean wool, or more mixture and less oil. The above mixture is better if allowed to stand a week before using. I would not advise the mixture for use only when the stock is to be put upon the cards very soon after it is applied; or it would do very well for the self oiling machines. For lots which are oiled and picked, and stored for a week or more, the evaporation of the water, &c., will not leave the stock in as good condition as clear oil. The mixture would be a good one without the sal soda, its tendency is to soften the staple and assist in scouring. Most people know the virtue of Borax, what a good effect it produces upon the hair, making it smooth, soft and glossy; it has a similar effect upon wool and is a valuable assistant in the carding process, and would be a good mixture for any kind of oil.

ADULTERATED OIL.

The desire to adulterate oils, seems to be almost equal to the desire of some of the manufacturers of woolen goods; sharp competition prevailing the past few years, some unscrupulous dealers have been tempted to offer staple oils, guaranteed strictly pure, at less than the cost of production, and by adulterating are able to obtain a margin of profit. Crude petroleum is found to be benzined; lard oil is adulterated with cotton seed oil, and sometimes it contains acid; lubricating oils are made heavy with rosin oil; therefore a test to detect the adulteration is much desired. The following method for testing lard oils for manufacturers, is about if not quite equal to any yet known, as follows: Take a common glass tumbler and fill about one-third full of melted scouring soap, of pretty good strength, not much stronger than for using, say two or three degrees hydrometer. (See finishing.) And add to this about another one-third of the oil, stir and mix well, and then observe as follows:

A No. 1 lard oil, will yield a milky like mixture, and if allowed to stand awhile, will not separate much if any, and if it appears as above stated, it is a good article and will work through all departments nicely. A No. 2 lard oil, will also appear something like the No. 1, only there will arise at the surface small patches which will not mix readily, and if allowed to stand awhile, the soap and oil will separate very much. When either of the two numbers have been adulterated much, they will not give so much of the milky appearance, and will separate very quickly; and if adulterated very much, will make a thick mass, similar to meal and water. The writer saw an instance where it appeared as last mentioned, but hundreds of yards of goods were damaged before the matter was traced to the oil in the picker room. The goods were damaged in the scouring, as they were washed with an excessively strong soap to start the grease; the cloths being black and white double and twist, were made cloudy, i. e., the grease and color was started in some places, and set in others, giving the so called cloudy appearance. Had that oil been tested it never would have been applied, and the damage never happened.

The Saponified Red Oil will not yield a milky like mixture, but will retain its reddish color; yet it will mix and appear soapy, and a few particles will arise at the surface. Should it be very poor, it will thicken somewhat and curdle. We also have the Red and Elaine oils, which are not so much used as the better grades, and are usually applied to satinet stock, &c.

SPINNING ROOM.

This department the next in order is an important department, though should the stock not have been properly fitted, or properly selected to meet the requisites intended, it is not liable to be improved much by the process of spinning. Calculations are usually made before the stock reaches this department, as to the size of yarn required, and the stock is selected, and carded to meet the requirements. But sometimes the stock is not qualified to spin to the size desired, when it has been properly carded; in which case it may be made to spin better, and not to change calculations very much, by altering the size of the yarn, that is, providing the stock was proposed for an 8 run yarn, and it will not draw out to that size without much trouble, by breaking when spinning, then perhaps there may be an improvement made by making the yarn a little heavier, by spinning 7½ runs fine, or a little heavier, and perhaps it will then answer just as well for the fabric. Again, suppose the stock was qualified, and not properly carded, then perhaps the same alteration in the size of the yarn will make an improvement, so that there is a little chance to correct defects in this department. In this department, previous faults arising from improper selections of stock, improper mixing and improper carding will be first observed.

In this department as well as any of the others, the stock may be improperly managed. Skill is required on the part of the spinner who operates the jack, especially when fine yarn is in the process. An unskillful workman may easily make bad work by causing the threads to break upon the jack; practice is required to operate a jack properly, after the theory is fully understood. The self operating machines (mules), are an improvement upon the ordinary jack; thus the fact is presented that to operate the jack in a proper manner, it must be moved uniformly when drawing out, the coarser the yarn is wanted the less drawing is usually required; yet care is required as well as for finer yarn.

The several twists to which yarns are submitted, are designated as right, left, hard, slack, double and twist, three ply, four ply, diamond, &c. These twists perform important services in a fabric. Very many of the woven cloths are of the twill order, and twists and twills are dependencies. When a good, smooth, round right hand twill is wanted, the warp yarn must be right twisted, and for a good left hand twill have warp yarn left twisted. The first sample of cloth, will serve to illustrate twills; the herringbone comprises two twills, the right hand side from the point is a right twill, the left hand side from the point is a left twill, so that to make the two twills perfectly, two twists are required; but the twists in the sample are both right hand, and thus by observing it may be easily seen there is a difference in their appearance; the right hand side twill is smooth and round, while the left hand is more flat and not as smooth; the difference would show more distinct if the herringbone was larger, so that more of the twills could be seen. Also the yarn is very hard twisted, so that there is less difference to be noticed.

The twist applied to the filling as regards right or left, does not have any material effect upon the appearance of the face of the goods, and some manufacturers think the twist of the filling is of little importance whether a left or right twist. All know that it is easier to make one twist continually, than to change jack bands and change twists. Some manufacturers think a better fabric is made by having the filling twisted contrary to the warp. I have seen both plans tested and could not discern the least difference in their appearance or strength.

HARD TWIST.

A hard twisted yarn is made by subjecting the roving to an extended length of time while receiving the twist on the jack, thus making a hard firm thread; sometimes so much twist is put in that the yarn will be kinky; the kinks may not be observed till the yarn is being unwound from the bobbins when spooling, or in the shuttle when weaving. By subjecting the kinky yarn to a few minutes (in a box) steaming, the kinks will be somewhat taken out. For cloths upon which the twill is to show distinctly, or when several colors are combined and a close finish is intended to show the pattern distinctly, the yarns which predominate upon the face, either warp or filling, will require to be hard twisted, as cloths which are to receive such a finish in order to look well, clear and bright, are subject to considerable gigging, and if not well twisted, the threads upon the face will look raw and worn instead of smooth and bright.

SLACK TWIST.

Slack twist is the reverse of hard twist. Cloths upon which a thick nap is desired, the yarn is usually a slack twist, as for chinchillas, velvet finish, &c., unless for a black glossy doeskin or beaver. The extra amount of gigging applied to such cloths, requires a well twisted, strong thread, thereby requiring less gigging to work up the fibers necessary to produce the nap.

Yarns which are to be twisted with silk for a silk mixture, are usually slack twisted, as when in the process of spinning them together, the yarn receives more twist. Also the silk being usually a fine strong thread helps to strengthen them. Also the silk will show more conspicuous in the finished cloth, when applied to a medium slack twisted thread. When silk threads are applied to warp yarns, it may be necessary to have the yarn well twisted, so to make a good strong warp.

It is necessary to be very careful when making yarns for silk mixtures, to have them uniform in size. Also when applying the silk to have them evenly twisted, as silk mixed cloths show very quickly if the silk twist is uneven. Usually in the second process of spinning, when the silk is applied, considerable twist is put in, as the more twist applied the more silk will be shown in any given space.

DOUBLE AND TWIST

Yarns are also hard and slack twisted. If the two threads which form the twist are twisted very closely, the twist would be called "hard;" and if not closely and firmly twisted, the twist would be called "slack." The number of holes of twist applied to such yarns, may be ascertained by observing how many times the threads are wound around each other in the space of an inch. As for instance, if wound ten times in the space of an inch, it would indicate that ten holes of twist had been applied. The application of twist to yarns, will depend upon the style of goods to be made; to make a firm cloth of double and twist, the yarn is usually well twisted. Also to make a good twill, twist the warp yarns the same way of the twill as though single. A double and twist in the warp when very slack twisted, will not appear so regular and even in the goods as though hard twisted; and if twisted contrary to the twill, the cloths will appear a little uneven. The style of some goods require such an uneven and irregular appearance.

In some cases, when a somewhat peculiar and uncommon pattern is desired, only one or two holes of twist to the inch is applied to the warp, and in the cloth thus made, the colors composing the twist will appear irregular; sometimes one color will show for the space of one-half an inch, then the next color appears the same. Sometimes the filling is twisted the same when it is desired to appear irregular; but such twists are more commonly applied to the warp. Another twist may be made in the filling, by winding two differently colored yarns upon a bobbin, and when in the process of weaving and the two threads are unwinding, they will form a very slack twist and make a peculiar appearance.

THREE-PLY,

Three threads twisted together, is also made hard and slack twisted. Sometimes a double and twist of bright colors may require to be toned down so as not to appear quite so prominent; then by twisting another thread around them of a more somber color or shade, the brilliancy will be somewhat modified. Sometimes twists are used more especially to obtain weight, or in warp when a cord, or twilled stripe, or a feather, or a herringbone is to be made in a combination, with a ground work of single yarn, then by having the warp threads which are to produce the cord, twilled stripe, &c., made of double and twist, they will show more prominent, and will be somewhat raised from the ground weave.

DIAMOND TWIST,

Sometimes called braid, is made by having either a single, a double and twist, or a three-ply thread twisted with another thread, either a double and twist or single, twisted to the opposite. Thus the thread contains two twists, and appears diamond shaped, or something like braiding; and when used with two, three or more different colored threads, it makes a peculiar and uncommon twist. Sometimes the last thread or threads applied, are wound around very loosely which is usually called "lapping," and when applied thus tends to appear rather more peculiar.

To Calculate Sizes and Weights of Yarns Systematically.

In order to manufacture cloth in a scientific and systematic manner, by and with the use of various sizes and weights of yarn, it has been found necessary to devise some method by which both the sizes and weights may be calculated and known; and to meet this necessity, the spinner's table was originated, which is based upon weight. A given number of yards of spun yarn in order to be of a certain size, must weigh a certain specified weight. These various sizes of yarn are called runs; 1 run, 2 runs, 2½ runs and so on. The No. 1 run (or size), is the basis or starting point as speaking of the fineness, and is the largest size for which a weight is usually given. 1600 yards of number one run yarn weighs one pound avoirdupois (7,000 grains); 1600 yards of any sized yarn makes a run; but the weight of the run determines what number run the yarn is, or the size.

The following table for calculating the size of yarns, will be found a correct and convenient method, and is a calculation for 50 yards. As calculations can as readily be made from 50 yards as 1600 yards, the surest method is to take 10 bobbins from different parts of the jack, and reel off 5 yards from each for the trial, 100 yards would be required to weigh twice as many grains as specified in the table. There are yarn beams with the runs and fractional parts given for a certain number of yards, in which case the table would not be so valuable. But the apothecary scales are a surer balance than any other. As I have seen a considerable variation between two of the first mentioned balances, and a little variation makes quite a difference in the size of yarns, and a little variation in weight with 25 or 50 yards, foots up pounds in a few thousand yards.

SPINNING TABLE.

Runs.	Grains.	Runs.	Grains.	Runs.	Grains.	Runs.	Grains.	Runs.	Grains.	Runs.	Grains.	Runs.	Grains.
1	$218\frac{3}{4}$	3	73	5	$43\frac{3}{4}$	7	$31\frac{1}{4}$	9	$24\frac{1}{4}$	11	20	13	$16\frac{3}{4}$
$1\frac{1}{4}$	175	$3\frac{1}{4}$	67	$5\frac{1}{4}$	$41\frac{3}{4}$	$7\frac{1}{4}$	30	$9\frac{1}{4}$	$23\frac{3}{4}$	$11\frac{1}{4}$	$19\frac{1}{2}$	$13\frac{1}{4}$	$16\frac{1}{2}$
$1\frac{1}{2}$	146	$3\frac{1}{2}$	$62\frac{1}{2}$	$5\frac{1}{2}$	$39\frac{1}{2}$	$7\frac{1}{2}$	29	$9\frac{1}{2}$	23	$11\frac{1}{2}$	19	$13\frac{1}{2}$	$16\frac{1}{4}$
$1\frac{3}{4}$	125	$3\frac{3}{4}$	58	$5\frac{3}{4}$	38	$7\frac{3}{4}$	28	$9\frac{3}{4}$	$22\frac{1}{2}$	$11\frac{3}{4}$	$18\frac{3}{4}$	$13\frac{3}{4}$	16
2	109	4	$54\frac{3}{4}$	6	$36\frac{1}{2}$	8	$27\frac{1}{4}$	10	$21\frac{3}{4}$	12	$18\frac{1}{4}$	14	$15\frac{3}{4}$
$2\frac{1}{4}$	97	$4\frac{1}{4}$	$51\frac{1}{2}$	$6\frac{1}{4}$	35	$8\frac{1}{4}$	$26\frac{1}{2}$	$10\frac{1}{4}$	$21\frac{1}{2}$	$12\frac{1}{4}$	$17\frac{3}{4}$	$14\frac{1}{2}$	15
$2\frac{1}{2}$	$87\frac{1}{2}$	$4\frac{1}{2}$	$48\frac{1}{2}$	$6\frac{1}{2}$	$33\frac{3}{4}$	$8\frac{1}{2}$	$25\frac{3}{4}$	$10\frac{1}{2}$	$20\frac{3}{4}$	$12\frac{1}{2}$	$17\frac{1}{2}$	15	$14\frac{1}{2}$
$2\frac{3}{4}$	$79\frac{1}{2}$	$4\frac{3}{4}$	46	$6\frac{3}{4}$	$32\frac{1}{2}$	$8\frac{3}{4}$	25	$10\frac{3}{4}$	$20\frac{1}{2}$	$12\frac{3}{4}$	$17\frac{1}{4}$	16	$13\frac{3}{4}$

For estimating double and twist yarns, add together the grains opposite the number of each size used, their sum will be the weight opposite the size to which they belong.

Examples.

6 runs, $36\frac{1}{2}$ grains.
4 runs, $54\frac{3}{4}$ grains.

$91\frac{1}{4}$

Against those grains in the table, we find the yarn would be on the heavy side of $2\frac{1}{2}$ runs, i. e. between $2\frac{1}{2}$ and $2\frac{1}{4}$, nearer $2\frac{1}{2}$ runs.

6 runs, $36\frac{1}{2}$ grains.
8 runs, $27\frac{1}{4}$ grains.
10 runs, $21\frac{3}{4}$ grains.

$85\frac{1}{2}$

Against those grains in the table, we find the yarn would be on the light side of $2\frac{1}{2}$ runs.

These calculations will be somewhat imperfect, as the weight of the twist will depend somewhat whether they are hard twisted or slack twisted. Hard twist weighs the most. The surest method would be to weigh the twist, after the desired twist has been applied.

1600 yards makes 1 run of the clock attached to the jack (by which spinners are usually paid for their labor), without regard to the size of the yarn, so that providing there was no clock attached to the jack, the runs for the spinner could be determined by weight very correctly. Spinners if so disposed, can operate upon the clock, so that it will represent that several runs have been made, while in reality the jack has not been drawn out, nor a yard of yarn been spun ; this operation upon the clock is called "pumping." By understanding the spinner's table this operation may be detected; for the size of yarn, and the weight of yarn spun having been known, the number of runs for the clock may be calculated.

The following table shows how many runs for the clock will be made, from *one pound* of spun yarn of the various sizes; it also shows how many more yards of yarn may be made from one pound of stock when fine and drawn into a fine thread, as every 1 run for the clock makes 1600 yards of yarn, same as 1600 threads of one yard in length each.

SPINNING TABLE.—EXTENDED.

Size of Yarn.	Runs for Clock.	Yards.	Size of Yarn.	Runs for Clock.	Yards.	Size of Yarn.	Runs for Clock.	Yards.
RUNS.								
1	1	1600	3	3	4800	5	5	8000
1¼	1¼	2000	3¼	3¼	5200	5¼	5¼	8400
1½	1½	2400	3½	3½	5600	5½	5½	8800
1¾	1¾	2800	3¾	3¾	6000	5¾	5¾	9200
2	2	3200	4	4	6400	6	6	9600
2¼	2¼	3600	4¼	4¼	6800	6¼	6¼	10000
2½	2½	4000	4½	4½	7200	6½	6½	10400
2¾	2¾	4400	4¾	4¾	7600	6¾	6¾	10800

The above table is also an extension of the spinning table, and shows that the word run has two definitions. We say a yarn is 4 runs when speaking of its size; the same 4 runs also says, that one pound of that size makes 4 runs for the clock, and 6400 yards of yarn same as 6400 threads of 1 yard in length each. The above might be extended to 16 runs, but is sufficient to explain the idea intended. By referring to the table, the number of runs to the pound of the various sizes of yarns are given; and by weighing each set of bobbins spun, the runs may be calculated as follows:

EXAMPLE.

There was spun on the jack 100 lbs. net of 4 run warp, how many runs for the clock? 100 lbs. x 4, as 1 lb. of that size makes 4 runs, = 400 runs answer.

Suppose the several sets of yarn weighs 120½ lbs. and the size 3¼ runs, how many runs for the spinner?

$$\begin{array}{l} 120\tfrac{1}{2} \text{ lbs.} \\ \quad 3\tfrac{1}{4} \text{ runs to the pound.} \\ \hline 361\tfrac{1}{2} \\ \;\; 30\tfrac{1}{8} \\ \hline 391\tfrac{5}{8}, \text{ ans.} \end{array}$$

As yarns sometimes are on the heavy or light side of regular sizes, calculations must be made which will average accordingly.

Remarks on Mixtures, Apothecary Scales, &c.

The apothecary scales will be found very serviceable when making a mixture. No rule can be given or table arranged, by which a good mixture of two or more colors or shades may be united to form another color or shade, unless the different colors or shades are represented by colored (stock) samples. If a copy is to be taken from a mixture, some idea of the colors or shades of the combination may be formed, and then use the scales as follows: Suppose a West Point cadet mixture is desired and we have a sample of the cloth; by a close examination there appears to be three colors or shades, blue, yellow olive and red claret; the blue predominates, the yellow olive and red claret appear about equally divided, so that we will weigh 10 grains of the blue, and 5 grains each of the yellow olive and red claret; and to mix these colors we will use a pair of cotton hand cards (or strippers), and will mix them thoroughly, and compare with sample. Should the mixture be what is desired, then use grains for pounds and lay out stock accordingly. Or should the mixture not be shaded right, add more or less of the colors as desired, and keep account of the grains. Should the cloth finish as desired, then the colors or shades may be arranged in a book for that purpose, with the pounds of each taken, and if making many mixtures, by keeping account of the various shades and colors, we can have a perfect table to refer to.

These scales will also be found very convenient for weighing and calculating the weight per yard for cloths, when only a small sample of the cloth is obtainable. The following table is arranged for weighing one square inch, and is based upon 27 inches wide.

TABLE FOR CALCULATING THE WEIGHT OF CLOTHS FROM A SQUARE INCH.

Grains.	Ounces.	Grains.	Ounces.	Grains.	Ounces.	Grains.	Ounces.
1	$2\frac{2}{10}$	5	11	9	20	13	$28\frac{8}{10}$
2	$4\frac{5}{10}$	6	$13\frac{3}{10}$	10	22	14	$31\frac{1}{10}$
3	$6\frac{6}{10}$	7	$15\frac{5}{10}$	11	$24\frac{4}{10}$	15	$33\frac{3}{10}$
4	$8\frac{9}{10}$	8	$17\frac{7}{10}$	12	$26\frac{4}{10}$	16	$35\frac{5}{10}$

Suppose you have a sample of cloth, and you wish to know how many ounces a yard of the cloth will weigh of three-quarters width; cut from the sample one square inch and weigh with the scales. Opposite the grains in the next column will be found the average weight per yard in ounces and the fractional parts. As for instance, suppose a square inch weighs exactly 5 grains, then one yard of cloth of 27 inches wide same as the sample, will weigh 11 ounces. For 6 quarters wide, double the ounces above given.

Connected with this department usually is the spooling and dressing of the yarn.

SPOOLING.

Care should be taken when the yarn is being spooled, to have the ends securely tied, and have the vibration when various guides are used correctly adjusted, so that the spools will be wound evenly from the bobbins, and thus the spools will unwind evenly in the dressing process, which is of much importance.

DRESSING.

This is a process by which the yarns are arranged for producing the patterns, and great care should be taken to have them arranged properly, and also to have the various sections reeled equally alike as regards tension, and avoid letting threads run loosely, and have the lease cords correctly put in. And when the yarn is sized, be sure and have the cylinders sufficiently heated to dry the yarns; for perhaps by letting them be improperly dried and not woven very soon, the yarn will get mildewed. When winding the yarns from the reel upon the warp beam, have the tension to all the sections as near alike as possible.

YARN TABLE,

Showing the weight per yard, for various numbers and sizes of threads of warp and filling. In the left hand column find the size of yarn, and at the right in the column headed by ounces, will be found the number of threads required in one yard, to produce the weight mentioned.

Runs.	1-10 Oz	1 Oz	2 Oz	3 Oz	4 Oz	5 Oz	6 Oz	7 Oz	8 Oz	9 Oz	10 Oz	11 Oz	12 Oz	13 Oz	14 Oz	15 Oz	16 Oz
1	10	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
2	20	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
2½	25	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000
3	30	300	600	900	1200	1500	1800	2100	2400	2700	3000	3300	3600	3900	4200	4500	4800
3¼	32	325	650	975	1300	1625	1950	2275	2600	2925	3250	3575	3900	4225	4550	4875	5200
3½	35	350	700	1050	1400	1750	2100	2450	2800	3150	3500	3850	4200	4550	4900	5200	5600
3¾	37	375	750	1125	1500	1875	2250	2625	3000	3375	3750	4125	4500	4875	5250	5625	6000
4	40	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	
4¼	42	425	850	1275	1700	2125	2550	2975	3400	3825	4250	4675	5100	5525	5950		
4½	45	450	900	1350	1800	2250	2700	3150	3600	4050	4500	4950	5400	5850			
4¾	47	475	950	1425	1900	2375	2850	3325	3800	4275	4750	5225	5700	6175			
5	50	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000				
5¼	52	525	1050	1575	2100	2625	3150	3675	4200	4725	5250	5775					
5½	55	550	1100	1650	2200	2750	3300	3850	4400	4950	5500	6050					
5¾	57	575	1150	1725	2300	2875	3450	4025	4600	5175	5750						
6	60	600	1200	1800	2400	3000	3600	4200	4800	5400	6000						
6¼	62	625	1250	1875	2500	3125	3750	4375	5000	5625	6250						
6½	65	650	1300	1950	2600	3250	3900	4550	5200	5850							
6¾	67	675	1350	2025	2700	3375	4050	4725	5400	6075							
7	70	700	1400	2100	2800	3500	4200	4900	5600	6300							
7¼	72	725	1450	2175	2900	3625	4350	5075	5800								
7½	75	750	1500	2250	3000	3750	4500	5250	6000								
7¾	77	775	1550	2325	3100	3875	4650	5425	6200								
8	80	800	1600	2400	3200	4000	4800	5600									
8¼	82	825	1650	2475	3300	4125	4950	5775									
8½	85	850	1700	2550	3400	4250	5100	5950									
8¾	87	875	1750	2625	3500	4375	5250	6125									
9	90	900	1800	2700	3600	4500	5400	6300									
9¼	92	925	1850	2775	3700	4625	5550										
9½	95	950	1900	2850	3800	4750	5700										
9¾	97	975	1950	2925	3900	4875	5850										
10	100	1000	2000	3000	4000	5000	6000										
10½	105	1050	2100	3150	4200	5250	6300										
11	110	1100	2200	3300	4400	5500											
11½	115	1150	2300	3450	4600	5750											
12	120	1200	2400	3600	4800	6000											

The preceding yarn table will be found to assist very much when proposing yarns for warp or filling when a certain weight per yard is desired, and the size of the yarn is known, or when a certain weight is desired, and the number of threads are known to find what size yarn will produce the desired weight, &c. The second column from the left, shows how many threads are required per yard of a certain size, to weigh 1-10 of an ounce.

NOTE.—Suppose a warp of 2000 threads of four run yarn is proposed; how many ounces per yard will there be of that size yarn? By referring to four run yarn in a column opposite will be found 2000 threads, and at the head of that column stands the figure 5, denoting five ounces.

Suppose a doeskin warp is desired of $6\frac{1}{2}$ run yarn, with 2350 ends in the warp; what weight will be a yard of warp yarn? Opposite $6\frac{1}{2}$ runs in the fourth column, we find 1950 ends weigh three ounces, and in the column headed $\frac{1}{10}$ of an ounce, we find that 65 threads weigh $\frac{1}{10}$ of an ounce, so that in 400 ends we get 6 of the 65 threads and 10 over, so that the warp would be on the heavy side of $3\frac{6}{10}$ ounces. For filling, suppose we wish to weave a cloth 36 inches wide in the loom, and intend to put in 70 picks per inch of five run yarn, what will be the weight of a yard of the filling. First multiply the width 36 inches by 70 picks per inch, and we find there will be 2520 threads, and opposite 5 runs in the sixth column we find 2500 threads weigh 5 ounces, so that 2520 threads will weigh on the heavy side of 5 ounces per yard.

The weights of yarn, &c., as given in the table will answer as a starting point, as a very correct idea may be formed of the various sizes and numbers of threads required to produce a certain weight. But these weights will always fall short a little, (as was mentioned in part first, answer to question No. 8,) for when the warp and filling are united, the yarn for each is taken up in the weaving process, so that a yard of the cloth when woven, will weigh from one to three ounces more than the yarn calculations, as per table. The taking up of the warp will be controlled by the size of, and the number of picks of filling applied; and the taking up of the filling depends upon the number of threads in the warp and the size of yarn. Also listing threads which are usually about one run, increase the loom weight as per table; 10 threads of one run yarn weighs $\frac{1}{10}$ of an ounce, so that 50 threads of listing of one run yarn weighs $\frac{1}{2}$ an ounce. The weights as per table will come nearer the finished weight, providing no flocks are applied, as there is a reduction in weight in the milling, scouring, (extracting the oil), gigging and shearing, so that calculations made from the table, will come very near to finished weights when no flocks are used. Thus the fact is presented that the loom yards and weights, will be the safest to make the estimations for the cost of the stock, &c., which is hereafter explained.

WEAVING ROOM.

This department is considered by some manufacturers to be most important of all. All must admit it is of much importance. The stock is here gathered and the various colors, qualities, and quantities, are united respectively and made to assume the appearance of a fabric. The stock has been selected to make the required size of warp, perhaps ornamented with a color or shade, reduced to yarn, and finally appears at the loom. In the mean time the other requisite (the filling) is in process. The stock having been selected, perhaps ornamented as was the warp, reduced to yarn, and appears already to be united with the warp, and as they are here united so must they remain. Thus two important points may be clearly determined, which are to have the warp made conformable to meet all the requirements, such as operating evenly and smoothly, and without unnecessary breaking, and delay, and also to have the loom properly adjusted so that the filling will be properly applied to suit the demands of the warp and fabric, and thus avoid making many of the imperfections which often occur in this process by the omission of proper attention in these directions. Another important point is to have skillful loom fixers, and operators who are capable of keeping the essential parts in proper running order, so that a large production of yards may be obtained; the production of woven yards is of great importance. A large production shows that the preceding departments have each made good use of their time in furnishing the required stock necessary to bring forth a large production. The larger the production of yards from the looms the less will be the average cost per yard for nearly all the expenses connected with the business excepting the expenses for stock and selling goods, as all estimations for the cost of goods are made upon a yard and by the yards woven. In weaving the cloths it is very important that they be made the proper width in the loom, so as to receive the proper felting without being subjected to the friction, and wearing of the fulling mill, (in next department,) to an unnecessary length of time, before they are reduced to the desired width. Cloths which are of an open or slack weave, or made with much slack twisted yarn usually require less time in the fulling process, than those of hard twisted yarns and firmly woven cloths. The former would usually be made wider than the latter when much fulling is desired. Also cloths which are heavily loaded with cotton should be made narrower, as cotton is not a felting material.

Generally speaking, cloths which are loaded with much short stock will not full as much as good wool; some goods demand much felting to bring them up to the desired style and finish. Sound judgment is required on the part of the designer, to bring the goods to the proper width, weight, &c., in the loom, to meet the requirements of a well finished fabric; and thus it may be safely stated that a part of the finishing is really applied in the weaving. Probably in no other department is the close attention of a skillful overseer so much required, as in this.

With many manufacturers, a custom has been established in favor of the weaver, which is to allow them to leave out a few picks per inch of filling, as for instance, a piece of cloth is to be woven with 60 picks of filling; the price per yard for 60 picks may be six cents, and the weaver instead of putting in those 60 picks, according to custom, puts in 56 or perhaps 50; there will be a saving of a little filling, and a little rise in the cost of weaving, as the cost of weaving 55 picks would be about a quarter of one cent less. This custom may be well enough, but there are always some to take advantage of a little privilege. I have known weavers who were paid for 40 picks, to actually leave out 10 picks to the inch in some parts of a cut, and the consequence of such uneven weaving, is cockled and imperfect finished cloth. Such a weaver is committing a dead fraud upon his employer. Such weaving is more apt to be carried on when the weave room is not well supplied with a competent overseer, who is capable of judging such cloth at sight, when perching or looking over.

Care should also be taken to have the yarn correctly drawn into the heddles, and also into the proper reed and correctly, and also use good heddles. The improved heddles made by Messrs. Hertle & Thompson, (see card, part third), are a superior article. Any improvements which tend to increase the production of yards from the looms are of much importance, providing the cloths are suitably finished, properly designed, and all other requisites fully complied with necessary to produce a good fabric, for which a good price may be obtained, and a profit realized.

FINISHING ROOM.

The next, and usually the last in the series of departments connected with the manufacturing appears this department, and as with all the others it is of great importance. For, providing the stock was properly selected, colored, and treated in all the other departments, and appears in this room in the form of a perfect unfinished fabric, by improper treatment it may be almost entirely spoiled. A good and suitable finish applied to any manufactured article, has a tendency to improve its general appearance and selling qualities.

The leading and principal department for some cloths is the finishing, especially for highly finished face cloths. A good finish will also very often remedy defects resulting from improper operations in some other department. The various processes to which the cloths are subjected in this department, each require care, good judgment and skill.

FULLING, OR FELTING AND FLOCKING.

Upon the fulling or felting process, depends very much the compactness and good handling qualities of the fabric. There are two important senses called into use when a sample of cloth is displayed, and which are the principal senses used for judging nicely of any performance or production, namely, seeing and feeling. If a fabric is composed of color or colors, they may make a favorable impression upon the mind through the eye by being clear, bright, well arranged and combined. But these favorable impressions may be greatly diminished by a sleazy, harsh, and infirm feeling.

A closely united and firm fabric will depend very much upon a proper fulling, i. e., providing it was properly woven, so that the proper fulling may be applied, and the clearness and brightness of the color or colors, depend very much upon the scouring, gigging, and also somewhat upon the fulling, i. e., providing they were produced from the dye house correctly, and were not impaired by mixing with other and worthless colors. Care should be taken when flocks are liberally applied, not to have them get upon the face of the cloths; also cloths of an open or slack weave, when they are not correctly applied, they will work through and show upon the face. Flocks are not an article which improve the appearance of colors or the face of cloths generally, their tendency is to improve the handling qualities when applied in reasonable quantities, and also their weight.

APPLYING SOAPS.

Care should be taken when applying soaps. To apply soaps in fulling and scouring processes in a scientific, economical and systematic manner, the strength of the solution when being prepared for use, should be regularly tested by the Hydrometer (Twaddle's), especially for scouring; and when the proper degrees of strength which will meet the required demand, and the best soap have been determined, then a certain degree of strength may be regularly applied, and thus clean cloths will be produced without injuring stock or colors. There are also many kinds of soaps made and used for fulling and scouring purposes, some of which have been found injurious to stock and colors, and which will be referred to hereafter.

The application of soap in the fulling process, depends somewhat upon the methods adopted. Some manufacturers full in the grease, (i. e., full the cloths before scouring), others full clean, (i. e., full the cloths after scouring.) Most of our manufacturers who bear the reputation of making the finest and best grades full clean; this process requires a third process which is washing, and thus more time and labor is required, and no doubt it is for that reason that the later method is not more commonly adopted. In most cases for either method, the soap (solution) employed for fulling, does not require a strength of alkali sufficient to sustain even one degree of the Hydrometer; but the soap should be a pure, good bodied soap, which will unite with the stock, relax the oil, and moisten the fabric thoroughly and thus support the felting. Care must be taken not to apply too much soap, (especially when fulling with the rotary mills), so as to produce a lather and cause the rollers to slip on the pieces and wear them, instead of drawing them between the rollers and thus produce the required friction and heat, necessary to produce a good felt. Cloths fulled clean will also take flocks better than when fulled in the grease.

When fulling in the grease, the same care should be taken not to use too much soap, nor have it too hot or too strong, and the same (neutral) pure good bodied soap is the best for this method, (as well as the other); as the felting principles are alike. Sometimes when the cloths are closely woven, and do not contain delicate colors or shades, as the beaver, doeskin, &c., one degree of alkaline strength may be applied without injury, and in some cases where much waste is used, one degree may be required to start the grease a little, and also start the felting. Generally when a degree or more of strength (alkali) is applied in the fulling, less strength is required for scouring; and when the grease is well started in fulling, care must be taken when scouring. It would be best to commence washing with the water moderately warm in the washer, and let the cloths run in that until the soap and grease are well loosened before the cold water is let in. It is generally considered that one degree of strength applied in the fulling, is about the same as 2 or 2½ degrees applied in scouring, as regards starting the grease and colors; thus the fact is presented that it is body and ability required in the fulling soap, and not the strength of alkali to produce the best results.

As has been previously mentioned, care should be taken to have the cloths made a proper width in the loom, so that they may not be exposed to the friction, pulling and wearing of the fulling mill, to an unnecessary space of time, as the rotary mills more commonly in use at the present day, are rather more trying to the strength of cloths than the old fulling stocks. I have seen cloths made from good fleece wool, and well woven, and apparently strong, made tender in the process of fulling in the rotary mills, owing to their having been set too wide in the loom, and thus required too much pulling and wearing before they were fulled to the required width; and cloths from the same warp were fulled with the fulling stocks and came out strong and perfectly felted. The pieces should be overhauled occasionally during the milling process, and stretched width-ways so as to avoid mill creases, which make a very bad imperfection, as they extend length-ways and thus are liable to damage several yards in succession.

Cloths which are to be flocked in the fulling mill, should have the edges sewed or tacked with strong twine length-ways, at regular intervals of two or three feet, with their face inside, which will keep the flocks from the face of the goods. There have been several machines invented for applying flocks to cloths on the brushing principle. These machines have not thus far proved a success. For one piece of three quarter goods from 30 to 35 yards in length, weighing from 11 to 13 ounces per yard in the flannel, from 2 to 2½ pails full of soap will usually wet the pieces sufficiently to start the fulling; for heavier, wider, and closely woven cloths, apply soap accordingly. The soap should be applied, slowly, evenly, and moderately warm.

SCOURING OR WASHING.

Cloths in this process are usually treated to a liberal application of soap, and sound judgment is required in the person who is entrusted to make this application, as it should be in a skillful and economical manner. As there are many kinds of soaps, manufactured and used for this process, the same desire seems to prevail among soapmakers, as among other manufacturers and dealers, viz: the desire to adulterate. And thus it remains with the consumer to devise ways and means to detect the honesty of the soapmaker. Among the soaps in use we have the so called neutral soap, containing a good body, and ability, and which is the safest, most reliable, and economical soap for fulling, and a soap which contains those two essential qualities will also be found equally as good for scouring, as the same soap will be able to carry a great quantity of alkali when it is required, and still have a surplus of body and ability remaining to facilitate the operations. There are also other soaps for which no name can be given, some of which are heavily loaded with *rosin, clay, water,* sal soda, *soda ash, salt,* &c., and as one soapmaker has said with *lightning;* some one or two of the above mentioned articles may be required to form the alkali which is required. It may well and truly be said, that the colors are usually put to their severest test in this process, and we may also say the stock sometimes. Rosin and clay are not articles which have a tendency to benefit a woolen fabric in any shape or form, (water will be referred to hereafter,) soda ash is not an article to be recommended for general use upon cloths which are made of good stock, with various colors and shades, as when used in liberal quantities it is excessively severe upon both stock and colors, and has a tendency to make the cloths feel harsh and wiry, and destroy the colors or tone them down very much. Sal soda, (soda ash ammoniaized) is far more excellent or desirable than any other of the alkaline materials generally used, its tendency is to make the cloths feel soft, and is not severe upon colors when used moderately and properly; salt is not an article which is to be recommended for general use as an alkali, it contains soda and muriatic acid, (more soda than acid, and more water than either.) Again sal soda, soda ash, and salt may be obtained at a less cost than by paying the usual soap prices for them, as we do when buying them in some of the heavily loaded scouring soaps. I think this article of soap which appears in the class of necessary supplies is often overlooked by many of the manufacturers, and is not very well understood by many of their finishers. And as manufacturers generally depend upon their finishers for their reports upon them, it may be well enough for them to be sure that said finishers are capable of judging in a scientific manner of their essential qualities and abilities. There are many finishers who make up their soap solutions by guess work, or perhaps by the taste of it, to decide its strength, which is guess work. A cook may be able to flavor a soup by the sense of tasting, but it is no rule for a finisher to go by. Again some finishers will use about the same number of pounds of soap for a boiling (solution) and pay no attention to its qualities and will add about the usual weight or amount of sal soda or soda ash, whether it may happen to be a pure and neutral or a heavily charged alkali soap, and then if the colors are injured condemn the soap, or if the cloths are not produced clean condemn the soap, and if the grease is not easily started keep applying the soap till it does start; such methods are applying the profits of an establishment to the trench. Again some finishers think they must use both sal soda and soda ash, and if they get out of sal soda will use the same quantity of soda ash to make up; they are probably not aware of the fact that one pound of soda ash, will produce nearly three times the alkaline strength of the same weight of sal soda, in the same quantity of water. The only safe and systematic method for using soap, is to use the hydrometer, and with the aid of it, and by observing the results obtained by using the various soaps, manufacturers can detect the honesty of the soapmaker, and by experimenting with the different soaps they may be able to make out very correct estimates of what soap it is for their advantage to use, as regards cost, as well as to meet the wants of their particular class of goods. Uniformity in soap is of as much importance as in drugs, dye stuffs, oils, &c. A finisher can produce better work by using one kind and quality of soap continually, providing it is made honestly, (i. e. uniform in quality) as then he is better able to judge of the treatment necessary to have his cloths always clean, colors bright, and the goods feeling soft and smooth.

The mistaken ideas of some manufacturers often lead them to buy what they would call a cheap soap, the cheapness of which they determine by the price paid per pound. But the simple instance as is shown by the following statement of a test trial, to show the average cost per piece of cloth for a soap which would be called by some comparatively dear, and another which would be called comparatively cheap, will show such buyers how dear, what they would call a cheap soap may prove to be.

I recommend a *neutral* soap to contain a good body and ability to carry alkali, and thus I may add an alkali as I desire, to suit the class of goods I make. And I have made estimations, in a scientific manner, and I think such a soap is the cheapest, although the first cost of such soaps are usually the highest.

The previous remarks on the economy of buying a neutral soap, lead me to give the result of a test made between a pure neutral good bodied soap, and one pretty well loaded with alkali, &c. And I will mention only the name of the party who are favored by the statement.

There was taken

171½ lbs.	of Dobbin's Electric Soap	9½ cts. per lb.,	$16.30
100 "	Soda Ash, - -	4½ " "	4.50
22 "	Sal Soda, - -	3 " "	.66
8 "	Salt, - - - - - -		.13
			$21.59

with this solution there was scoured 300 pieces of three quarters width fancy cassimeres, at an average cost of 7 and $\frac{19}{100}$ cents per piece.

There was taken

260 lbs.	of soap made by another Co.,	5½ cts. per lb.	$14.30
50 " "	Soda Ash, -	4½ " " "	2.25
12 " "	Sal Soda, - -	3 " " "	.36
4 " "	Salt, - - - - - -		.06
			$16.97

The above is every pound of alkali it would carry.

With this solution there was scoured 164 pieces of goods of the same width, weight, and length, as those scoured with Dobbin's Electric, and at a cost of 10 and $\frac{35}{100}$ cents per piece.

Difference in favor of Dobbin's Electric Soap, 3 and $\frac{16}{100}$ cents per piece, this saving on a production of 40 or more pieces per day would foot up quite a sum in a year.

These statements show though rather anomalous that a 9½ cent neutral good bodied soap, is cheaper even for scouring than a 5½ cent soap heavily loaded with some worthless mixture, *and verifies my statement* as to the economy of buying a pure good bodied soap, to which an alkali may be added for scouring purposes, and equal or better results obtained at a less cost than by buying some of the cheap soaps manufactured purposely for scouring. The 5½ cent soap as per statement was made by a company who have the reputation of making good soaps. For the purpose of adding more weight to my remarks upon a neutral good bodied soap, &c., and to show that such a soap is not necessarily confined to any one kind or class of goods, I will mention what some of our well known practical manufacturers say as to the merits of such a soap. The information thus obtained and given was addressed from them directly to the author (by correspondence,) and they each say respectively as follows: Mr. S. J. Chaffee, Superintendent of the New England Company of Rockville, Connecticut, says:

"We use Dobbin's Electric Soap because its felting properties are better, and also it goes further pound for pound than any soap we ever used."

Mr. R. D. Nesmith, Superintendent of the Woodvale Woolen Mill, Johnstown, Pa., says: "With the use of Dobbin's Electric Soap we get our goods clean without injury to the colors or staple of wool, and cheerfully give it the preference to any soap we ever used."

Messrs. Damon, Smith & Co., Westvale, Massachusetts, one of the largest firms in this country engaged in the manufacture of flannels, say: "We have used the Dobbin's Electric Soap for more than a year. We like the soap, and have found it to be a cheap and uniform article, and shall continue to use it as long as it maintains its present quality."

Mr. James Kitcheuman, manufacturer of all styles and grades of carpets, Philadelphia, Pa., says: "Dobbin's Electric Soap on carpet colors answers my purpose, and is to be recommended."

Mr. N. Fels, Superintendent of the Hamilton Mill, Paterson, N. J., engaged in manufacturing nice shawls, yarns, &c., says; "I have used nothing else but Dobbin's Electric Soap for the last eight months, and it gives me better satisfaction for washing shawls, and keeping colors up as wanted, than any other used before. In my opinion, the above mentioned soap is the best in market for shawls, and by trying, parties will find it so."

The soap referred to by the preceding manufacturers, is the same as referred to in the "Test Trial," and which shows that it contains the necessary qualifications to operate satisfactorily upon Fancy Cassimeres, Flannels, Carpets, Shawls, Yarns, &c.

Dobbin's Electric Soap is manufactured by Messrs I. L. Cragin & Co., Philadelphia, Pa. It is cut for consumers into thin shavings, and the water is very effectually dried out, and thus you pay for actual weight when dry, at the uniform price of 9½ cents per pound. And thus you buy a soap containing body and ability, instead of a surplus of alkali and water, for it is on the last mentioned article (which costs nothing), that manufacturers are sometimes very badly cheated. Chemistry has discovered that soaps have a strong attraction for water and consequently always retain a considerable quantity in their composition. And that the proportions in the best hard soaps vary from 25 to 30 per ct. and that it is possible to prepare a solid soap containing more than its own weight of water. And this fact is no doubt known to dealers as some of them store their soaps in cellars and damp places, since it is for their interest if not known to consumers, to sell as large a proportion of combined water as possible. But how are the pecuniary interests of the consumer affected by buying a surplus of water at from 3 to 6 cents per pound. The hydrometer in the hands of a skillful workman who understands the results which are obtained from a given weight of good soap will soon detect the extent of adulterations in soap.

WATER AND ITS EFFECT ON SOAP.

The water employed in connection with soap produces a variety of actions, and water is thus familiarly spoken of as hard and soft, according to its action on soap. The hard waters usually found in the western country contain compounds of lime and magnesia, and would be called hard. And these earths produce with the fat of the soap a substance which is hardly soluble, and occasion a curdling of the soap; soft waters do not contain these earths and unite with soap without difficulty. It is no doubt the presence of these earths which cause the difficulty experienced by western manufacturers when scouring or washing the oils from their fabrics, requiring an excessively caustic alkaline soap to make any impression. For if the soap is curdled and not properly held in solution it will be a hard matter to make it unite with the oil in the fabric and produce the required saponification. Suppose the soap solution to have been well made and applied to the fabric, and a good lather produced and the oil effectually started, and then to wash off the soap and dirt, the hard water to be applied; the hard water instead of cleansing the remaining soap and dirt from the fabric which is desirable, would tend to curdle it and set it in the fabric instead of removing it effectually. Many hard waters become soft by boiling, the heat expelling the substances which held the earths, and they are deposited upon the sides of the interior of the boiler or tank, forming an encrustation. Thus the idea is presented that by boiling a hard water or even warming it, it would overcome a great difficulty, and a little expense incurred for that purpose, would no doubt prove an economical expenditure.

TO TEST THE HARDNESS OF A WATER.

WELLS PRINCIPLES OF CHEMISTRY.

"The hardness of a water may be easily tested by adding to it a few drops of a solution of soap in alcohol; if the water remains clear it is perfectly soft, if it becomes cloudy it may be regarded as hard, and the degree of hardness being proportioned to the degree of cloudiness occasioned," in the ordinary waters of the east, (soft waters.)

When a good oil has been applied to the stock, a soap solution of sufficient strength to sustain about 2½ or 3 degrees of the Hydrometer has been found a safe strength for scouring when the colors are not very delicate, and will not injure stock. But as was previously stated when scouring after fulling, and one or more degrees of strength was applied in that process, then usually less strength is required in scouring, and when scouring before fulling generally a little more alkaline strength is required; should a strong soap happen to be applied in the fulling, care would would have to be taken in scouring, and not apply a strong soap especially if there are colors or the stock is any object; sometimes only warm water is necessary in this process, in fact warm water only should be used, because if the grease was effectually started and the piece had become cool, cold water would set the remaining grease very firmly. Also less alkaline strength is usually required when the borax solution, as was mentioned in the Picking

Room, was applied with the oil, as that solution tends to break the oil, and also produces a soap solution to a certain extent. Soap solutions should be tested by the Hydrometer, when about to a hand heat or a little warmer is no objection. For one piece of three-quarters goods as was mentioned in fulling, from $1\frac{1}{2}$ to 2 pails full of soap will usually answer to start the grease and dirt, but a lather is what a finisher desires to see, and then he is usually very sure the soap is working correctly upon the applied oil, removing it from the fabric, and that when washed it will be clean.

SOAP FOR SOLUTIONS.

An ordinary pail full of good fulling soap dissolved and boiled in from 40 to 45 gallons of water will usually make a good bodied solution for fulling use as previously directed. And about 16 or 20 pounds of good scouring soap dissolved and boiled in from 40 to 45 gallons of water, will make a good bodied solution, for the alkali; when more is desired add sal soda. To make a scouring solution of the Dobbin's Electric soap less weight of soap is required than when using the heavily loaded alkaline soaps.

TO NEUTRALIZE HARD WATER.

The following plan would be a good one for hard waters for Western Manufacturers; have a cask or vat capable of holding from two to six barrels of water, according to the size of the mill, situated near the washer. Have the supply pipe near the top, and the draw off pipe at the bottom of the cask or vat; have the draw off pipe so arranged, that the water may be brought to the washer, so that the water may be applied directly upon the pieces when they are revolving around the rollers; perhaps if a sprinkler should be attached to the end of the pipe, so that the water would be applied evenly upon the pieces it would be best. Introduce a steam pipe into the cask to heat the water, or any other effectual method; as soon as the cloths have run in the soap and a good lather obtained and the grease has been started, let off the soap and let on the warm water from the cask, at the same time let cold water into the cask, and by the time they have run in the warm water and have got well cleaned, the cold water will begin to appear, and by letting them run in the cold water awhile, they will come out bright and clean. A very good method for restoring acid shades when nearly spoiled by excessive alkali, will be found in the Dye House remarks.

GIGGING.

The cloths after scouring and washing are usually partially dried by the extractor, (and sometimes are dried) and are ready for the gigging process. Great care should be exercised in this operation. Some cloths will bear several slats of fresh teazles and some will not. Fresh sharp teazles will wear a cloth so that it will soon be tender unless it is a very firmly woven, well felted fabric. When a thick heavy nap is desired, there should not be only one or two slats of fresh teazles in the cylinder to commence with, and the pieces should occasionally be turned, i, e., run the other way, and as the nap is raised from the bottom, a few fresh slats may be added. Some finishers think there is no benefit derived by turning the pieces, (reversing the nap.) But the idea is entertained by some of our best manufacturers, that cloths finished so as to have a little nap, feel softer and handle better when they are reversed during the process.

When what is called a thread or bare finish is desired, the quicker the nap is raised the better the goods will look; in which case, no bottom or fine nap is desired, and the pieces would not want to be turned or reversed during the process, as a short nap will make a thread finish appear as though not well cleared out, and the colors will not show bright and clear.

Great care must be taken when gigging cloths which contain ribs or raised figures, as the surface of the ribs, &c., are sometimes scratched off, and the furrow or ground work is not well cleared out. Silk mixtures will not usually bear sharp teazles. Generally speaking, when a pattern demands much gigging, the operation should commence with dull teazles, or with perhaps one or two fresh slats, and so on.

Cloths which contain colored cotton should be dried as soon as possible, as they stain very easily if remaining wet long. The sun and air are usually called the best agents for drying cloths, as they usually feel better and handle better, than when dried on some of the drying machines.

Shearing, Pressing, Steam Brushing, &c.

SHEARING is also an important operation, as the shear is a complicated machine, and skill and close attention are demanded to keep it in perfect running order, and pass the cloths smoothly and evenly by the blades. When the blades are not sharp or properly set, they sometimes pull off the nap instead of cutting it smoothly. Cloths usually present a better appearance when sheared down by degrees, than when the nap is cut off in a hurry by one or two runs. Some manufacturers employ two machines; one for cropping off the nap a little, and the other for finishing and cutting off the nap gradually and evenly. After the cloths have been sheared, and perhaps burled, and specked and perched, and the holes well fine drawn, they are usually brushed, so as to smooth the nap, and are papered and subjected to the pressing.

This operation tends to give the goods a firm feeling, and makes the face smooth and usually a little glossy. The gloss is not what is desired to meet the desired finish and style sometimes, and thus they are subjected to the steaming and brushing operations, which tends to remove the gloss, and also the stiffness, and makes them handle better, and usually makes them feel a little finer. This operation concluded and the cloths are usually ready to be carefully measured, and carefully done up for the market, and there to be disposed of for various prices, and which prices sometimes allow a profit and sometimes a loss; and in order to know about what prices should be obtained to allow a profit, it is necessary to make careful estimations of their cost.

No manufacturer can afford to make an article to be sold, without forming a very correct estimation of the cost of such an article, by accurate calculations with figures, and which figures should be obtained from book accounts and statements carefully, accurately and systematically compiled and arranged.

The importance of Estimating the Cost of Goods correctly and the most approved Method for making the Estimations.

Perhaps a few remarks upon this important connection of the business may prove a source of profit to some. This part of the business is not to be classed under the head of manufacturing, but may be called a financial connection; and to which all well managed concerns give a special attention. All who engage in a business wish to employ their means invested to the best advantage to enable them to realize a profit; those whoare operating with small means may perhaps, require to be more careful, and attentive to minute points than those who are operating with abundant means, but care and close attention is required of all who are engaged in the woolen business in these fluctuating times, to make it a paying enterprise. Goods may be perfectly manufactured and all the materials employed, and the affairs pertaining to the direct management of the materials may be conducted prudently, honestly, and in good faith, and yet by a want of system, and a proper knowledge of the requisites necessary to make correct estimations, and sharp financial abilities, the business may be carried on at a loss, and thus the estimating of the cost of goods scientifically may justly be considered an important financial connection of the business. Suppose for instance a style of goods has been manufactured, and placed in the market for disposal; from careful estimations we have ascertained very nearly as to how much these goods cost per yard, and thus are able to set the price for selling; suppose they cost $1 per yard, and some of them have sold for $1.25 and then they begin to drag at that price, and have accumulated some; the selling agents inform me that they can dispose of all they have at $1.12½, and to dispose of them and get the cloth into cash I direct them to dispose of them at once, and thus I am satisfied that there was no loss to my business. And thus by knowing very nearly their cost we may be able to devise ways and means to take advantage of some of the various reasons which cause the price of the goods to be depreciated sometimes below their cost. Suppose we are manufacturing and the goods are being disposed of at prices less than cost, and we have not made an accurate estimation of their cost, and we continue to manufacture and sell at ruinous prices, and are not aware of the fact till the requisite cash is not forthcoming to meet the necessary demands; having perhaps lost thousands of dollars, then we begin to search for an adequate remedy, but it is too late, the goods have been sold, and there is no chance to repair the losses already incurred.

Thus the imperative necessity of conducting a business in a skillful and systematic manner, and have complete control of it in all its details. Some may say that to manufacture a fabric is one particular business, and to manage the finance is another, but both are contained in a business, and thus both are implicated, there is one sure thing which is, the more extended the person's knowledge may be in relation to all branches connected, the more liable will he be to attain a station of eminence or fortune. No correct estimation of the cost of goods can be obtained without a thorough knowledge of the cost of the various materials and their respective proportions used, as for instance the stock material. Usually various weights, qualities and grades are employed and at different values, and it is necessary to know in what proportions each of those qualities and grades appear in the fabric; the cost for the stock material usually exceeds all the other expenses, this presents the fact that it is a very important expenditure, and that perhaps in some cases there may possibly be a chance to economise by substituting a cheaper stock in some part of the fabric without producing a damaging effect upon its general appearance and selling qualities, and to accomplish this we shall have to call upon our manufacturing and estimating abilities.

No person can be called competent to fill up a statement showing the relative proportions of the various stock materials employed unless he has a very clear knowledge of the manufacturing, and can calculate upon the weights of the various sizes of yarns, as is explained in the preceeding departments, especially spinning, or has an honest person at the head of the manufacturing who is capable of furnishing the required information correctly. Besides the stock material there are other necessary materials used such as drugs and dyestuffs, soaps, oils, &c., and in order to know very nearly what quantities are used monthly it will be necessary for those who use those supplies to make returns of the quantities of the various priced materials used monthly.

There is still another important expenditure, which is for labor; and in this expense there is frequently a chance to economise. Some overseers want a surplus of help, and some require more than others to perform the same amount of work. A skillful overseer who knows how to lay out his work properly, and thus take advantage of it, may sometimes produce better results than another overseer, who employs more help and still keeps them busily engaged. A very important point in the business is to employ good, faithful, and skillful overseers, and they in turn to employ good help. There are other expenses connected with the business which will be mentioned in their order.

For the purpose of filling out a statement, and to explain clearly the idea presented, we will illustrate by assuming that we are operating a four set mill. The mill main building, with the attached buildings, land, water privilege, machinery, fixtures, implements and utensils connected with the premises, all completed and in running order, have cost the sum total of $36,000; and I shall charge this amount 12 per cent. annual interest, to help keep the mill in running condition, and to allow a fair interest on the money invested, which will amount to $4,320 yearly, or $360 monthly; the interest thus charged I will call mill rent, and will add this amount to the other expenses, and which will eventually appear under the head of *manufacturing*. My 16 tenements, in-

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cluding the occupied land, have all completed, cost the sum of $8,000; these tenements return me monthly in the form of rent $80; and thus I realize about 12 per cent. per annum on the money invested, and thus I will consider they pay for themselves, and will not consider them in the accounts which are to be used in making estimations for cost of goods.

I have also appropriated to furnish the various materials necessary for manufacturing, the sum of $24,000 as capital; this amount I consider will be sufficient to carry on the business and which will be constantly passing through the various departments in the form of raw material, till finished goods are made and sold, when the money again appears. I will charge the amount thus employed interest at the rate of 12 per cent. per annum, which will amount to $2880 yearly or 240 per month. Thus I will say that I have appropriated the sum total of $68,000; $8000 is so invested that it returns an annual rent sufficient to meet my demands, the balance, $60,000, then has been appropriated directly for the purpose of manufacturing cloth, and I must look to the cloth manufactured to return the adequate sum to pay a fair percentage for the money thus invested, and for keeping the buildings, machinery, &c., up to their present value, and for my labor &c., &c. So that I must give close attention to the cloth manufactured to be sure I am realizing the sum necessary to meet the demands of the amount invested. Cloths being sold by the yard, upon a yard must all the estimations be made as to the cost for all the money employed; and thus the fact is presented why the production of yards woven is of so much importance, as if they are woven, of course they must be finished and shipped to market for disposal; the payments for "rent of mill," interest on capital in trade, day labor, salaries, and repairs, and some other contingent expenses, will be the same when the monthly production is 10,000 as when 12,000 yards; but the average cost per yard for these expenses will be less for the 12,000 yards than for 10,000 yards. The average cost per yard for material, such as stock, drugs and dyestuffs, oils, soaps, &c., will not be any more for the 12,000 than the 10,000 yards, so that it may readily be seen where a large production of woven yards tends to reduce the average cost for a single yard. I have always made calculations by the month, (12 months a year,) and have made the loom yards and weights the basis for estimating the cost, but as the goods are sold by the finished yards they must also be considered, which will be explained hereafter. In order to obtain the required information as to the various materials consumed and their respective quantities and prices, it will be necessary for the overseers of the various departments where the materials are used to keep an accurate account of them, and make returns so that the necessary figures may be obtained. And for the purpose of filling out a statement for explanation, I will suppose returns have been made for one month from the following:

Dyer, for materials consumed,			Drugs, Dyestuffs, &c., -	$220.00
Carder,	"	"	Oils, - - - - -	66.00
Dresser,	"	"	Glue and Irish Moss, -	22.00
Weaver,	"	"	Heddles, Shuttles, Pickers, &c.,	11.00
Finisher,	"	"	Boxes, Clothboards, Teazles, Soaps &c., - -	132.00
Fireman,	"	"	Coal and Wood, for steam, &c.,	220.00
Machinist,	"	"	For small repairs, &c., - -	33.00

The cost for materials (other than stock) used for one month foot up the sum total of - - - - - $704.00

The bookkeeper informs me that the total amount of the monthly pay roll which includes all that has been paid for usual labor, extra labor, and salaries, foots up, - - - - $2,079.00

He also informs me that the charges for teaming, freight bills, traveling and sundries, foot up the sum total of $143. I have also obtained the production of pounds and yards from the several departments, which are also necessary for making estimations, and to keep a close run of the business, and which read as follows:

Sorting,	Means the lbs. sorted and delivered to the dyer,	10,000 lbs.
Coloring,	" " of clean stock obtained from the 10,000	6,000 "
Carding,	" " of stock, waste, &c., used with the 6,000	8,000 "
Spinning,	" " of yarn obtained, - - -	7,500 "
Dressing,	Total yards of yarn dressed and warped, -	12,000 yds.
Weaving,	" " produced from the looms, - -	11,000 "
Finishing,	" " finished, - - - - -	11,000 "

All the returns as mentioned complete the list, and to form an estimation and statement to show the general average of each department for one month for sundry small materials, labor, &c.,

and to explain plainly the idea to be conveyed, I have taken all the previous figures excepting mill rent, interest on capital in trade, and arranged them in the form of a statement, showing the estimate "cost for small materials and labor for one month."

Estimate Cost for Small Materials and Labor for One Month.

	Production.		Cost for the			Cost per pound.			Average cost per yard.		
	Pounds.	Yards.	Materials.	Labor.	Total.	Materials.	Labor.	Total.	Materials.	Labor.	Total.
Sorting, - - - - - -	10000			66	66		.66-100	66-100	2.	6-10	.6-10
Coloring, - - - - - -	6000		220	121	341	3.66-100	2.01-100	5.68-100	.6-10	1.1-10	3.1-10
Carding, - - - - - -	8000		66	264	330	8-10	3. 3-10	4.10-100		2.4-10	3.
Spinning, - - - - - -	7500			275	275		3.66-100	3.66-100	.2-10	2.5-10	2.5-10
Dressing, - - - - - -		12000	22	88	110				.1-10	.8-10	1.
Weaving, - - - - - -		11000	11	605	616				1.2-10	5.5-10	5.6-10
Finishing, - - - - - -		11000	132	220	352					2.	3.2-10
Supt., Clerk, Watchman, Spare Help,				330	330				2.	3.	3.
Steam, - - - - - -			220	44	264				.3-10	.4-10	2.4-10
Repairs and supplies, - - -			33	66	99					.6-10	.9-10
Charges for teaming, Freight bills, traveling and sundries, - -			143						1.3-10		1.3-10
Materials cost, (part of manufact'g),			847						7.7-10		
Labor cost, - - - - -				2079						18.9-10	
Total cost, - - - - -					2926						26.6-10

You will please observe as per the third, fourth and fifth columns at the left, the cost for materials and labor are each arranged so as to show in which department they belong, and that they are the gross amounts; and in the sixth, seventh and eighth (short columns), the average cost per pound for each department is given; and in the last three columns the average cost per yard for materials and labor are given as they belong in each department.

The total cost for materials foots up	\$ 847,00
And for labor - -	2079,00
Total - .	\$2926,00

which divided by the 11,000 yards, gives

the average cost per yard for materials	$7\frac{7}{10}$ cents.
" " " " " labor	$18\frac{9}{10}$ "
Making the average cost per yard for the month	$26\frac{6}{10}$ "

To obtain the average cost per yard, the yards from the looms (production) are used 11,000 yards; and the average cost per yard for all the other expenses, will be calculated by the 11,000 yards, (excepting for stock and the cost for commission, insurance, storage, &c., in the market.) The other expenses to be added and averaged to a yard, are as follows:

The gas bills foot up yearly -	\$ 132	monthly \$11
Premiums on Insurance policies yearly,	720	" 60
Taxes on personal property and real estate	480	" 40
Rent of Mill yearly, - -	4,320	" 360
Interest on money as capital yearly, -	2,880	" 240
The total for one month foots up,		\$711

This amount divided by the production (11,000 yds.) gives the average cost to a yard a fraction over $6\frac{4}{10}$ cents, and added to the average cost for small materials and labor, and the cost thus far amounts to 33 cents; there must be now added the cost of the stock and for selling the goods.

For the purpose of explaining how to calculate the percentage of stock used and to fill out a statement, a supposition case will be necessary: Suppose that an estimation is to be made of the stock used to make a style which we will call No. 1, and that the yarn was spun and the required number of threads of warp and filling were each used to produce 12 ounces of stock in a yard, 6 ozs of warp and 6 ozs of filling. By referring to the Lot Book wherein entries were made of the stock material laid out, the quantities, qualities, color, size of yarn to be made, for what style, and whether for warp or filling. And the stock as laid out reads as follows: The Stock represented is the weight.

Warp.	200 lbs. 2d. qual. fleece, costing in market 57½ cts. shrinks 40 pr, ct. cost clean 96 cts.
	400 lbs. 4th. qual. fleece, costing in market 57½ cts. shrinks 40 pr. ct. cost clean 96 cts.
	400 lbs. 2d. qual. Cal. costing in market 40 cents shrinks 50 pr. ct. cost clean 80 cts.
Fill'g.	400 lbs. 4th. qual. fleece, costing in market 57½ cts. shrinks 40 pr. ct. cost clean 96 cts.
	200 lbs. 2d. qual. fleece, costing in market 57½ cts. shrinks 40 pr. ct. cost clean 96 cts.
	400 lbs. 4th. qual. Texas, costing in market 36 cts. shrinks 50 pr. ct. cost clean 74 cts.
	2000 lbs. total.

By the above memorandum it appears there were three different kinds of stock employed, and that there is a difference in their shrinkage and cost, and it will be necessary to ascertain the relative proportions (percentage) of each kind used. The total foots up 2000 pounds, and to get the several percentages used of each kind, divide each of the pounds taken by the total pounds; thus 200, 2d. quality fleece divided by the 2000, and it is found to be 10 per cent. And thus continue with each of the component parts of the combination, and the percentage of each kind used will read as follows: (see part first, answer to question 12, rule for calculating percentage of warp and filling).

Warp.	10	per	cent.	2d.	quality	fleece	wool,
	20	"	"	4th	"	"	"
	20	"	"	2d.	"	Cal.	"
Filling.	20	"	"	4th	"	fleece	"
	10	"	"	2d.	"	"	"
	20	"	"	4th	"	Texas	"
	100	"					

Suppose 10 pieces of style No. 1, have been woven and finished and the yards and weights are known. And the average of the yards and weights appear as follows:

Loom average 31 yards and 14 ounces.
Finished " 30 " " 12 "

Loss 1 yard. Loss 2 ounces in finishing.

As has been previously stated the loom weight will be used for making estimations of stock used. The average loom weight for the 10 pieces is 14 ounces, thus the 12 ounces of stock which was calculated in yarn weights, has by the take up in process of weaving increased to 14 ounces. As the stock used is of fair quality and of good staple, it will be a safe calculation if one ounce is added to a yard to make up for waste in process of carding, spinning and weaving, and with one ounce added to cover this loss by waste, we then have 15 ounces of stock to make calculations upon, and thus by multiplying the 15 ounces by the several percentages of the various qualities and grades, the relative proportions of each are obtained in ounces and fractional parts, and as the market prices and the shrinkages of each are known, the cost per pound is known as also the cost per ounce, and all the previous calculations are brought into a final statement as follows:

MEMMORANDUM OF THE COST PER YARD, FOR ONE NEW STYLE FANCY CASSIMERES, No. 1.

Loom average 31 yards and 14 ounces.
Finished " 30 " " 12 "

Loss, 1 yard and 2 ounces.

STOCK.

Warp.	2d. quality fleece	10 per cent	or 1½ ozs.	cost 6 cents per ounce clean,	= .09 cents.
	4th. qual. fleece	20 per cent	or 3 ozs.	cost 5¾ cts. per ounce clean,	= .17.25 cts.
	2d. qual. Califor.	20 per cent	or 3 ozs.	cost 5 cts. per ounce clean.	= .15 cents.
Fill'g.	4th. quality fleece	20 per cent	or 3 ozs.	cost 5¾ cts. per ounce clean,	= .17.25 cts.
	2d. quality fleece	10 per cent	or 1½ ozs.	cost 6 cts. per ounce clean,	= .09 cents.
	4th. qual. Texas	20 per cent	cr 3 ozs.	cost 4¾ cts. per ounce clean,	= .14.25 cts.
		100 per cent.	15 ounces.	Cost for Stock	.81¾ cts.
				Labor . .	.18.9-10 "
				Manufacturing	.14.1-10 "
				Loss of one yard in finishing process . .	.04 "
				Cost for Stock, Labor, Manufacturing, &c.,	$1.18¾
				Selling Goods,	.09¼
				Total cost for one yard,	$1.28

The total cost for labor as is filled in above, we have previously ascertained, and all other expenses, except for stock and selling the goods in market, are added under head of manufacturing. The addition for loss in finishing of one yard we found by the average of the 10 pieces, and as all the previous calculations were made excepting for stock and selling goods by the woven yards, if there is to be a loss of yards in process of finishing, this loss must be considered, and a loss of one yard from thirty one makes about 3½ per cent, and which amounts to a little less than 4 cents, but it is added in as 4 cents. The cost for selling goods will depend upon how affairs are managed; if a manufacturer has sufficient means to carry on his business so that he can wait two, three or four months for the net proceeds of his sales, i. e. till the money is due, he will usually save more than when he is obliged to draw on the commission house and pay a heavy discount for paper or cash; generally it costs from 10 to 15 per cent. for selling goods, and sometimes more. The commission paid for selling is now about 5 per cent. on the price obtained when sold, also for freight, storage, labor and insurance about 2 per cent; and the credits given to purchasers by which the interest is lost, and the holding of goods sometimes will make up the percentage about as much more; in the above statement the percentage is 8 per cent. and added to the total cost at the mill, i. e. upon all the other expenses, stock, labor, &c., &c.

It is advisable to make all the estimations on the outside, i. e., be sure and have the cost per yard full as high as it will bear, so that providing only the estimated cost was obtained, you may rest assured you are getting a new dollar for an old one. A manufacturer once said "he estimated the cost of his goods, on a similar plan with an old lady who made rhubarb pies; she said she added sugar till her conscience would not allow her to add any more, then she shut her eyes and put in another handfull; so after he had put the cost as high as his conscience would allow, he would then add ten cents;" this same manufacturer commenced business on a very small capital, in a small mill which he rented, and now he owns some 12 setts of machinery, with buildings, &c., and has a large surplus of cash.

As per the statement, the cost of the fourth quality of the fleece has been carried out at 5¾ cents, and the second quality of same lot is called worth 6 cents per ounce; the fourth quality does not shrink as much as the second usually, and thus is usually called a little lower priced; also the second quality is always called worth more than fourth, &c.

Some of our first-class manufacturers in making estimations

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after the average of yards and weights have been obtained, and the cost for the stock has been estimated in the same manner as was the stock for style No. 1; they then ascertain the cost for the labor, and add to the cost for stock, and make an allowance when there is a loss in finished yards. They then bring all the other expenses and add them under the head of manufacturing; and to ascertain the figures for that account, they double the cost for the labor; say where is added 14.1-10 cents, they would add 37.8-10, and not mention the cost for labor, &c., which would be double the cost of the labor as per statement, and their method would foot up, \$1 23¼, as the cost per yard, to which must be added selling goods. To double the cost for the labor, will in most all cases prove a safe estimate for all the expenses which appear under the head of "Manufacturing" and "Labor."

All the estimations which have to be made upon the production of yards (i. e., yards woven), have been calculated by 11,000 yards, and those yards have been taken as the usual average production, one month with another.

There is still another material used sometimes for increasing the finished weights of goods, and which material is flocks; when cloths are produced from the looms a certain weight per yard, and when finished they are about the loom weight, the ounces of flocks applied may be very correctly ascertained. As was said before, the calculations for yarn weights of warp and filling before the weaving process, will usually come very near to the finished weight of the fabric, when no flocks are applied. And when flocks have been applied, the difference between the yarn weight and the loom weight is a very close calculation of the weight of flocks applied, that is when there is not much difference between loom and finished weights; when estimations are made from flocks, usually twice the weight supposed to be applied is taken for obtaining the cost. Suppose we are using a flock worth 16 cents per pound which would be 1 cent per ounce, and we expected about 2 ounces were retained in the piece per yard we would then say 4 ounces of flock at 1 cent per ounce or 4 cents for a yard; (see memorandum of stock for cotton warp,) suppose no calculations had been made when the stock had been laid out for warp and filling to have them work up nearly together but that a large amount of stock had been laid out for extra filling, for other warps; and that the calculation which comes up first is for a style of goods, the warp of which was calculated so as to weigh 4 ounces per yard in the yarn, and the filling 6 ounces per yard in the yarn. And thus one yard of warp and filling weigh 10 ounces, thus $\frac{4}{10}$ is warp to $\frac{6}{10}$ filling $\frac{1}{10}$ of 100 per cent. = 10 per cent multiplied by 4 = 40 per cent. warp, 10 per cent. multiplied by 6 = 60 per cent. filling, so that to obtain the percentage of each kind used, the calculations will have to be made differently than for style No. 1, as the warp and filling percentage will have to be made separately. Suppose that the stock laid out reads as follows:

Warp.	800	pounds	4th quality,	fleece	wool,
	800	"	3d. "	Cal.	"
Filling.	1600	"	4th "	fleece	"
	800	"	4th & 5th "	pulled	"
	800	"	waste		

The total pounds of warp foot up 1600, and the percentage of each kind of stock (obtained as for style No. 1,) in the warp reads:

50 per cent. of 4th quality fleece,
50 " " 3d. " Cal.

Thus 50 per cent, of the percentage of warp (40 per cent.) is 4th quality fleece which equals 20 per cent, and 50 per cent of the percentage of warp is 3d. quality California, equals 20 per cent. The warp proportions will then read as follows:

20 per cent, 4th quality fleece,
20 " " 3d. " California.

The total pounds of filling foot up 3200, and the percentage of each kind of stock, (obtained same as warp) in the filling reads:

50 per cent. 4th quality fleece,
25 " 4th & 5th " pulled,
25 " waste.

Thus 50 per cent. of the percentage of filling (60 per cent.) is 4th quality fleece which equals 30 per cent. And the per cent. of the other kinds of filling stock obtained the same way and they read:

30 per cent. 4th quality fleece,
15 " 4th & 5th " pulled,
15 " waste.

And thus the relative per cent. of stock of the warp and filling for one yard of each kind of stock employed read as follows:

Warp.	20	per cent.	or 2	ounces	4th	quality	fleece,
	20	"	" 2	"	3d.	"	California.
Filling.	30	"	" 3	"	4th	"	fleece,
	15	"	" 1½	"	4th & 5th	"	pulled,
	15	"	" 1½	"			waste.

Proof 100 per cent. or 10 ounces.

The remainder of the calculations are to be made out the same as for style No. 1. The calculations would be obtained by the same method providing the warp had been 6 ounces and the filling 4 ounces, but the percentages would read differently, or in any case where the stock is laid out without regard to equal or proportionate parts. And generally the stock is laid out in about that order, especially for filling, sometimes the filling is laid out for several warps of different weights, sometimes changes are made in the weights of both warp and filling.

Probably this method for obtaining the exact percentage of stock in a yard would be the safest and most approved method unless as for style No. 1, the weight of warp and filling should be the same and the stock laid out accordingly.

ESTIMATING COTTON WARP GOODS.

Suppose a few pieces of cotton warp goods are to be made from the following stock, for filling :)

Filling.	320	pounds	4th	quality	fleece (No. 1,)	wool,
	640	"	4th & 5th	"	pulled	"
	320	"	7th	"	Texas (medium)	"
	320	"			waste (good thread).	
Total	1600	pounds.				

the percentage of each kind of stock above mentioned when obtained as per previous calculations will read:

20	per cent.	4th	quality	fleece,
40	"	4th & 5th	"	pulled
20	"	7th	"	Texas
20	"			waste

Proof 100 per cent.

The warp is No. 18, black cotton 1800 ends, cotton runs are double wool runs, thus a warp of 1800 ends of 18 runs, No. 18 cotton warp, will be the same as a warp of 1800 ends of 9 run yarn by wool calculations. And by referring to table of warp yarns spinning department, there will be two ounces of cotton warp to each yard. And with the usual take up in weaving it will be calculated as 2¼ ounces. The cotton warp cost 8 cents per yard, which makes 4 cents per ounce, the average of several pieces has been obtained.

The shrinkage of the wool, the cost per ounce when clean, and all the figures necessary to fill out a statement are supposed to be known (by a careful study of the previous examples), and they are brought together and formed into a statement, as follows:

Memo. of the Cost per yard, of a Cotton Warp Fabric.

Loom Average	30	yards	12	ounces.
Finished	"	32	" 14	"
Gain,		2 yds.		2 ounces.

STOCK.

	Warp, 1800 Ends Number 18 Cotton,	2¼	ozs. at 4 cents,	09. cents.
Filling.	20 pr. ct. of 4th qual. fleece wool,	2.2	ozs. at 5 cents,	11. cents.
	40 pr. ct. of 4th & 5th qual. pnll'd wool,	4.4	ozs. at 4 cents,	17.6 cents.
	20 pr. ct. of 7th qual. Texas wool,	2.2	ozs. at 4 cents,	08.8 cents.
	20 pr. ct. of Waste,	2.2	ozs. at 2 cents,	04.4 cents.
	100 per cent,	13¼	ouuces,	50.8 cents.
		2	ozs, Flocks cost	02.
			Cost for Stock	52·8 cents.

The cost for labor and manufacturing are to be added when obtained, and a deduction made for gain of yards in finishing process.

As per statement, the average loom weight is 12 ounces, of which 2¼ ounces is cotton warp; thus 9¾ ounces will be the average weight of filling stock in a yard. As a portion of the filling stock is waste, and as there will be a waste made by carding, spinning and weaving, 1¼ ounces has been added to the filling weight to make due allowance for the loss by waste, and thus 11 ounces is called the filling proportion, and which will be a safe calculation, as most of the stock is a fair staple. When much waste is used, more weight should be added for calculating, as the more short stock employed, the more waste will be made usually, as was said before.

All the estimations should be made full high enough, to insure the cost is on the safe side, and thus providing only the cost is obtained for the goods, the *credit* side of your account will be apt to be increased.

The stock in the statement is supposed to be clean stock, as no correct estimations can be made when different kinds of wool of various percentages of shrinkages are used, or when waste and cotton are used with wool, unless the weight of clean stock is known, or calculated very nearly correct, as the clean stock is really made into the fabric; also the percentage of loss in scouring must be known, to know the cost of the stock used.

Also even numbers were employed in the statements to make the figures and explanations plain, and as was stated in the Wool Room department, the shrinkage of the wool must be known to ascertain its cost, and also to furnish the figures for a correct statement of the stock used, because if wools of different qualities and kinds are used, there will be usually quite a variation in their shrinkage, and if the weights in the grease are used, no correct statement will be produced.

The foregoing methods for estimating the cost of goods, are the same as are employed by the first-class manufacturers of this country.

RULES AND REMARKS

On the Circular Motions of Wheels, Pulleys, Gears, &c.

Their respective driving power, their comparative surface value when of wood, rough and polished Iron, &c., &c., with a few facts on Machine Belting, &c.

When a series of Wheels, Pulleys and Gears are so arranged that one being set in motion imparts motion directly to another, and that to a third and so, on then as their respective diameters, circumferences, and the number of teeth one to another so are their respective revolutions one to another in the same space of time. In every machine there are combined drivers and driven as speaking of their motive power, as there must be some first point of motion, and the points thus transmitting the power become the drivers and driven, and driven and drivers.

EXAMPLE.

A drum on a main shaft is 24 inches in diameter, and by means of a belt drives a pulley whose diameter is 8 inches, how many revolutions will the pulley make to one of the drum ?

RULE.—*Divide diameter of drum by the diameter of the pulley.*

24 divided by 8=3 ans.

EXAMPLE.

What part of a revolution will the drum make, while the pulley makes one revolution?

RULE.—*Divide diameter of the pulley by diameter of the drum.*

8 divided by 24 = 8-24 = $\frac{1}{3}$ ans.

EXAMPLE.

The drum makes 80 revolutions per minute, how many does the pulley make?

RULE.—*Multiply the diameter of the drum (the driver) by the number of revolutions made per minute. Divide the product by the diameter of the pulley (the driven).*

Diameter of drum 24 inches.
Making 80 revolutions per minute.

Diameter of pulley 8 inches,)1920

240 ans. revolutions per minute.

EXAMPLE.

The diameter of the drum (the driver), is 24 inches and makes 80 revolutions per minute; what size driven pulley will be required to obtain 240 revolutions per minute?

RULE.—*Multiply the diameter of the driver, by the revolutions per minute. Divide the product by the revolutions required.*

Diameter of drum 24 inches
Making 80 revolutions per minute.

Revolutions required 240)1920

8 inches size of driven pulley.

EXAMPLE.

The cylinder to a willowing machine should make 240 revolutions per minute, the shaft of which has an eight inch pulley attached. The driving shaft makes 80 revolutions per minute. How large will be the drum (or driver) required to furnish the desired speed?

RULE.—*Multiply the revolutions required, by the size of pulley attached. Divide the product by the revolutions of the driving shaft.*

Revolutions required, 240
Diameter of attached pulley, 8 inches,

Revolutions of driving shaft, 80)1920

Answer, 24 inches size of drum or driver required.

EXAMPLE.

Required the speed of a buzz saw, which is furnished with drivers and driven pulleys as follows: The pulley on the saw shaft is 4 inches in diameter; the next pulley which is to be a driver for it, is 20 inches in diameter. At the opposite side of the saw bench and on the same shaft with the 20 inch pulley, is a driven pulley and which is 14 inches in diameter. The driver for this pulley is on the main shaft, and the drum or driver is 40 inches in diameter, and the main shaft makes 140 revolutions per minute, what is the speed of the saw?

RULE.—*Multiply the diameter of the drum by the revolutions per minute; divide the product by the diameter of the next driven. Multiply the quotient thus obtained, by the diameter of the second driver; divide the product by the diameter of the next driven, the quotient will be the revolutions of the saw.*

140 x 40 = 5600, divided by 14 = 400, x 20 = 8000, divided by 4 = 2000, answer, as the revolutions per minute of the buzz saw.

EXAMPLE.

The basket to a Hydro Extractor should make 550 revolutions per minute. Attached to the shaft of the basket is an 8 inch pulley; the driver of this 8 inch pulley is a 10 inch pulley; what should be the diameter of the main driving pulley, the main shaft making 110 revolutions per minute.

RULE.—*Multiply the desired revolutions of the Extractor, by the size of the pulley attached; divide the product by the revolutions of the main shaft, the quotient is the diameter of the main driver required.*

550 x 8 = 4400, divided by 110 = 40 answer, as the diameter of the main driver required. The 10 inch intermediate pulley is not considered in the calculations, as any number of intermediate pulleys may be used, providing they each transmit the same speed as they each receive respectively.

Calculations are made for gears, pinions &c. the same as for wheels, drums and pulleys, the former transmit the power and speed by teeth, while the latter transmit by belts.

EXAMPLE.

A pinion of 10 teeth drives a wheel of 50; how many revolutions does the pinion make to one revolution of the wheel?

50 divided by 10 = 5 revolutions, answer.

EXAMPLE.

A pinion has 10 teeth and makes 40 revolutions per minute; how many revolutions does a wheel make in the same time, which has fifty teeth and works in contact.

10 x 40 = 400, divided by 50 = 8 revolutions, ans.

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Example.

A wheel has 50 teeth and makes 8 revolutions per minute, how many teeth must a pinion or wheel have to work in contact and make 40 revolutions in a minute ?

50 x 8 400, divided by 40 = 10 teeth, ans.

To find the number of revolutions made by the last, to one revolution of the first, when several pinions or wheels work in contact in a train.

Rule.—*Divide the product of all the teeth in the drivers by product of all the teeth in the driven; the quotient is the number or ratio desired.*

Example.

A wheel of 36 teeth drives a pinion of 7 upon whose shaft is a wheel of 28 teeth that drives a pinion of 5, upon whose shaft is a wheel of 70 teeth, that drives a pinion of 12, how many revolutions does the last pinion make to one revolution of the first wheel ?

$\frac{36}{7}\ \frac{28}{5}\ \frac{70}{12} = 168$ revolutions, answer.

Probably the foregoing examples will serve all practical purposes for calculating the required speed for the different machines, pulleys, gears, &c., as the sizes of the pulleys, gears, &c., connected with the different machines such as the Loom, Card, Shear, Dresser, &c., are usually regulated and attached to speed each connecting part so that they will work together, so that by changing the speed to their main driver, the speed of the whole of the machine will be effected uniformly.

REMARKS ON MACHINE BELTING.

The following observations, remarks and facts on Machine Belting with directions for use, and the corresponding driving powers of different kinds of bands and pulleys, &c., &c., were furnished the author, by the well known and extensive manufacturers and dealers in Belts and Belting of all descriptions, Messrs. Fairbrother & Fales, Pawtucket, R. I.

TABLE

OF THE

DRIVING POWER OF DIFFERENT KINDS OF BANDS AND PULLEYS.

Experiments made by Hoyt Brothers, at their Manufactory, N. Y.

This table gives the relative driving power of Leather Belting with both grain and flesh side to pulley, also of Rubber, Gutta Percha and Canvas. The Pulleys on which the experiments were made were the same in size, on one shaft, and their surfaces severally of leather, polished iron, rough turned iron, and polished mahogany. The bands were passed over the pulley, one end made fast and stationary, and on the other end one pound weight was suspended to every square inch contact surface of the band and pulley.

The number of pounds required to slip the band are given; also the number of pounds strain on the band at which it will cease to slip; and also number of pounds required to make it continue to slide.

The belts were in like condition, and had the same contact surface, the same strain; consequently it is easy to determine the relative value of each for driving machinery, also that of pulleys.

A Table of the Relative Value (per square inch Pulley Contact) of Leather, Gutta Percha and Rubber Belting for driving Machinery; also the Surface Value of different Pulleys.

	LEATHER. Grain side to the Pulley.			LEATHER. Flesh side to the Pulley.			RUBBER.			GUTTA PERCHA.			CANVAS.			Relative Value of Different Pulleys.
	Commence to slip.*	Cease to slip.†	Slide.‡	Commence to slip.	Cease to slip.	Slide.	Commence to slip.	Cease to slip.	Slide.	Commence to slip.	Cease to slip.	Slide.	Commence to slip.	Cease to slip.	Slide.	
Pulley with Leather Surf.	6	2½	10	3½	2¼	7	2½	1½	5	2½	1¼	3½	1¾	1	1¾	52
Polished Iron Surface.	1½	1	9	1¼	¾	6½	1¼	¾	4½	¾	½	2½	1	½	2	33¾
Rough Iron Surface.	1½	¾	3	1½	¾	2¼	1¼	¾	4	¾	½	1½	1	¾	1¼	21½
Smooth-turned Mahogany.	3¾	2¼	4	3	1½	3¼	2¼	1½	4½	2½	1	2½	1¾	1¼	13	36¾
Rela. Value of each Belt.		45¼			33½			29¾			19¾			15¾		

* "Commencing to slip," refers to that point when the resistance is sufficient to make the Belt (almost—not qnite) slip over the Pulley.
† "Cease to slip," refers to that point when the Belt has just slipped over the Pulley, and takes a new hold.
‡ "Slide," refers to that condition when the motion of either Belt or Pulley ceases while the other passes over it.
☞ Belts are liable to stretch more or less, decreasing their tension, so that they will slip—hence the necessity for the above distinction.
Paper Belts abont the same as Canvas.

DEDUCTIONS AND CONCLUSIONS DRAWN FROM FOREGOING TABLE.

Pulleys covered with leather, with grain side of band to pulley, will sustain 50 *per cent. more resistance* than without the pulley being covered. The per cent. of resistance of the bands on the different pulleys is nearly as follows, and this per cent. will indicate the relative working value of each pulley respectively:

Iron Pulley covered with Leather,	36	per cent.
" " Polished, - -	24	"
" " Rough Turned, -	15	"
Wood, Polished Mahogany, -	25	"
	100	

Full six per cent. should be added to the Polished Iron Pulley, to make allowances for the difference between commencing to slip and its sliding; thus making polished pulley thirty per cent. or next in value to leather.

The relative or comparative working per cent. of the different bands, as indicated by the Table, is nearly as follows:

Leather, grain or smooth side to Pulley,	31	per cent.
Leather, flesh side to Pulley, - -	23	"
Rubber, - - - - -	21	"
Gutta Percha, - - - - -	14	"
Canvas, - - - - -	11	"
	100	

Thus Leather Belts, grain side to pulley, will drive 34 per cent. more than flesh side to pulley,—48 per cent. more than Rubber,—121 per cent. more than Gutta Percha,—180 per cent. more than Canvas; consequently the very best arrangement for Belting, is to use it with grain side to drum or pulley, and have the pulley covered with leather. This is best in all cases. The next best pulley is polished iron, especially for quick motions. Polished wood next, and rough iron last in value.

Leather used with grain side to pulley will not only do more work, but last longer than if used with flesh to same. The fibre of the grain side, is more compact and fixed than that of the flesh, and more of its surface is constantly brought in contact or impinges on the particles of the pulley. The two surfaces, that of the band and that of the pulley, should be make as smooth as possible—the more so the greater the contact surface and the more the particles of each impinge on the other. The smoother the two surfaces, the less air will pass under the band and between it and the pulley—the air preventing the contact of band with pulley—the greater this contact the more machinery will the band drive. The more uneven the surface of band and pulley, the more strain will be necessary to prevent bands from slipping. What is lost by want of contact, must be made up by extra strain on the band, in order to make it drive the machinery required—oftentimes, if the band is laced, causing the lacings to break, the holes to tear out, or fastenings of whatever kind to give way. This want of contact is noticeable on most of new bands used with flesh side to pulley, and is distinctly marked by dark impressions on the band where it comes in contact with the pulley. Oftentimes not half of the surface will be found to have come in contact, and until it is worn smooth, or filled in with other substances, the full extent of the power of the band is not obtained.

Bands used with grain side to the pulley will never crack, as the strain in passing it is thrown on the flesh side, which is not liable to crack or break, the grain not being strained any more than any other portions of the band. When a piece of leather is bent or doubled, the fibre on the outer surface of the curve formed is stretched or extended, while that of the inner surface is crowded together, there being a point between the two extremes where it remains unchanged in its surface, this may be termed the fulcrum point. The thicker the band, the further is this point from the pulley, consequently any unevenness in the band serves as a wedge to increase its tension as it passes on to the pulley, and to decrease as it passes off, causing, when the velocity is great, sudden jerks upon the band, and an irregularity of motion—this irregularity is easily perceived where machinery revolves with great velocity.

Therefore, *Bands for Saws and Blowers,* or where quick motion is wanted, should be made as level or even as possible, and endless if practicable. In slow motion, any uneveness of the band would not be noticed, as the extra strain would be so gradual as not to cause any irregularity of motion.

Where thick joints are wanted, they should be made as short as practicable, for the reason, that if short, there will be less strain upon the band as it passes the pulley; there being the same difference as between the introduction of a long and short wedge.

When bands are run horizontally, the driving half should be the lower half when practicable, then as it stretches, the loose or upper half will cover more and more of the pulley surface. If run contrariwise, then, as the band stretches, it will fall from the pulleys, having less of contact surface.

Long horizontal bands are so far desirable, as that their weight increases their contact with the pulley. Double bands have this advantage to a great extent.

Bands connecting pulleys perpendicular to each other should be kept tightly strained, and should be of well stretched leather, as their weight tends to decrease their close contact with the lower pulley.

Bands of coarse, loose leather will do better service in dry, warm places, than in wet or moist. For use in these last named places, bands should be made of the *finest* and *firmest* leather.

DIRECTIONS FOR CALCULATING THE WIDTH OF BELTS REQUIRED FOR TRANSMITTING DIFFERENT NUMBERS OF HORSE POWER.

The following calculations were predicated on the basis of allowing each square inch of belting in contact with the drum or pulley, to raise half a pound one foot high in one minute, and the raising of 36,000 pounds same height in same time as a horse power.

By increasing the tension of the belt much more than a half may be allowed to the square inch.

Multiply 36,000 by the number of horse power; divide the amount by the number of feet the belt is to run per minute; divide the quotient by the number of feet or parts of a foot in length of belt contact with smaller drum or pulley; divide this last quotient by six, and the result is the required width of belt in inches.

Example: Required the width of belt, the velocity of which is

1,600 feet per minute, to transmit twenty horse-power, the diameter of smaller drum being four feet: 36,000 x 20=720,000 ÷ 1,600=450.

Diameter of smaller drum being four feet, the circumference over twelve feet, we will suppose the other drum so near and so large as to leave but five feet of the smaller drum's circumference in contact with belt—the 450÷5=90÷6=15 inches, the required width of belt.

DIRECTIONS FOR CALCULATING THE NUMBER OF HORSE-POWER WHICH A BELT WILL TRANSMIT, ITS VELOCITY AND THE NUMBER OF SQUARE INCHES IN CONTACT WITH THE PULLEY BEING KNOWN.

Divide the number of square inches of belt in contact with the pulley by two; multiply this quotient by the velocity of the belt in feet per minute, and this amount divided by 36,000, and the quotient is the number of horse-power.

Example: A twenty-inch belt is being moved with a velocity of 2,000 feet per minute, with six feet of its length in contact with the circumference of a four feet drum—desired its horse-power: 20x72=1,440 ÷ 2= 720x2,000 = 1,440,000 ÷ 36,000=40 horse power.

TO FIND THE LENGTH OF A DRIVING BELT.

Suppose the distance from the centre of the driving-shaft to the centre of the pulley-axle, of any machine to be driven, is 10 feet, the diameter of the pulley on the driving-shaft is 16 inches, and the diameter of driven pulley is 12 inches, what length of belt will be required?

RULE.

Double the distance, which is here 10, and add the diameter of the two pulleys together, and multiply the product by 3, or more correctly by $3\frac{1}{4}$; this product divide by 2, and added to the double of the distance between the shafts, will be the length of belt required.

EXAMPLE.

Ft.	In.		Feet.	
1	4	driving pulley.	10	from centre to centre of shafts.
1	0	driven "	2	
2	4		20	double.
	3		Add $3\frac{1}{2}$	
2)7	0		$23\frac{1}{2}$	length of belt.

$3\frac{1}{2}$ feet around the pulleys.

TO FIND THE LENGTH OF A CROSS-BELT FOR THE SAME PLACE.

RULE.

Procéed in the same manner as with the other, with this difference: add the diameters of the two pulleys together, and multiply the product by 3, and that product again by 2; divide the sum of these multiplications by 3: this last product, added to 20, will give the required length of the cross-belt.

EXAMPLE.

Ft.	In.	Feet.	
1	4	10	
1		2	
2	4	20	
	3	4	8
7	0	24	8
	2		
3)14	0		
4	8		

24 feet 8 inches, length of cross-belt.

THE TEARING OUT OF LACE HOLES.

The more thoroughly stretched the band, the more liable will it be to be complained of in this respect; not that stretching properly done (i. e. wet stretching) injures the fibre of the band, but that too much allowance is made for stretch, in cutting off the proper length, or in fact the band is made too short. If it is then put upon the pulleys it must be strained to its utmost tension, in order to make the ends come together; when laced, the strain upon it will be of itself almost sufficient to break out the lace-holes. When the machine is set in motion, the extra strain is more than the band will bear, and it gives way in its weakest place, the lacing breaks or the holes tear out. Then, in all probability, the broken ends will be cut off on a line with the holes, making the band still shorter, new holes punched, and the band strained upon the pulleys, to break away again, with like result. The leather is then pronounced worthless. A band properly stretched will readily yield as it is tightened, and consequently the lacing would not be liable to break or tear out.

THE PUTTING ON OF BELTS.

Care should be taken that the ends of bands, if to "be butted" together, are cut square across, else a crook may be made in the band, and the belt-maker be blamed for it. The shafting of the pulleys to be connected should be parallel to each other, and the centre of each pulley on a line at right angles to the shafting, or the bands will not run well on the pulleys. If the belt is made endless by a lap-joint, the edges of such joint should be on a right line with each edge of the band.

WIDTH OF BELTING AND SIZE OF PULLEYS.

There seems to be a growing disposition among Machinists, Millwrights, and others, to make their pulleys and drums of such size and width as will require as narrow and short a band as possible, in order to save expense. This false economy seldom decreases the first cost of machinery, and only saves in first cost of belting. This small amount saved is soon lost many times over by stoppage of machinery, slipping of bands, and consequent loss of time, extra strain on the shafting, and an increased amount of friction, requiring additional driving power, and by causing the more rapid wear of belts.

In almost every case where pulleys or drums are not perpendicular to each other, the "following half of band" should be so loose as that its centre should fall some inches below a right line drawn from the points where this half of band comes in contact with either pulley. Whatever strain is thrown on the *loose* or *following half* of bands, in order to make them do the required amount of work, is just so much unnecessarily added to the friction of the shafting or machinery; and the wear is the same, and a loss of power to the amount required to overcome this friction. Were pulleys made of a proper size and width, and then covered with leather, the belts run with grain side to the pulley, thousands of tons of coal might be saved annually, and an immense amount of water-power.

COVERING OF PULLEYS AND DRUMS WITH LEATHER.

THE importance of this is realized but by few persons who have charge of or use machinery. Fifty per cent. more work can be done on machines without belts slipping, if pulleys are covered with leather. The closer the band hugs to the pulley, the less tightly will it need to be strained, the longer time will the band last, the less friction of machinery, and consequently the less power required to drive it. The covering of the pulleys with leather, in many establishments where there is a deficiency of power, would produce such an improvement as to astonish those not acquainted with its value. Large pulleys and drums may be covered by narrow strips of leather, or by being wound spirally—narrow pulleys should have leather the same width as the pulley surface.

OILING AND GREASING OF BELTS.

CARE should be taken that belts are kept soft and pliable. The question is often asked, "What is best for this purpose?" We advise, when the belt is pliable, and only dry and husky, the application of blood-warm tallow; this applied and dried in by heat of the fire or sun, will tend to keep the leather in good working condition; the oil of the tallow passes into the fibre of the leather, serving to soften it, and the stearine is left on the outside to fill the pores and leave a smooth surface. The addition of resin to the tallow for belts used in wet or damp places, will be of service, and help preserve their strength. Belts which have become hard and dry, should have an application of neat's foot or liver oil mixed with a small quantity of resin; this prevents the oil from injuring the belt and helps to preserve it. There should not be so much resin as to leave the belt sticky.

Binders should never be used, as it takes power to drive them, besides they will injure any kind of belt when used.

Reasons why Rubber, Gutta Percha & Canvas

ARE THE DEAREST ARTICLES TO USE FOR BANDS.

UNDER the same circumstances and on the same machines, these bands will not last or wear one-fourth as long as leather. When once they begin to give out it is next to impossible to repair them.

Wide bands cannot be used for, or cut up into narrower ones, as leather can be.

Leather belts may be used over and over again, and when of no further value for belts, can be sold for other purposes.

A rubber band, costing hundreds of dollars, may be spoiled in a few moments, by the lacing giving out and the band being run off into the gearing, or by being caught in any manner so as to damage the edge; or by stoppage of either the driving or driven pulley. A few moments of quick motion or friction, will roll off the gum from the canvas in such quantities as to spoil the band. Leather belts may be torn or damaged, yet are easily repaired.

Should a rubber or gum belt begin to tear by being caught in the machinery, if the rent strikes the seam it is most certain to follow it, even the entire length, if the machinery is not stopped. It would be impossible to tear leather in a like manner.

Oil in contact with rubber belting, will soften the gum so as to be like dough. Put a piece into oil for a day or so, and then examine it, and test the truth of this statement. Oil or grease produces an acid which will destroy or rot the vegetable fibre of the canvas in a short time.

Such a degree of heat as would not burn leather, if applied to rubber or gutta percha bands, will so act upon the small particles or quantity of gum which is contained in the outside coating, as to cause it to roll off easily when slight friction is applied; in fact, the whole mass loses its adhesiveness and becomes disintegrated.

The seams of rubber and gutta percha are covered by a strip of rubber, which will not stand as much heat as leather, and next to no amount of friction. When this seam is destroyed, the band is destroyed, or at least is liable to part, thus rendering the band of no more use than if the whole were coated with like material.

Rubber, gutta percha, and canvas belts will continue to stretch as long as in use, rendering it necessary to shorten them continually.

During freezing weather, if moisture or water finds its way into the seams, or between the different layers of canvas composing these bands, and becomes frozen, the layers are torn apart, and the band is spoiled; or if a pulley becomes frosty, the parts of band in contact with it will be torn off from the canvas and left on the pulley.

Gum belts will not answer for "cross" or "half-cross belts," for "shifting belts," "cone pulleys," or for any places where belts are liable to slip, as friction destroys them.

In fact, buying a rubber, gutta percha, or canvas belt is very much like buying a sickly horse at 33⅓ per cent. less than a good healthy one would cost. If such a horse is well groomed, used carefully, left in the stable when sick, when the weather is hot, when cold, and when stormy, he may live six months; with extreme care and good luck, one may be able to say, that he owns a horse for twelve or eighteen months. Pay 33⅓ per cent. more and buy a good healthy one, use him well and kindly, he is always at your service, and can be depended upon. After being in use twelve or fifteen years, he is still good, and if sold, will bring 33⅓ per cent. of his cost. "A word to the wise is sufficient." A well-made leather band, if properly looked after—the width and pulley surface proportioned to the amount of work to be done, will last 12, 15, or 20 years, and yet be of value to work over into narrower belts.

The majority of those who buy Belting, are not good judges of leather. This fact is taken advantage of by many, and a large quantity of belts are manufactured and sold, that are not what they are represented to be. Some of them are made from purely hemlock-tanned leather, which is colored and made to resemble oak, by the use of alum and quercitron bark. Others are made from dry hide leather, and still others from sole leather, &c. The leather is often cut full length of the side, without being stretched, or if not, it is stretched in the side and then cut; either way making a poor article of belting. Those who purchase of MESSRS. FAIRBROTHER & FALES, may rest assured that there will be no misrepresentation; that they will obtain a good article of belting, which we warrant to be well stretched, to run truly on the pulleys, and to do good service.

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1a

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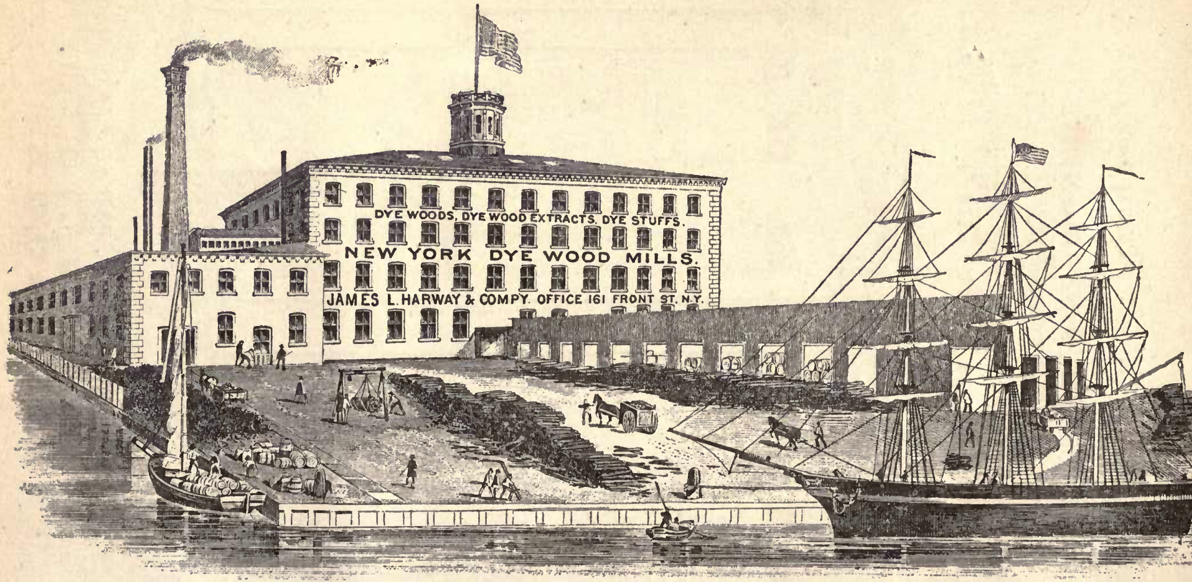
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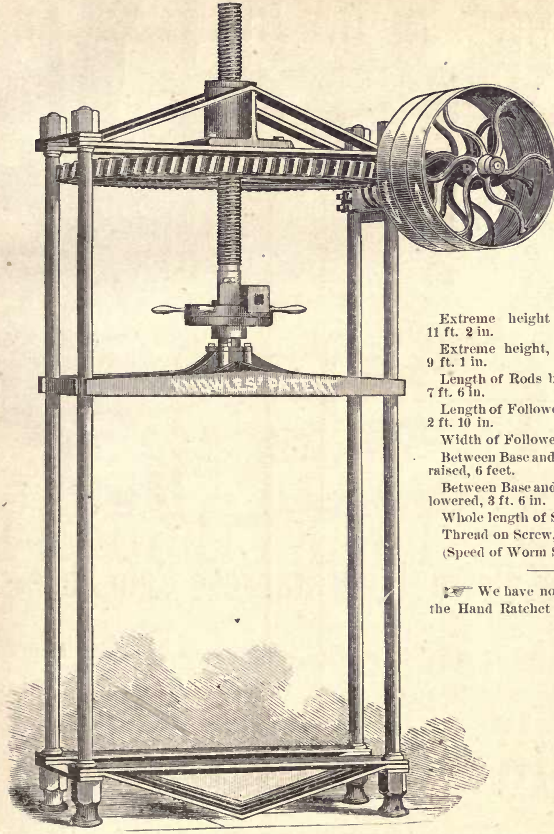

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Width of Follower, 1 ft. 4 in.

Between Base and Follower, screw raised, 6 feet.

Between Base and Follower, screw lowered, 3 ft. 6 in.

Whole length of Screw, 4 feet.

Thread on Screw, 3 feet.

(Speed of Worm Shaft, 100 to 125.)

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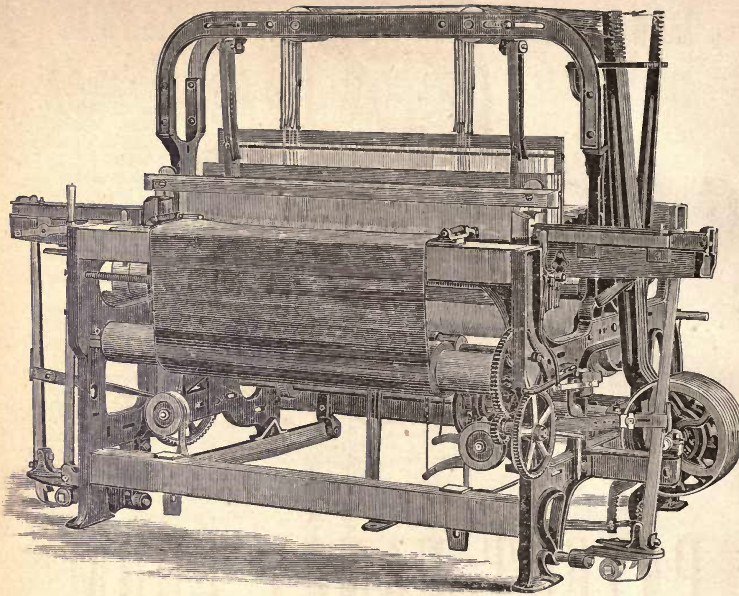

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