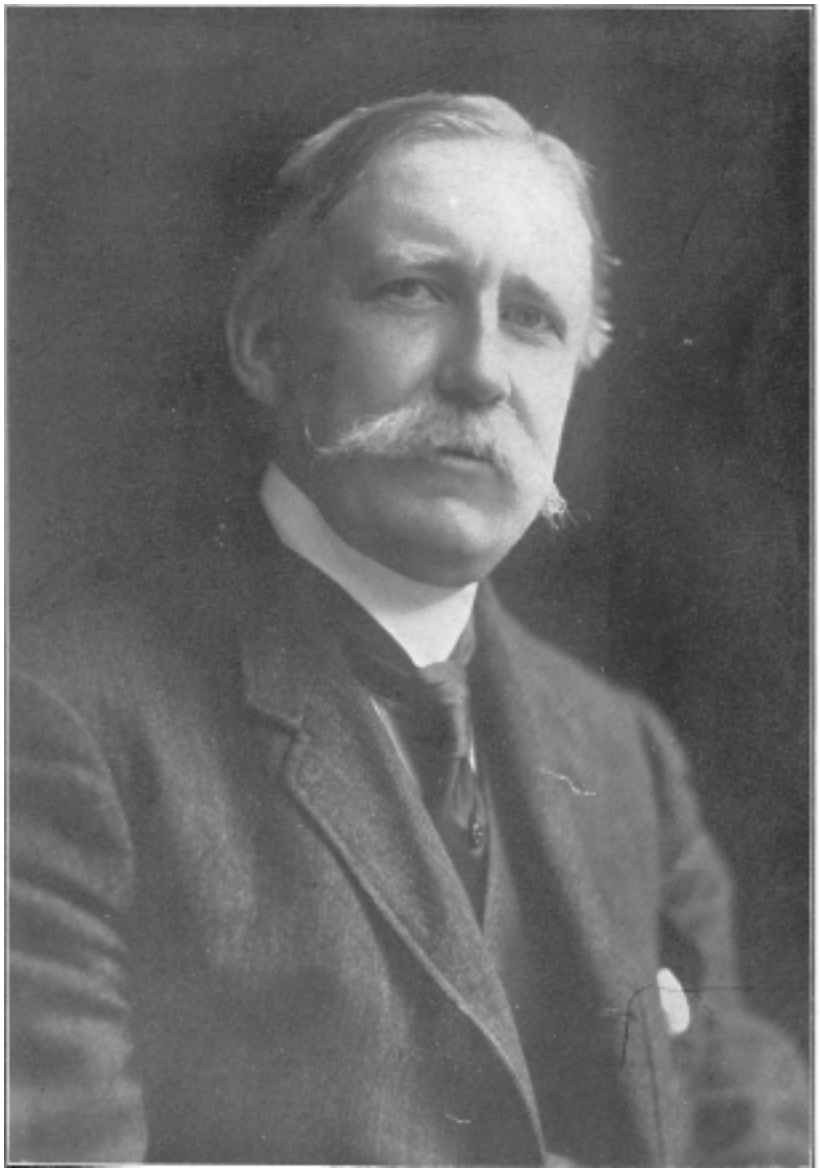
SILK MANUFACTURING AND ITS PROBLEMS



James Chittick.

SILK MANUFACTURING AND ITS PROBLEMS

BY

JAMES CHITTICK

Being a series of papers on important questions of interest to all those engaged in the Manufacture and Distribution of Silks and Other Textiles

PUBLISHED BY
JAMES CHITTICK
NEW YORK
1913

Printed by
THE BARNES PRINTING CO.
NEW YORK

TO

ROBERT S. McCREERY, Esq.
OF NEW YORK

This volume is inscribed
as a token of the lasting regard of
the Author

A Man, a Generous Friend, in whom you find,
Honour, and Worth, and Modesty combined.

PREFACE

The papers which have been here assembled were, with two exceptions originally published in "Silk," during the period from October, 1907, to October, 1912.

In preparing them for publication in book form, extensive revisions, as well as additions to the text, have been made, so as to present new points of interest, to eliminate matters of an ephemeral character, and to bring all of the articles up to date.

There has also been introduced into the body of the book much additional tabular matter, which should greatly add to its usefulness as a book of reference.

In addition, there will be found interspersed among the pages of the advertising section a large number of other tables of much value to all engaged in silk manufacturing.

While these articles were originally written for the benefit of the producers and distributers of silk merchandise, and for those financially interested in such enterprises, yet the majority of the subjects discussed are of equal moment to those engaged in the cotton, woolen, worsted, and knit goods branches of the textile industry.

As each of these papers is a complete monograph in itself, and as some of them touch upon one or more points discussed in other articles in the book, it happens that, in occasional instances, there will be a repetition of matters elsewhere referred to.

Where such repetitions have occurred they have been allowed to

stand, so as not to detract from the comprehensive treatment required for each subject in turn.

The contents of this volume are founded upon the personal experience and observation of the writer, and the views expressed in connection therewith represent his unbiassed opinions regarding the same.

In certain cases it has seemed necessary to criticise practices of an illogical or pernicious character, prevailing in different branches of the industry. While frankly expressing his views concerning them, it has been with the hope that, in voicing these criticisms, they might in some measure assist in the recognition and correction of the abuses pointed out.

In conclusion, he desires to express his sincere thanks to those representative concerns which, by the support of their advertisements, have assisted in the bringing out of the book.

JAMES CHITTICK.

ROSEVILLE, NEWARK, N. J.
June, 1913.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

After the Index will be found the Advertising Section, together with the Reference Tables contained therein.

LIST OF
TABLES, TABULAR MATTER, ETC.

LIST OF TABLES, TABULAR MATTER, ETC.
Continued

The list of the Tables in the Advertising Section will be found on the next page.

LIST OF TABLES, ETC., IN THE ADVERTISING SECTION

THE ADVERTISERS

At the latter part of the book will be found the advertisements of the following representative houses which have in this way co-operated in the bringing of it out.

Advertisements have only been accepted from those concerns which, in the opinion of the writer, could be dealt with in entire confidence.

LIST OF ADVERTISERS

*Space taken but no advertisement inserted.

I

SELECTING A LOCATION FOR A MILL.

There are times when a manufacturer is confronted with the question as to where to locate his mill—either his principal plant, if he be going into a new enterprise, or a branch factory, if he be already established. Or, it may be that he desires to equip himself with a throwing, dyeing or printing department, and so has to determine on a place best suited for such work.

Many important questions have to be decided, and frequently by persons who are not conversant with them themselves, but who, by virtue of their holding the purse-strings, have to make the final decisions. Foreigners, too, who are planning to go into manufacturing in this country, are often greatly in the dark as to the conditions to be reckoned with, and, in a measure have to "go it blind" and take their chances. The right decision may spell "success," and the wrong one is pretty sure to spell "failure," and, in any case, the locking up of a lot of capital in such an inconvertible form as land, buildings, power plant, etc., is a matter for serious consideration.

When one is looking for a location, and is unrestricted as to choice, he starts with the intention of finding a place where every condition will be ideal, but speedily finds that no such spot exists, and that the best he can do will be to decide on a place which has the balance of advantages for his uses.

Points to be Considered.

It is the purpose of this article to point out the principal features that need consideration, and, with these points clearly in mind, the desirability of one location, as compared with another, can be intelligently passed upon; and, as the considerations that will influence one firm will always be different from those that affect another, each concern will have to act on its own judgment.

Questions of great importance are those relating to labor, power, water supply, State laws, distance from market, and others.

What Would be Ideal Conditions?

An ideal location would be one in which labor was abundant, intelligent, skilled and cheap; where there were no labor unions or strikes; where the laws of the State made no restrictions as to hours of work or age of workers; where people were accustomed to mill life, and where there were no other textile mills in the vicinity to share in the labor and bid up its price. The land, too, should be cheap and situated on the edge of a river, or lake, which would afford ample and suitable water for all manufacturing purposes. The railway facilities should be good, with a siding into the mill yard. It should be near the market, making freight, express, and traveling charges small. Fuel should be very cheap, or water power or natural gas might be available. The local conditions, such as police and fire protection and drainage, should be good, and city gas, water, and electricity should be available if wanted, together with good street-car service, and what not. It should be in a climate neither very cold nor very hot, and should be immune from floods.

The above, and many other minor advantages, are what all would like to secure, but the mere reading of the list shows, as remarked before, that such collective advantages are unattainable. With a view to determining which considerations should govern, we will, therefore, follow out more in detail the various points.

Importance of the Labor Question.

First in importance comes labor, and in hardly any industry is the labor question more dominant than in silk manufacturing. For certain lines of manufacture, skilled help, already trained, is imperative. This, usually, can only be obtained in proper quantity in the large silk centres, and even then the supply is none too large and the cost is not low. People, therefore, who intend to make high-class novelties are much restricted in their choice of locations.

For all weaving, and for all other dyed-silk work, considerable training and skill is required. Those who go to districts away from the silk centres must expect to go through a long period of small production and imperfect product while training their workpeople, and, in fact, to keep a small textile school constantly in operation, for training fresh hands to take the places of those who, from one cause or another, may leave. In the throwing branch, it does not take so long to bring the help up to the point of efficiency, and a country location is not so disadvantageous.

In towns where there is a fair-sized population, and no manufacturing industries of moment, a good supply of female help can usually be had at low prices; but, should other industries come to the town, the demand for help may soon exceed the supply, and the employer find,

owing to the bidding up of the labor, that its cost is greatly increased, its supply insufficient, and its character arrogant and independent, and, with no growth to the town equal to the increasing employment offered, he finds himself in a very uncomfortable position.

So long as there is an ample supply of help to go round, the presence of other silk mills in the district is not a drawback; but, if some of the mills are in those branches of the trade that require more skill, and pay higher wages, it exercises an adverse influence on those mills doing the simpler work, and properly paying less wages, as their help cannot see why they should be paid less than the people in the other mills, and will leave to go to work at the other mills whenever they get a chance.

The proximity of other textile mills—wool, cotton, etc.—may be of advantage if their scale of wages is lower than in the silk mills (which is usually not the case), as their help would then go to the silk mills which paid the better wages. The reverse, however, may well be the case, and the silk mill may find itself compelled to pay the higher wages that obtain in the other mills if it wants to keep any help at all.

In a place where there are many large factories, of whatever kind, using principally female help, it is generally disadvantageous to locate, as labor will then be scarce and high. If, however, the local industries are those employing mostly male labor, such as collieries, tanneries, breweries, locomotive and metal-working shops, jewelry making, etc., there will be considerable unemployed female labor in the families of these male workers which can often be secured at a fair price.

In some branches of work, particularly those devoted to the production of novelties or goods affected by fashion, the orders come in a very irregular manner. It is often either a feast or a famine; at one time running everything to the limit (with perhaps some night work thrown in), for two or three months; then, a sudden dropping off in the demand, which necessitates the laying off of a considerable number of workpeople. It would be quite impossible in a country district either to get extra people at a moment's notice when needed, or to expect them to come back to work at the convenience of the employer, and it is only in large silk centres that such a course could be pursued.

Where the labor obtainable is largely foreign-born, understanding English imperfectly, if at all, it is very desirable that the foremen should be able to speak to them in their own language and understand how to get on with them.

Unless the workpeople live within easy walking distance of the mill, it is necessary to be close to the street-car lines, or else the people will be constantly drifting away to take work nearer their homes.

In considering the relative cost of the lower wages in the country towns with that in the cities, the efficiency of the labor must be considered. Thus, if the country labor was 20 per cent. less efficient than the city labor, it would require, for an equal output of goods, an addi-

tional investment to that amount in the machinery and plant, with the additional help required to run it to be paid for, which would be a substantial offset to a large nominal saving in the cost of the labor. Good mill-engineers, carpenters, loom-fixers, mechanics, beamers, foremen, etc., etc., are very scarce in the country and often have to be brought from the cities, and can then only be got by paying them substantially more money than they could earn at home.

It will be seen from the foregoing what a variety of questions arise in connection with labor, and how necessary it is to be accurately informed on all phases of it before deciding on a location.

State Labor Laws.

We will now touch on the matter of labor legislation—that is, the State laws as they are at present, or are likely to be in the near future. The Federal laws do not often enter into the question, and could not be avoided anyway.

Locations suitable for silk manufacturing are to be found in many states, and one would naturally turn to whatever state had the most liberal laws.

It has been customary for the different states to pass laws prescribing the number of hours per week that factories shall operate, and it has been the custom for manufacturers to conform to such hours. In the case of the employment of minors, that is, males under twenty-one years of age, and females under eighteen years—or whatever the legal age limit may be for females in the state—it seems to be well settled that, by virtue of its police powers, the state has the right to so limit the hours of work. On the other hand, it seems to be equally certain that if males or females of full legal age desire to contract with their employer to work any length of time that they and he may desire, the State is impotent to prevent it, for to do so would be to interfere with the right of contract specifically guaranteed by the Constitution of the United States, to say nothing of the State Constitutions themselves. Recent legislation in some states has, indeed, been enacted, limiting the hours of women's work, but it is very doubtful if the United States Supreme Court will sustain such laws when they come before it on appeal.

A manufacturer in any state might, therefore, run such machinery as was operated by help of full age for just as many hours as he chose, but this is seldom, if ever, done, as he is restrained by the custom of the locality, by the opinion of his fellow manufacturers, by the fact that the very considerable amount of machinery run by the younger help would be idle, and by the unwillingness of most of the workpeople themselves to contract to work longer hours even with the proportionate addition to their pay.

Hours of Operation.

The hours so delimited by the State laws vary, in this part of the country, from fifty-five to sixty per week, these two extremes being represented by the two principal silk manufacturing states—New Jersey and Pennsylvania.

The employees on day work do not receive more, when working a sixty-hour week, than if the legal week was shorter; the workers on piece work, working sixty hours, are probably content with a lower rate than if they only had fifty-five hours to earn their living in; and, as the sixty-hour mills operate 9 per cent. longer than the fifty-five-hour mills, the cost per unit for general expenses should be correspondingly lower.

These are weighty advantages and it is largely owing to them that such a great growth of the silk trade has taken place in the eastern part of the State of Pennsylvania—that part nearest to New York.

Corporation Laws.

Here and there, some manufacturing state enacts very exacting laws regarding corporations, compelling them to publish certain reports and to do many other things that they may find troublesome or undesirable, to say nothing of not favoring them in the matter of taxation. On the principle that it is easier to avoid trouble than to get out of it when in, many people avoid locating plants in such states.

Age Limit for Children.

The age limit for child labor is another feature in which State laws differ widely and which is of much moment to the employer. To employ persons so young that they do not yet possess a proper sense of responsibility is a foolish and wasteful plan, particularly when dealing with such an expensive commodity as silk. Few employers, also, would desire to put young people to work unless they were physically and mentally fit for it. A hard and fast age limit has its disadvantages, as some children are as mature at thirteen as others are at sixteen, and if the age limit is set too high it debars many children, anxious and well able to work, from getting it and leaves the employer short of their labor. Some of the Southern States have made the age limit very low, but there seems to be a distinct tendency there of late to advance it.

On the statute books of most states there are many other laws relating to factories, such as those concerning sanitary arrangements, fire escapes, construction of buildings, etc., which commend themselves to any sensible and civilized man, and which therefore would not be factors in considering a location.

We will now consider some of the other points.

Local Inducements Offered.

A manufacturer generally desires to sink as little of his capital as possible in the comparatively unremunerative form of land, bricks, and mortar, and to put all that he can into productive machinery. With this in mind, many people have been led to locate in small towns, owing to attractive offers made to them. Such communities, desirous of having mills established in their midst that will furnish employment to their people, have frequently made very favorable propositions. They may offer the land free of cost, arrange to remit all taxes for a term of years, and may possibly get sufficient subscriptions in the town to the stock of the company to defray the cost of erecting the factory,

To be thus furnished with a free-of-cost factory is a great advantage if the labor and other conditions in the place are all right. It has sometimes occurred, however, that the local conditions have been disadvantageous, and, after a time, the management has concluded that it would be better to go elsewhere. In such a case it may be found that, having accepted the land, buildings, etc., they are not free to move their machinery away, but are anchored to the place, and that they can only escape by paying back to the contributors the value of the land and buildings.

Land Values.

In buying land for a mill site, one cannot afford to pay high prices. It may be urged that, though the price seems high, the rapid growth of the community will cause a doubling of values in a few years, with a consequent large profit to the mill. Though this may well be the case, yet a gain of this kind is one that cannot be realized on without selling the mill and putting it practically out of business; for, while you may move your machinery to a distance, moving your help is quite another matter, and any moving is difficult and expensive. The increase in the value of the land, though it looks well on the balance-sheet, adds to the operating expenses in the shape of a larger tax assessment.

Allowing that land at a moderate price is available, it is desirable that a reasonable amount, in addition to that required for the buildings, be provided. It is very awkward not to have the land for a necessary extension, and if more has been bought than is ultimately needed, what is not wanted can be re-sold.

Other Questions Affecting the Location.

Good approaches to the property are necessary, and the character of the roads, both as to pavement and grade, is to be considered, particularly if there is much hauling to be done.

Dryness and solidity of ground are desirable, so that good foundations for the buildings and engines can be secured; and, on the other hand, if there is much excavating to do, the presence of rock is a drawback on account of the cost of removing it.

In damp situations the working of textile fibres is facilitated, owing to the moisture in the air, and, consequently, a situation near a stream in a valley would be superior to one high up on a wind-swept hillside, though, with the means that we now have for artificially moistening the air, this has ceased to be the factor that it once was.

Should the land lie alongside the railway, it would be well to arrange to have a switch from it into the mill yard for facilitating the handling of coal, machinery, etc. Outside of the coal deliveries, however, this matter of a railway switch is one of very little moment to a silk mill, unless it be a dyeing establishment.

In considering the price of the land, it is well to inquire what future assessments are likely to fall on the property for grading, paving, sewering, and what not; and, if these improvements have already been made, a higher price can be paid for the land than if they have still to be done.

Building Costs.

Then, there is the question of the character and cost of buildings as affected by the location.

In various places there will be quite a difference in the cost of bricks, lumber, and other building materials, owing to the distance they have to be carried by freight. In the country districts, also, the wages of mechanics are apt to be materially less than in the cities. These features should receive consideration.

Should the mill be located in a cold climate, and where fuel is dear, it may be profitable to provide the buildings with double windows, which will make the expense of heating much less. Also, if land is cheap, all the buildings may be built of one or two stories, while with high-priced land it may be necessary to use less land and more sky, and so there they might be put up four or more stories high.

Distance from the Market.

A matter of much importance is the distance that a mill is from the primary selling market, where its sales offices are located. If it is running largely on fancies, it is of great moment that it be so closely in touch with the market as to enable it to respond in the most prompt manner to the rapidly changing requirements of the trade. New samples coming forward, new fashions, new colors, and what not, have to be discussed carefully with the sales agents; and in such cases a near-by location is most desirable, so that as little time and money as possible will be used up in coming together for the many necessary conferences, and in the large amount of telephoning that it entails.

For mills on plain goods, this closeness of touch is not so necessary. Throwing mills, too, can be advantageously run at points considerably distant, but dyers find it desirable to keep pretty close to their customers.

Transportation Expenses.

In considering the matter of distance, the expenses of transportation are of importance. The freight or expressage on silk from raw-silk merchant, throwster, finisher, or dyer, as the case may be; the transportation charges on the finished goods and samples going forward to the market; the expressage on the supplies constantly coming in; and the cost of the traveling backwards and forwards from the mill to the market, by the managers or employees, bulks up into a very large sum for a factory located far away. The probable expenses on this score should be figured out as carefully as possible, and should not be guessed at.

Another point is that a mill, at a distance from the supply markets, may suffer in the matter of production by the stoppage of machinery on account of delay in arrival of supplies, and by breakdowns, etc., which may cause a stoppage of days instead of hours, as would be the case were the mill near to its base of supplies. A smaller stock of supplies, too, can safely be carried when the location is near at hand.

If none of the owners is resident at the mill, the further it is away the less they are likely to know about how it is being conducted.

Local Conditions.

The local conditions in a place under consideration are always of interest. What sort of a fire department is there? How far away is the nearest hydrant, and what is the supply of water and the pressure? This will affect the fire-insurance rate, and a good pressure is required for the automatic sprinklers. Is the neighborhood quiet and orderly, and is there proper police protection? Is there a local gas company, and an electric light and power company with whose lines you can connect, so as to have gas and electricity at command when needed? Is the town drinking water pure and good, and is the locality healthful? Is the working population used to mill life, mill hours, and mill regularity; or, if not, may you not find your place half empty when summer-boarder-time comes around, or when there is berry picking, hop picking, or fruit preserving to do, or when a circus comes to town? Is it a long haul from the yards of your coal dealer? Are the trolley connections good and close at hand? Is the railway station inconveniently far away? Are the taxes low, and do the tax assessors pursue a policy of taxing mills lightly, or the reverse? Is the property ever subject to the danger of inundation by floods? Are there other factories close by which burn soft coal, the smoke from whose chimneys, entering the windows, would cause damage to light-colored goods? Is there telephone service?

Many other questions may no doubt be raised, but the foregoing will show the importance attaching to local conditions.

Cost of Power.

Of great moment are the conditions that affect the cost of producing power. In all mills the cost of producing the power is a large expense to the business, but in an organzine or crêpe twist throwing mill it is vital. So, also, in a dyeing plant, the great quantity of steam used makes the fuel question one of the first importance.

A location in the natural-gas belt would be most advantageous, but that is too far off. Water powers are scarce, and many of them are too small to be of much use, and in dry weather they are likely to fail. The water privileges, too, are not given away by any means. Niagara Falls offers cheap power, and a large amount of power at a low rate is said to be available in the neighborhood of Ogdensburg, N. Y. In the South, also, some of the water-power companies make low prices. All of these places are a long way from New York, but if low cost of power is a primary requirement their advantages are considerable.

Sometimes a local electric company will sell power to mills at a rate which they could not improve on if they produced their own power, and they are therefore enabled to save the capital that would otherwise be sunk in their power plants, and simply put in motors to be run by the company's current. Many electric companies pursue the short-sighted policy of making so high a price as to compel manufacturers, starting in their district, to put in their own power plants, and so they lose a large, steady, and profitable business that they could easily have secured.

Most mills, however, are run by steam power, and some by gas engines, and the question is, What conditions will best serve for these purposes? The steam boilers and engines are of many and varied types—old and new, wasteful and efficient. Hard or soft coal may be burned; the engines may be simple or compound; high speed or the reverse; driving direct or through the medium of dynamos and motors; direct-connected or belted; condensing or non-condensing. The gas engines may use natural gas; or illuminating gas, bought from the local company; or producer gas, made on the premises. The desirable thing is to get plenty of good coal cheap, and plenty of good water at little or no cost.

Bituminous coal, while containing more heat units than anthracite, is not desirable for use in mills making colored silk, on account of its sooty smoke. Mills located near the mouth of a coal mine can usually get very cheap coal, and the great culm banks near the mines have, in the past, been regular gold mines for many manufacturers, as, for a long time, almost any one could get all he wanted for about the cost of the cartage, and this culm, when burned under proper conditions, has a most considerable fuel value.

Hence it is that the coal regions have been so attractive to people looking for mill locations, and, when cheap power is required, these parts have a heavy advantage. With engines running on producer

gas, the cost of the fuel is relatively of much less importance than with steam engines, as the best types of gas engines do not use more than about half the coal consumed, for equal service, by the best types of steam engines.

Water Supply.

As a proper supply of good water is essential, it is well to locate in a spot where this water can be had from wells of not too great depth, or from natural sources. Gas engines use a fair amount of water in their cooling jackets, and gas producers in their scrubbers, but almost any sort of clean water will serve for this.

For steam engines, however, the quality of the water must be right for boiler purposes, and care should be used to find such a supply as will be suitable. A location on the banks of a stream or lake will generally insure this for the cost of the pumping, and water would then be available also for the condensers, if it was desired to run the engines condensing. The water supplied by the various towns is generally good, but too expensive.

For the weighting and dyeing of silk, the amount of water used per pound is astonishingly large, and it must be just right, too; and unless the proper water, and in large quantity, be found, there would be no use in starting a dyeing plant. Dyeing plants, also, burning as they do great amounts of coal, need large volumes of soft water to feed their boilers.

In the silk-printing industry, water cuts a great figure, too, as huge quantities are used for the boiling off of the raw goods, the rinsing and washing of the fabrics after printing, and the washing of the back gray cloths, as well as for boiler and other uses.

Summary.

To summarize the substance of this article, it may be said that a manufacturer, seeking a location for his mills, should bear well in mind, and carefully inquire about, the various points here mentioned whenever he thinks he has found a place that will suit him; and, if then he finds that the balance of advantages is largely in its favor, he will probably make no serious mistake in locating there.

II

PURCHASING RAW SILKS FOR A MILL

In purchasing raw silks for mill consumption, a wide variety of questions confronts the manufacturer. The proper qualities and sizes have to be determined for the various fabrics that are to be made; the question as to when to buy, and whether to contract ahead or not, is a matter of grave moment; the merit of the season's crop and of the individual chops or marks that are offered must be determined as well as possible; the assurance that the house from which a purchase is made can and will deliver exactly what is contracted for, and deliver it on time, is a factor; and one of the most important considerations is the question of adopting a general policy for the raw silk purchases and then adhering to it.

Requirements to be Met.

In preparing to make any particular line of goods, the manufacturer knows the result he has to attain, and, of course, desires to produce a satisfactory cloth at the minimum cost. To be able to do this requires sound judgment and much experience. Any one, by using the best materials and labor, can produce a good cloth; but if his competitor can produce as good a cloth from cheaper materials, and with less labor, the difference in cost will put the first man hopelessly out of the race for business.

The art consists in using materials sufficiently good, but no better, than are required for the purpose; in letting one's best material show up for all it is worth; and in using a poorer quality where it is covered up or hidden. Again, in many fancy fabrics, much may be done by so arranging the patterns, colorings, and yarns, that the eye will be caught and held by the rich and bright little effects scattered over a comparatively poor foundation, and the cloth, in consequence, may be so attractive in appearance that a considerable sale may be found

for a cheaply made article at a satisfactory price.

One thing is certain, and that is that buyers will not pay for *invisible values,* and, if a line of goods costs much more than what its appearance would indicate, it will not sell.

Methods of Manufacture.

Now, bearing all this in mind, what course should be pursued in selecting the silk?

One person may argue that, by using fine sizes, such as 10/12 denier silk for organzine, the silk can be spread thinner over the surface of the fabric, and a finer, closer appearance achieved, while fewer pounds in weight will be required.

This is quite true; but, on the other hand, a 10/12 denier silk may cost more for the same quality than a coarser size, and is sometimes hard to get also; the cost of the throwing is greater; the cost of the weaving and other processes is more; and the product will be less. These disadvantages may more than offset the benefits to be derived.

Another may try the other extreme, and, by using a coarser silk, which will be strong and weave fast with a minimum of breakage, and which will cost less for throwing, weaving, etc., and for general expenses, may obtain a fabric which, for a given weight of material, will show a low unit of cost.

Such a cloth, however, may well be too open and coarse to be satisfactory, and so may not command the expected price.

If a middle course be pursued, and ordinary, suitable sizes be used, the manufacturer will find himself in just the same boat as a lot of his competitors, with no advantage on the one side or the other, and all of them, in consequence, held down to a price showing little or no profit.

Questions such as the foregoing must be decided according to the conditions that each mill has to face, such as the character of its machinery, the supply and degree of skill of the labor available, the requirements of the trade for which the goods are designed, the relative cost, at the time, of the various grades and sizes of silk, and so forth, to say nothing of the technical skill in the construction of fabrics possessed by the designer.

Buying Ahead.

In buying raw-silk, great advantage accrues to those who, having first-rate information about the market, and suitable experience, have the *commercial courage* to buy silk on their own judgment, and to buy heavily if conditions are favorable.

When silk is really cheap, it may safely be bought liberally, even if the market seems weak and likely to go lower, which of course it may; but the man who expects to get in at the bottom of the market never does so except by the merest chance, and generally puts off buying till too late.

It requires nerve to buy 6 to 12 months' supply of material when things seem to be going to the dogs, and when every one else appears to be staying out of the market; but, if the silk is intrinsically cheap, and it generally is at such times, one can often get just the chops, qualities, and deliveries that he wants, and on a basis that a few weeks later may look very low.

This is where the real money is made in silk buying, not in haggling over 2½ cents in price, or a month or two in time, on some small lot of 10 or 20 bales, important in a minor way though such a saving may be.

How Raw-Silk is Graded.

The grading of silk is done in a way quite different from what exists in the grading of other fibres—wool, cotton, etc.—where XX Ohio, or Middling Uplands, stands for a certain specific grade or quality.

In the classifying of silk, the basis of classification is a shifting one. It starts at the top, with silks described as Extra Classical, Double Extra, No. 1 (in Chinas), etc., which are supposed to be made from the best cocoons of the season reeled in the best possible manner.

From this highest quality they grade downward. Now, as the merit of the cocoons, due to weather conditions and other causes, will vary considerably from season to season, it follows that the Extra Classical of a poor season may be no better than the Extra of the preceding one, and thus the quality of a silk carried over a season may be different from the same nominal grade reeled the following year.

A knowledge of the relative goodness of the succeeding crops of silk of the various countries is therefore most desirable.

Reliability of the Qualities.

The care and skill used in the filatures is in the highest degree important, as on this depends the regularity, size, and cleanness of the raw-silk produced.

In Europe, the reeling is more accurately done than in Asia, and the sizings of the silk are consequently more regular and better to be relied on as a whole; though, as to the nature of the silk, both continents produce qualities of the highest class.

The products of the various filatures are sold under different chops, marks, or names, each establishment usually producing a number of grades (generally not less than three), these grades being quoted, sold, and accepted on the market according to their classification and merit.

If the qualities of these chops were constant from year to year, there would be little trouble in their selection; but, instead of that, and independent of the varying qualities of the crops, they are most of them in a constant state of flux.

Better methods, machinery, and organization in some filatures may gradually improve the value and consequent grading of their output, even when sold under the same chop tickets, while the reverse of this, with a corresponding deterioration in quality, may be taking place in other establishments.

The silk buyer must, therefore, be on the alert in this matter and keep himself well informed as to the character of the output, from season to season, of those establishments whose product he is interested in.

Status of Private Chops.

In addition to the market chops, most of the large silk dealers offer goods under private chop tickets of their own, professing in this way to secure to their customers, through the care taken by them in the selection of the silk so offered, grades fully up to the quality represented.

The value of such marks lies in the care, experience, and honesty of the house offering them, the private marks of some houses being always acceptable, while some of those of other firms are notoriously unreliable.

It should be pointed out, also, that private chops do not command quite the same price that market chops of the same nominal grades do, and, if a manufacturer wishes to resell any of his silk he is at some disadvantage if it happens to be a lot with a private mark.

On the other hand, if the buyer is desirous of securing silk of some specific mark, and makes an inquiry, say, for "Kubotakan" from each of the raw-silk dealers who are constantly soliciting his trade, the result will be that a half-dozen, or more, cables will be sent simultaneously to Yokohama, asking for offers on that particular chop, and the natural effect will be to cause its quotation to advance at once, because it would appear as if there was some great demand for it.

Deal Only with the Best Houses.

When a contract for the purchase of raw-silk is entered into, the manufacturer is required to live up to it to the letter. It is therefore in the highest degree important that he be well assured of the ability, and of the intention, of the other party to the contract to carry out his part of the agreement.

Thus, it is wise to have, if possible, dealings with such houses only as have a high reputation for integrity, as well as the necessary capital, standing, and volume of business that may be needed for transacting their business properly.

Some of the very large concerns can offer special advantages in the way of arranging for almost any deliveries wanted, whether prompt or forward, owing to the great quantities of silk they constantly have in transit, to say nothing of the fact that they generally have more or less spot silk for sale, from stock bought for their own account.

Should silk, when delivered and inspected, prove to be not up to specification, the seller is always obliged to exchange it; but, if the market is bare of stock at the time, and more cannot be procured for a month or two, while the manufacturer needs it then to keep his looms running, the latter too often has to accept the unsatisfactory delivery, work it up at a disadvantage, and grin and bear it.

Raw-Silk Classifications.

The classifications of raw-silks, as traded in on the New York market, are presented in the following list, this classification having been approved by the Board of Managers of the Silk Association of America on June 10, 1908:

EUROPEAN SILKS

Grand Extra.
Extra Classical.
Best Classical.
Classical.
Best No. 1.
No. 1.
Realina.

JAPAN SILKS

FILATURES.

Double Extra.
Extra.
Sinshiu Extra.
Best No. 1 to Extra.
Best No. 1.
Hard Nature No. 1.
No. 1 (of the grade of Sinshiu Okaya (Chicken) Summer reeling Season 1907–8.
No. 1–1½.
No. 1½.
No. 1½–2.
No. 2.

REREELS.

Extra.
No. 1.
No. 1–1½.
No. 1½.
No. 1½–2.
No. 2.
No. 2–2½.
No. 2½.
No. 3.

KAKEDA.

Best Extra.
Extra.
No. 1.
No. 2.
No. 3.

It is to be noted that the Best No. 1 Japan silks of the New York market correspond only with the No. 1 of the Yokohama market, and other grades accordingly.

Most of the Japan silk used by American manufacturers, for organzine, grades from Best No. 1 to Extra, and, for tram, from No. 1½ to No. 1, with Rereels from No. 1½ to No. 1.

For single weaving, for warps of piece dyed goods, best Extra Classical to Grand Extra Europeans are principally employed, with some small proportion of highest grade Japanese filatures.

Policies That May be Pursued.

In the purchasing of regular supplies of raw material for mill use,

it is well to have a clearly defined policy to adhere to.

Roughly speaking, the policies of mills seem to fall into three categories.

First, the buying of the very lowest grades that can be made to answer, looking to the saving in the cost of the silk to more than offset diminished production and inferior goods.

Second, the buying of the very highest grades, with the view that the increased production and improved quality will more than equalize the additional price paid for the silk.

Third, a policy of opportunism, in which fair working qualities are used for both warp and filling, with occasional purchases of higher grades of silk when relatively cheap, and the running in of lower grades than usual when it is hard to figure a profit on the qualities generally used.

Leaving out of consideration the various kinds and qualities of goods that a mill may make, and the wide variety of materials that must often be provided, and confining ourselves to the question of policy, we will consider the first case.

Cheap Silks and Low Production.

If a fabric such as a cheap, 36-inch, black taffeta, taking, say, 9 pounds of raw silk to the 100 yards of cloth, were in work, and a low grade of silk for both tram and organzine were used, costing, say, 30 cents a pound less than good grades, a saving of $2\frac{7}{10}$ cents a yard would result.

If, further, on a basis of using pretty good silk, a sum of 8 cents a yard was paid for weaving, and a further sum of 8 cents a yard had to be earned for expenses, and if the product were cut down 10 per cent. in consequence of the poorer silk used, the mill might have to pay $\frac{8}{10}$ of a cent a yard more to the weaver, and earn $\frac{8}{10}$ of a cent more for expenses to equalize matters.

Even then, however, the cost would be over 1 cent a yard less. The goods might not be quite so good, but, being in a low grade, they might sell for the usual price.

There are many manufacturers, too, who furnish poor silk, but pay their help only the prevailing prices in the district for weaving ordinary silks of the same widths, ends, and picks, and whose loss from the poor silk used is only in the expense account, waste, and imperfection of the goods, the weavers standing the loss of their own diminished earnings.

Good Silks and High Production.

In the second case, the reverse of the above will obtain. The machinery can be speeded faster, and, even with the increased speed, the percentage of broken ends will be less on account of the strength and elasticity of the high-class silk used, and, in consequence, an extremely large proportion of the theoretical product can be got out,

and the goods will be of a higher excellence and very perfect and regular.

By having nothing in work but the best silks, the help can rely on a large product, and are therefore content to take a lower rate of pay per yard than would otherwise be the case, as, even then, their earnings per week would be better.

This diminished weaving cost, and consequent lower expense cost, should more than offset the higher cost of the silk, besides which there is the superior quality of the product.

Few mills, however, follow either of the above policies, or, if they do, do not follow them consistently, which makes them of much less value.

The Policy of Opportunism.

Most mills purchase their supplies in the third way referred to, using fair qualities for both warp and filling—say an average of Classical, or Extra, for warp purposes, and an average of No. 1 for filling.

They are apt, however, to buy rather too wide a variety of kinds and qualities—being influenced by the attractiveness of the prices of particular parcels—and so their product is likely to be irregular in character.

The variation in size of the various lots, that is to be expected in such a case, makes it hard for the manufacturer to arrange his materials properly.

The organzine for a fabric may be on the heavy side, and it may happen that the tram intended for use with it may be on the heavy side also, and even the taking out of as many picks as can be abstracted without injuring the appearance may still leave more silk in the cloth than calculated, with a loss in consequence.

Similarly, should the lots run fine, picks have to be increased, with a corresponding loss of product, and perhaps more pay for weaving. It happens, therefore, that when random purchasing is done, one may have quite a large stock on hand and yet be bothered to find anything available for the orders as they come in. This leads to the necessity of sometimes using a best Extra Classical, that may happen to be in stock, in a fabric where a fair Extra would do the work, because it may be the only silk available in the proper size.

As it is not customary to speed up looms when weaving an occasional warp of extra good silk, the manufacturer gets no lower weaving rate in such a case, little or no more product, and no better price for his goods, and yet is using organzine costing much more than his calculation.

It is true that, if a skilled manufacturer, who is one of the partners or materially interested in the *profits,* lays out the work in his mill himself, good results can still be obtained, particularly if the mill makes a wide range of fabrics, so that a silk not fitting in one

place can be used to advantage elsewhere.

In such a case the manager's pocket will be vitally affected by any waste of money, and he will turn and twist his stock, and plan ahead with great care, so as to be at as little disadvantage as possible.

In many, or perhaps most, cases, however, the man who attends to the disposition of the silk for the orders is not pecuniarily affected by such misuse of material, and, in consequence, stocks of high-class silk, provided for special purposes, will be used in inferior fabrics, and will melt away in an astonishing manner.

Disadvantages of Certain Silks.

Some silks have inherent disadvantages about them which must be remembered when considering the price. Thus, Tsatlees, owing to their great irregularity in size, and to the way in which they are generally reeled, not only cost more for throwing, and in waste, but may require the use of more weight of material to give the proper cover.

For instance, if a fabric were in work with a small spot in the pattern, made by the filling, it might require say 8 picks of a regular sized silk to give proper cover to the spot.

With such an irregular silk as Tsatlee, it would happen that the thin threads would not cover the spots properly, and so a larger number of picks, perhaps 9 or 10, would, in the same space, be necessary in place of 8, to give the proper appearance to all the spots.

The amount of the boil-off of the silk, too, has to be well considered, particularly in fabrics for piece dye, as it makes quite a difference whether the silk boils off 24 per cent., as in the case of a yellow Italian, or 18 per cent., as in the case of a Japanese silk.

The dyer, in his charge for weighting, makes no distinction between such silks in his prices, though he should properly do so, as to bring up the weight of a silk with a large boil-off will require an additional pass or two through the weighting bath beyond what would be needed for a silk with a small boil-off.

Similarly, the throwster, in his charges, is equally illogical, as he will throw for organzine a Best No. 1 at the same price as an Extra Classical, or, for tram, a 1½ Filature at the same figure as a Best Re-reel, though the cost to him may be 5 to 10 cents a pound more in either case.

Adherence to Policy.

In conclusion, it may be said that one will not go far wrong, after a certain policy has been adopted, in sticking to it closely, and in buying nothing except the exact qualities and sizes demanded by the goods to be made, and in leaving alone everything else, even when the price may be very enticing.

It may be of interest, also, to note that most of the very successful manufacturers use largely the highest qualities of silk.

III

THE CHARACTERISTICS OF JAPANESE RAW SILKS.

From time to time, inquiries have been set on foot in this market, by influential persons in Japan who were interested in the welfare of the silk industry of that country, with the object of ascertaining the nature of any objections to Japanese silk that might exist, so that, if anything was wrong, either with the silk itself or in the methods of trading in it, steps might be taken in the direction of improvement.

It is well that the Japanese interests recognize that there is always room for improvement, and it is to be hoped that, in time, their average product may be brought to a point where it will compare favorably with European reelings for regularity and reliability.

In connection with this subject, it may, therefore, be of interest to discuss the general character of Japanese silks, and to make note of some of those features that make them desirable for the use of American manufacturers, and to point others wherein they are properly subject to adverse criticism.

Good Features of Japanese Silks.

Among the features which make these silks popular may be mentioned their small amount of boil-off, their generally good white or creamy color, their freedom from hard gums, their generally well-made skeins, being cross reeled and of convenient size and weight, the small size of the bales and the compact books in which they are packed, the moderate prices, the relatively long time on which the silk is sold, and the large quantities that are nearly always to be had for prompt delivery in the different grades.

So far as brilliancy, strength, and elasticity are concerned, the silks will vary among themselves as all silks do, but the average is very fair.

Where Japanese Silks are Deficient.

Points of criticism may be found in the irregularity in size of the silk; in the unreliability of chop tickets and gradings; in the fact that, when silk is scarce and the market is rising, much silk is delivered that is inferior to what has been contracted for; in the usual custom of selling silk on invoice weight rather than on conditioned weight, thus making the real cost of it always something of a question; in the disinclination on the part of reelers to contract with buyers for all or part of their output for the season at a fixed price; and in the fact that the nature of the inspection which the shippers from Japan are permitted to make of the silk that they purchase is often of such an inconclusive character, that the question of what any lot of silk will be like when it gets into work is always problematical.

Percentage of Boil-Off.

Coming now to the details, we will first take up the matter of the boil-off.

The reports of the Lyons Conditioning House for the years 1893 to 1908, inclusive, show that the average losses of Japan raw-silk in the boiling-off tests that were made there, for each of the years in question, were as follows:—17.41, 17.40, 17.26, 17.25, 18.06, 18.15, 18.05, 18.03, 17.76, 18.00, 18.09, 18.18, 17.77, 17.98, 17.93, and 17.90. The average of them is 17.83 so it is fair to state that, in round numbers, the average loss of Japan silks is not over 18 per cent.

The report of the same conditioning house of average boil-off losses for other silks, of large general use, during the year 1908, shows the following percentage of loss: Yellow silks: French, 24.18; Italian, 23.40; Piedmont, 22.92; Spanish, 24.34; Syrian, 24.35; Bengal, 22.09; White silks: French, 21.54; Piedmont, 20.68; Italian, 21.40; Brusa, 21.92; China, 17.98; Canton, 22.17; and Japan, 17.90 per cent.

It may be noted here that the average boil-off of white China silks, as shewn by the reports of twelve years, is 18.45 per cent.

It will thus be seen that the boil-off of Japan silks is lower than that of any of the other important silks, and this is an advantage of no inconsiderable moment. When the silk is used in piece dyes, the fabric, after dyeing, will be 6 to 8 per cent. heavier than the same cloth made of an equal quantity of yellow silk. If, on the other hand, it is dyed in the yarn, and is weighted up to the desired weighting, the proportion of silk fibre in the thread will be greater, and the proportion of adulterant will be less, than would be the case with a silk of greater boil-off.

Of course, the percentage of loss varies widely in different lots. Whether the amount of gum averages less in silks of soft nature than in those of hard nature is difficult to say, but it is possible that it does. At any rate, those soft silks, like Sinshius, are frequently much injured by a too severe boiling-off as a preliminary to the dyeing. The

result is that the individual filaments of the silk are opened up, and the dyed silk is soft, spongy, and hairy.

The injurious effect of too severe a treatment in the degumming is seen in the well-known specky or "lousy" appearance shown by some dyed silks, which is due to the splitting up into fibrillæ, in places, of the individual cocoon filaments.

It would seem to be the part of prudence for manufacturers to notify the dyers about all lots of soft nature silk sent them to dye, so that they could govern themselves accordingly.

A disadvantage connected with the low boil-off is obvious in the case of silk intended for single weaving. For this work, great coherence of the cocoon filaments composing the thread is a necessity, and, owing to their greater amount of gum, the yellow silks commonly used for the purpose excel in this respect.

Silks Reeled for Single Weaving.

In spite of the careful efforts that have been made by many Japanese reelers to produce silk suitable for single weaving, most of them have still far to go. A thread may be very regular and perfect, and if one defect occurred in 1,000 yards it would seem almost negligible and a thing that no one could complain of. If, however, such a silk were used in a 36-inch satin warp, containing, say, 11,000 ends, it would mean, practically, that in weaving one yard of cloth, which might ordinarily take half an hour, the loom would have to stop for broken warp threads eleven times, an amount of stoppage that would more than cut the production in half and render such a silk commercially useless for the purpose.

To attain the great perfection demanded in these silks, nothing will take the place of the careful, constant, and vigilant inside superintendence, and the watchfulness over the smallest details of the work that is typical of the high-class European filatures, and which is, if we may trust the statements of intelligent and apparently disinterested observers, conspicuous by its absence in most of the Japanese reeling establishments.

The annual consumption of raw silk for single weaving is steadily increasing, and when Japan can send us a steady supply of thoroughly reliable silks for this purpose, in the standard sizes of 12-14, 13-15, and 14-16 deniers, and silks that are equally reliable each year and every year, they will be eagerly welcomed.

Color, Strength, Elasticity and Brilliancy.

The color of Japan silk, in the medium and better grades, is all that can be desired. While not so white as the China silks, it is white enough for practically all purposes. In the lower grades, there is more or less streakiness and discoloration to be looked for, which is apt to cause shadiness in the dyed silk. This is a fault that should be guarded against, and corrected by the reelers so far as possible.

The strength and elasticity vary widely, the writer having observed different cases where silks graded as low as No. 1½ filature, New York Classification, were very superior in this respect, but it is too often the other way, and a large amount even of so-called Extras are anything but satisfactory in this regard.

Reports regarding these qualities must, however, be considered with discrimination, as a silk when fresh and when worked under fairly moist atmospheric conditions, may be all that could be desired, while the same silk, if stored long in a dry place, and then worked in a very dry atmosphere, might be found to have lost all its vitality and to be brittle in the extreme.

Japanese silk does not possess, as a rule, the brilliancy of the Chinese, or high class European silks, nor does it have the same nerve, and its relative deficiency in these respects puts it at a disadvantage for some classes of work.

Character of the Packing.

The manner in which the silk is put up is convenient and satisfactory. Standard sized skeins, neither too large nor too small, with a good crossing, and the ends properly tied in, are wanted by the throwsters, and there is usually not much to be complained of along this line. Packing the silk in books is also a convenience, and the moderate size of the bales—about 133 pounds net—is quite a help to many small people who can only handle a bale at a time, whereas, in buying a European bale, they would have to take 220 pounds.

Terms and Conditions of Sale.

European silks, usually, are sold on 60 days' credit, though 3 months' or 4 months' terms (at, of course, a difference in price equal to the interest), are very common. Asiatic silks, on the other hand, are sold on 6 months' terms, and the additional time so given is a great help to many houses in the financing of their business, and makes them favor Asiatic silks, other things being equal.

The custom of selling Asiatic silks on invoice weight, or conditioned weight plus 2 per cent., is a practice that might well be changed. All silk should be sold on conditioned weight and in no other way. The prices adjust themselves to the weight given.

The position that was generally assumed by raw-silk dealers that buyers must either accept invoice weight, or else conditioned weight plus 2 per cent., for Asiatic silk transactions, is an illogical one, and one which tends to militate against the general use of a conditioned weight basis.

All manufacturers of experience know that the average run of Japan silks will not show a loss of as much as 2 per cent., and, therefore, if they buy on conditioned weight basis plus 2 per cent., they are out of pocket. Thus, many of them will accept invoice weights as the least of two evils, and will omit conditioning their silks, as they will

not only have no recourse against the seller for short weight, but will have to pay for the testing charges as well, and unverified weights of silk deliveries open the door for many evils. Similar remarks apply to China steam filatures.

With reference to the loss in conditioning of Japanese raw-silks, the writer has before him the report of 300 bales tested, representing lots aggregating 900 bales, where the average loss figures 1.61 per cent., the better qualities averaging, as a general rule, appreciably less loss than the lower qualities. Hence, as compared with invoice weights, a basis of conditioned weight plus 2 per cent. would bear more heavily on the users of the better silks than on the users of the poorer grades.

(NOTE. *At the time when the Raw-Silk Division of the Silk Association of America adopted rules to govern transactions in raw-silks—May 22, 1908—provision was only made for the selling of such Asiatic silks on the basis of conditioned weight plus 2 per cent., or "actual" weight, or invoice weight, although the writer, and no doubt others, strongly protested, in writing, against the manner in which these terms militated against the manufacturers.*

However, it is gratifying to find that the raw-silk merchants have come at last to recognize the justice of these criticisms, and, on August 9, 1911, they amended their rules so as to provide for the selling of Asiatic silks on conditioned weight also. It is to be hoped that, in time, sales on conditioned weight alone will be the invariable custom.)

With the excellent testing-house facilities in Yokohama and in New York, there appears to be no reason why the whole business could not be put on a conditioned weight basis, and the added 2 per cent. eliminated from calculations, where it is a disturbing factor. Concerted action of all the raw-silk houses looking to this end would be very welcome, and general terms of net 3 months, for both European and Asiatic silks, would be a reasonable limit.

The size of the Japanese crop, the immense importation into America, and the great quantity of silk handled by the large importers, materially assist the operations of those buying this staple. It is generally easy to find on the market any standard quality or size that may be desired, or at any rate very prompt deliveries can be had, and the importers often accommodate their customers by exchanging contracts of one grade for another, at the market difference in price, according to the exigencies of the trade. The importers also carry, at ordinary interest charges, silk for their clients until it suits their convenience to call for it. This arrangement is of the greatest help in facilitating large transactions for future delivery.

Speculative Attitude of Japanese Reelers.

A peculiarity observed in dealing with Japanese silk producers, is the general disinclination or refusal of the reelers to contract the output of their establishments far ahead. A European reeler welcomes

a contract at the beginning of a season that will keep him fully employed throughout the season, and at a reasonable profit. The speculative spirit of the Asiatic, however, prevents him from doing this, and he seems to prefer taking his chance of the rise and fall of the market, rather than to work at a small, but assured, profit.

This is a distinct drawback, as it militates against the stability of prices, and makes of each reeler a potential speculator, and the result is seen in those erratic advances in prices, with their subsequent reactions, which upset so seriously the orderly and regular sale and distribution of merchandise, and which cause very heavy and needless losses to the manufacturers.

How Price Fluctuations Hurt Manufacturers.

When the raw-silk market advances heavily, those who have a good stock of silk rarely get much benefit from their foresight, because there are always some people, also long of silk, who, owing to pressure from their customers and from their own salesmen, do not advance their prices for goods until their cheap silk is exhausted, and their competitors, in great part, have to follow suit.

At the same time, those who are short of silk, and who have to buy on the rising market, are in the unpleasant position of having to pay more for their raw material while getting no more for their goods, and thus have no alternative but stopping their looms, or running, either without profit or at a loss.

On the other hand, when the market is falling, and prices are breaking rapidly, firms who are bare of silk go out and book orders at prices lower than the market then warrants, expecting, and generally with good reason, to be able to cover themselves a little later with silk at remunerative figures. This action as to price, gives those who are long of high-priced silk no chance to turn it into money without loss, and, even when they have booked business on the high-price basis, the bulk of the contracts are promptly cancelled by their customers in favor of the cheaper goods being offered by their neighbors.

A large number of the manufacturers thus suffer whenever these sharp fluctuations in prices occur, and, at the same time, the sales of goods are often much restricted, as the buyers are unsettled in their minds regarding values, and the consequent effect on the trade, as a whole, is disastrous.

It would be a distinct advantage to the market if a great thrown-silk business should be built up here. Not only would it be a convenience and advantage in many ways to the users of silk, large as well as small, but the constant presence on the market of a large stock of thrown-silk, would assist materially in helping to check some of the acute variations in prices, caused by speculative manipulation and not by the legitimate operations of the law of supply and demand.

Irregularity of Japanese Silks.

Japanese silks are distinctly irregular in size as compared with the standards set in Europe. The quality known as strict No. 1, 13-15 deniers, New York Classification, may have a variation in size of as much as 6 to 10 deniers between the finest and the coarsest reelings. Some sellers are brave enough, in selling such silk, to promise that there will not be a variation of more than 5 or 6 deniers, but such statements are quite unwarranted, and if the size does come within these limits it is simply a matter of chance, as it is quite as likely to vary 8 deniers as 6.

The better grades, of course, will show less variation, and the lower ones more. In America, there is not much attention paid by buyers of goods to the evenness or regularity of size of the silk in them as is the case abroad. Price is the dominating consideration with the buyer, as production is with the manufacturer, and if the weaver should buy more expensive silk for the sake of getting greater perfection of fabric, he would not, in most instances, be able to secure any higher prices for his goods.

So long as the size has not been too grossly irregular, and so long as it would be otherwise strong and weave well, the American manufacturer has shown marked indifference on this point, and this indifference has, no doubt, been reflected in the lack of improvement in Asiatic silks in this respect.

These variations in size frequently affect the cost of goods not a little, as it makes quite a difference whether a silk averages 13.90 deniers or 14.40 deniers if no modification of picks or ends is made.

Unsatisfactory Classifications.

Yokohama classifications do not correspond with those of New York, the No. 1 of Japan being called here Best No. 1., and in fact the greatest haziness and looseness seem to exist in this classification matter.

This is one of the very worst features of the situation. For years there has been a gradual lowering of the standard of all grades—if the best authorities are to be believed—and the merit, or demerit, of most of the chops will vary widely from season to season. The same chop may be offered at the same time, by different houses under two, or even three, different gradings. As there are no fixed standards for comparison, it is next to impossible to absolutely demonstrate that any inferior delivery is not of the classification bought.

Buyers often know next to nothing about how any particular silk should be classified. Most of them are apt to declare that they rarely buy anything lower than Extras for organzines, or lower than No. 1 Filatures for tram. Also, that they only buy hard-nature silks and Summer reels. Just the same, there is a large importation of both

soft-nature silk and so-called Spring reels, and a great quantity of silk below No. 1 is sold, and somebody must get it.

The throwsters can speak with feeling on this subject, for many of their clients buy silk not much better than No. 1 to 1½ for organzine and then wonder that it does not run well in the looms, and still lower qualities will be regarded by them as first-class tram stock. These clients think that if a silk is troublesome and expensive to throw, it is the throwster's lookout and not theirs, but they fail to consider that trouble in the throwing means increased waste, and, if a throwster is out of pocket 10 cents a pound for excessive labor on a particular lot, the owner of the silk loses as much, or more, on the excess waste made, but this he generally does not know as the wastage is concealed by a heavy soaping.

If throwsters' prices were modified by the grade of the silk, lower figures being charged for high-class silk and higher figures for poor silks, it would help to correct this, but they are not.

Inferior silks of whatever grade are undesirable property, as they mean excessive waste, poor merchandise, and diminished production, and it is a notable fact that, as a rule, the best and most successful houses are free users of the very best silks.

Rereels and Their Relative Cost.

Rereels go very well in the throwing process and are much favored by many buyers. There is, however, no way to distinguish a rereel, either from its appearance or from the manner in which it is put up, from the regular filatures, nearly all of which, of course, have also been rereeled. Now, with rereels commanding a price of say 7½ to 12½ cents a pound above the price of No. 1 Filatures, as is often the case, and with the latter silk perhaps just as good, and no way to distinguish between them, the temptation to put well-known rereel chop tickets on market chops of filatures must be a strong one, but whether it is yielded to or not is for others to say.

I have often had parcels of rereels submitted to me as being the very last 20 or 40 bales of this or that chop to be had, and, having bought them, have been offered a few days later more of the same mark. Whether the silks on such occasions are held back, and the quantity for sale is lied about, or whether the additional supplies of rereels are secured by the use of the paste brush and chop tickets, I do not know.

Table Showing Gradings of Rereels.

In this connection I am presenting a table which was published in "Silk," in October, 1907, showing the various chops and grades of the principal Japanese rereel factories, as produced at that time.

TABLE SHOWING APPROXIMATE GRADING OF VARIOUS "REREEL-CHOPS" AS AFFIXED ON THEIR PRODUCE BY "REREEL-FACTORIES" OF JAPAN.

GRADE.	FACTORIES.												
	USUISHA.	KAMRASHA.	SHIMOMITA.	KOSUISHA.	TENSENSHA.	TOMIOKA.	KAISHINSHA.	ZENSHINSHA.	RYOSEISHA.	TOHOKUSHA.	YAMADA.	TSURUMIGAWA	SANSAESHA.
No. 1.	5 Girls.	Red K.R.	One Peach.	—	—	—	Chrysanthemum.	—	—	Jap. Hat.	—	—	—
No. 1-1½.	Basket.	Gold K.R.	Bull.	Sun & Tortoise.	Gold Character.	—	Wooded Island.	Eboshi. (Gold).	Spinning Girl.	Biwa.	Hotei. (Gold.)	Crest of Stork with Medal.	Fuji. (Gold.)
No. 1½.	2 Girls. Stag.	Gold Eagle.	Two Peaches.	Pines. One Crane.	—	Red Sun & Cherry.	Lily Bulb.	Fans. Flag.	Red Leaves. Baby. (Gold.)	Chrysanthemum. Lily. (Gold.)	Tortoise.	—	—
No. 1½-2.	Dolls. Red Maple.	Silver Eagle	—	—	Silver Character. One Hare.	—	Lily in Pot. Lily Flower (Gold.) Ground Pine.	Eboshi. (Silver.)	Owl.	Cock & Hen.	Hotei. (Silver.)	Crest of Stork. Two Pigeons Two Sparrows.	Fuji (Silver.)
No. 2.	Gold Maple.	Silver K.R.	Gold S.N.	Two Cranes.	Two Hares.	Gold Sun & Cherry.	Lily Flower. (Silver.)	"Kikusui." (Gold.)	Toys. Baby. (Silver.)	Lily. (Silver.) Paper Storks.	Hotei. (Blue.)	—	Fuji. (Copper.)
No. 2-2½	Silver Maple.	Blue K R.	Silver S.N.	—	—	—	—	—	Circus.	Fisherman.	—	One Crane.	—
No. 2½.	Green Maple.	—	—	Bamboo.	Lobster.	—	Lily Flower. (Yellow.)	"Kikusui." (Silver).	—	—	(Hotei.) (Black.)	—	Mulberry-leaves.
No. 3.	Bamboo & Leaves.	Black K.R.	Black S.N.	Plum.	—	—	—	"Tsuzumi."	—	—	—	Tortoise. (Gold.)	—

Inaccurate Crop Information.

Reliable information as to the real size of the crop, and the amount of silk available for export, is not always to be had, and the stock reported as being on hand at Yokohama is no criterion. It is realized that if too large a stock is visible there, it will have a depressing effect on the market, and the opinion seems to prevail that, even if the reports of stock are trustworthy, silk must at many times be held back in the interior so as to keep it out of sight.

Unreliability of Chops.

The unreliability of chops, and the loose way in which grades are described, is bewildering. Three manufacturers may each have made a purchase of "Extras" at the same time. One may have paid $4.00, another $4.10, and the third $4.20, and very likely the $4.20 man will not have got a real Extra. The honest dealer, who will not misrepresent his silks, is at a serious disadvantage in such a competition, particularly when the ignorance of so many of the buyers is considered, for, while such a dealer may be able to sell quite as cheap, the buyer cannot judge the silk well and simply relies on its nominal classification.

Some salesmen meet the situation by asking the manufacturer for a sample of his "Extra" or other grade, or for the name of the chop he is buying, and then quoting on one of similar merit, and calling it an "Extra" to satisfy him, even if it be a No. 1. He practically names the price, and they supply him with whatever silk can be offered at that figure.

This, in turn, means the undercosting of his goods by that manufacturer, for, by the time he finds that the quality he is using has caused him diminished production, and increased cost in consequence, the harm has been done as his prices have been quoted and his orders taken.

Manufacturers having a good experience with certain chops, are apt to specify those marks in their offers, and in this way help to bid up the prices on themselves, and when they get the silk it may be disappointingly poor compared with what they had before.

Private Chops.

Then, they may turn to the private chops, relying on the inspection and care of the houses putting out such marks. Now private chops, in many cases, do not sell as readily or command, on the average, quite so full a price as market chops. Of course, if the house offering the silk has been able to buy a thoroughly good silk for the grade, at a low price, either because of its being a new or little-known mark, or for whatever reason, it would be right for them to so ticket it, and they could sell at a little lower than the market chops and at the same time make an extra profit for themselves.

Such opportunities cannot always be found, and the temptation is strong for those putting up private chops to select silk of a little lower grade than they should; and different houses, even some of high standing, at times put out silk under their private chops that is disgracefully overclassified. If they are selling to any customers whose credit is poor, and who are not in a position to rebel, such lots are sure to be unloaded upon them, and, perhaps, may even have been put up with that intention.

In this way, private chops are often spoken of in disrespectful terms, but it all depends on the house, certain houses keeping up the standard of their qualities at all times.

Nevertheless, private chops do not give the guarantee of correct grading that is the only reason for their existence, and I would avoid them; and I do not believe that the seller has the right to deliver his own private chops against a contract, unless specially arranged for with the buyer.

Manufacturers Suffer When Silk is Wrong.

Contracts being placed as they are, and the silk being carried by the importer after its arrival till the manufacturer needs it, it follows that it is generally not called for till just when it is needed.

This being so, the manufacturer finds himself in an unfortunate position if the silk turns out badly, for his machinery needs silk right then, and, unless the seller has a spot lot of equal quality with which he can replace it—which is not often the case—the manufacturer is forced to go ahead and use this poor lot, as he cannot wait for another to arrive.

In conclusion it may be said that, as the bulk of Japanese silks are bought to arrive, the spot business being relatively very small, a buyer has no assurance as to what sort of silk he will receive against his order, and, in the last analysis, has no trustworthy means of informing himself.

IV

ADULTERATION OF SILK GOODS

The reputation of silk fabrics has, of late years, suffered greatly in the public estimation, on account of the extent to which the use of adulterants has been carried, resulting in a general overweighting of their goods by manufacturers.

Retailers, and other distributers, from time to time, rush into print decrying in unmeasured terms this practice, boldly charging manufacturers as a class with dishonesty, and talking as if each increase in the degradation of the fabric was done by their volition and design, and for the purpose of increasing their profits.

Where Adulteration is Justifiable.

It is well to inquire what adulterations are right and necessary, what are to be condemned, and who are the people mainly responsible for them.

Any deceit, practised on any customer, by manufacturer, jobber, cutter-up, or retailer, is wrong and indefensible, and if goods are adulterated they should not be represented as other than what they are; but, on the other hand, if there be no deception, many goods can be adulterated with great advantage to all concerned.

Take rubber, for instance. The price of crude rubber may be $1.50 a pound. If our garden hose, overshoes, or other rubber goods were composed solely of the pure stock, the prices would be so high as to force many goods out of general use, and also would no doubt push the price of the pure gum far above such a level as the above. It is quite true that a great quantity of trashy, so-called rubber, goods are regularly sold, the adulterations being far in excess of reasonable limits; but it is also equally true that a judicious and reasonable admixture of foreign substances with the rubber, will allow of the manufacture of rubber goods with thoroughly good wearing qualities and at

most reasonable prices. In this way, the consumer saves money, the world's supply of the material is conserved, and the manufacturer and dealer find their account not in any increase in their percentage of profit (for the competition in trade prevents that), but in the widening of the field for articles made of rubber, which means a larger manufacture and a larger sale.

Shoddy and Woolens.

Then, there is the introduction into woolen goods of so-called shoddy admixtures, which some of our well intentioned but not very well informed Congressmen, laboring for the public weal, have been earnestly trying to have prohibited by law, though, fortunately, the absurdity of their propositions, and the impossibility of enforcing the proposed laws, have so far been made apparent in time to prevent the enactment of such measures.

The term "shoddy" covers a wide range of substances, and is often used to include all waste textile products, whether they be new wastes from the mill machinery or scraps of the oldest and poorest clothing. The columns of various textile papers, which give waste and shoddy quotations, will show what a long list of materials are included under this head—noils, card waste, all kinds of spinning, weaving and knitting waste, flocks, mungo, garnett waste, old stockings and jerseys, new tailors' clips, seamed and unseamed rags, and a lot of others.

At the one end of the scale may stand the long and beautiful white wool and worsted waste, from the combing, spinning, knitting and weaving operations, or long and fine white worsted waste extracted by the garnett machine from old white jerseys, sweaters, etc., and these materials, when worked over, may be, and frequently are, far superior to much of the new wool, fresh from the sheep's back, that is on the market, and the price is correspondingly high.

At the other end of the scale (leaving out the floor sweepings mixed with trash), may be placed the shear flocks, that fine woolen dust, as it might be called, which is sheared from the face of the cloth, and which is very useful in increasing the weight of such fabrics as ladies' cloths and other fulled goods.

The use, and re-use, and use again on a descending scale, of these various waste materials, furnishes the mainstay of the stock of woolen material that is annually required to clothe the race and protect the people of the country from cold. Were the use of such materials prohibited, woolen garments would be beyond the reach of the poor.

Manufacturers are not anxious to use these admixtures, as they are very troublesome to handle, while to have the best new stock for his raw material would make any mill man happy. It is the necessity of furnishing goods at prices within the reach of the masses that drives him to use shoddies, and the competition prevents his getting any better profit from the fabrics so made.

Annual Per Capita Supply of New Wool.

It may be of interest to state here that, in 1907 (and similarly for other years), the amount of scoured wool annually produced in, and imported into, the United States, 306,500,000 pounds, would only allow 54½ oz. of scoured wool (which will lose 30 per cent. in manufacturing), for each inhabitant, to provide for all their multifarious needs, whether blankets, carpets, clothes, or what not. How far would this go unless backed up by the great floating stock of re-manufactured wool?

The 70 per cent. remaining from the 54½ oz. would be 38⅛ oz., equal to about 2⅜ yards of 16 oz. 54-inch men's wear goods, so, if a man was restricted to his share of the stock of new woolen material, he would have enough for a coat and waistcoat, but would have to go without trousers.

The cotton cloth used for bags for salt or flour has large amounts of clay and starch in its composition, thereby making a cheaper and yet thoroughly serviceable and satisfactory article, and at the same time reducing the demand upon the over-taxed cotton fields.

Many other instances of so-called adulterations could be cited, covering a wide variety of products, where the uses of goods have been extended, prices have been lowered, and the drain upon supplies of raw material, difficult and costly to produce, has been lessened.

All of these instances bear out the statement that, within proper commercial limits, and allowing that no deception be practiced, many adulterations, or admixtures of foreign material, are not only defensible but absolutely necessary.

Fraudulent Representations.

Fraudulent representation is common, mostly on the part of those who deal with the consumer. Brass-plated iron is sold as solid brass; papier-maché as leather; cotton-mixed cloths as all wool; lumber, curtain poles, etc., furnished in scant size; coal allowed to have much slate (dignified by the name of bone) in it; oleo-margarine masquerading as butter; and so on, ad infinitum. The fraud, be it observed, is not in the production and sale of the goods, but in the representing them to be something other than what they are.

Silk Weighting, and Why.

Returning to silk, it is fair to presume that, originally, the desire to use weighting agents was created by the large loss that silk undergoes in the boiling-off processs preparatory to the dyeing. It is no light matter to see the weight of such an expensive material shrink, in this way, from 20 to 25 per cent. When, therefore, it was observed that silk had an affinity for certain substances which it would absorb, and still retain through the dyeing process, what more natural than that they should be so employed?

The practice of weighting the silk having been once begun it would be naturally used to a greater and greater extent, being limited only by the power of the material to absorb it, the ability of the dyer to apply it, or the limitations of the strength of the fibre.

There are many substances that can be used as weighting materials, such as sugar, different forms of tannin, salts of iron, tin, and other metals, and a variety of other agents.

Sugar has largely gone out as a weighting agent, and so to a great extent have gall and tannin, for colors, these latter materials being unsuitable for use where pale shades are needed. The iron dye is used where blue-blacks are required. The weighting material of the greatest general use is tin, that is, the metal tin dissolved in dilute hydrochloric acid.

As this solution is colorless, it can be employed when dyeing the most delicate colors, and while for some time dyers continued to dye the dark shades in gall weighting, using the tin for the pale shades, they have eventually found it more convenient and economical to use tin for all colors.

Processes of Weighting.

Without going into technical descriptions it may be explained that, after the boiling out of the natural gum in the silk, if it is then treated to a bath of the tin liquor it will absorb a certain amount, say a couple of ounces to the pound of silk. If the silk is now washed out, treated to a bath of a phosphate of soda preparation, and again washed out, it is brought into a condition where it will absorb a couple more ounces of the tin.

This succession of baths can be carried on continuously, being limited only by the skill of the dyer and the diminishing strength of the silk.

Limits of Weighting.

It is a matter of nice judgment to know how far it is prudent to go in weighting, and this will depend on many things—the character of the silk, whether organzine or tram, whether colors or blacks, the use to which the goods are to be put, etc., etc.

Where filling is wanted for cheap, black, heavy ribbed gros-grain, or similar fabrics, where the filling is entirely covered, silk weighted to 40 oz. and upwards can be employed; that is, a pound of silk, boiling off to 12 or 13 oz., can have added to it enough adulterant to increase its weight to the above figure.

For "bright" silks in blacks, that is, for silks from which the gum has been fully discharged, and which in consequence have a good lustre, the maximum limit of weighting is about 44 oz., and about 40 oz. is the limit in the case of spun or schappe silks.

Souple silks, being those from which very little of the gum has been

discharged, and which are consequently somewhat dead and lustreless in appearance, can be weighted up to 60 oz.

For ordinary black goods of fair quality, the warp may be weighted, say, from 20 to 26 oz., and the filling, say, from 26 to 30 oz.

In colored goods with tin weighting, it is not usually safe to go above about 18 oz. for warp and 24 oz. for filling, which would mean that a silk fabric, whose warp and filling were equal in amount, and the silk in which boiled off, say, 20 per cent., would be so treated that the apparently pure silk, finished, article would really be composed of 61 per cent. of silk and 39 per cent. of tin.

The writer's opinion is, that the limits of judicious weightings (as far as the durability of the silk is concerned), are 16 oz. for organzine, and 22 oz. for tram, when Asiatic silks are used, and less weightings for silks with greater boil-offs. Above these limits, silks are apt to deteriorate too soon.

Relative Weights of Fibre and Adulterant.

The real amount of weighting, that is, the percentage of adulterant added to the silk fibre by these weightings of various ounces, will depend upon the amount of gum, soap and oil, that the thrown silk loses in the boiling-off.

Most manufacturers have no real idea of the percentage of loading they are putting on their silk, as they seldom have boil-off tests made on their thrown silk.

If silk was regularly ordered weighted $22\frac{2}{24}$ oz. (that is, that 16 oz. of thrown silk must, when dyed, weigh not less than 22, nor more than 24 oz.), it might happen that one lot of Japan tram would have a natural boil-off of 16 per cent., that 2 per cent. of soap and oil had been added by the throwster, and that the weight returned by the dyer might be 22 oz.

Another lot might have a natural boil-off of 20 per cent., the throwster might have added 4 per cent. of soap and oil, and the return weight might be 24 oz.

Now, the manufacturer thinks that both lots are weighted alike, yet the first would have been weighted but 67.68 per cent., while the last would be loaded 97.36 per cent.

This well illustrates the practical difficulty that would confront those who wish laws passed requiring manufacturers to mark on their goods the exact amount of adulterant contained in them.

Of course, these figures are all relative, heavier weightings being permissible for special reasons and lighter weightings being necessary in many cases.

Dyers, and Their Charges.

This adulterating is a high-class chemical art, and any carelessness, or mistake in process, may so destroy the strength of the silk either at the time, or before it has been long in stock, as to make it rotten

and worthless. For this reason it is vitally important for manufacturers to commit their work only to dyers of the highest reputation, and, by preference, to those sufficiently strong financially to be able to pay a heavy claim for damage should the occasion ever arise, which, with such firms, it is not apt to. Whatever such a dyer's price may be, above competitive quotations, it will be no more than what it is worth to the manufacturer as an insurance that he will get his silk properly handled.

Such work of course is not cheap. While pure dye may cost 25c. a pound, 14-16 oz. will be 50c. and 20-22 oz. 90c., in colors, while the very heavy weightings on blacks may run up to $2.50 a pound. From these prices there will be some discount, according to the market and the size of the customer's business. While expensive, the weighting, naturally, costs less than the silk.

Advantage of Adulteration to the Consumer.

Taking now an ordinary 19-in. colored taffeta, of a good quality, retailing at, say, 75 cents a yard, and composed of five-eighths silk and three-eighths tin, it is safe to say that if such a cloth has been made of good silk, carefully weighted and dyed, and well manufactured, it can be safely claimed to be a sound commercial article, that if properly stored will not deteriorate by being kept in stock for an extended period, and that will give most satisfactory wear in service for all usual purposes.

Such a fabric, if made in pure dye, could not, on the same relative basis of costs, be retailed at less than about $1.10 a yard.

The woman who has a waist or dress made of a colored silk does not expect or desire it to last for a life-time. At the end of the season it is much soiled, the fashion of the sleeves, etc., has changd, and the color may be passé. If she desires, she may get a second season's wear from it, but if it were indestructible she would seldom want to wear it longer.

She has, therefore, been able to get her material of the right weight, feeling, color, and strength at a price of only two-thirds of what it would have cost her had adulterants been unknown, and the quantity of raw-silk that would otherwise have had to be produced has been lessened in consequence.

Here is a clear commercial gain to the world, in that a smaller value of material has been made to do the work of a larger value, and no one has suffered in consequence.

Difficulties with Weighted Silks.

It is true that all weighted silks have some drawbacks, and are not suited for every surpose. Tin-weighted fabrics, particularly in pale shades, deteriorate rapidly in strength when subjected to continued exposure to sunlight. The acid of perspiration, too, will speedily rot

such a cloth so that ample-sized dress shields are a necessity for waists made of weighted silk. There is always a chance, also, that some occasional lot, even when very little weighted, may have gone wrong in the dyeing, and the goods made from it may prove to be defective in strength. This should be a very unusual occurrence.

Where the Blame Lies for Overweighting.

Allowing, now, the commercial propriety and necessity of such reasonable adulterations as manufacturers are compelled to use, and in using which the competition prevents them from realizing any extra profit (for the dyer will weight silk for any one and every one), and allowing that manufacturers always prefer to use good materials and that consumers desire to puchase reliable goods, why is it that we find such grossly excessive weightings employed, which give the makers no end of trouble, and which go into fabrics that get rotten almost as soon as made up into garments, and which bring all silk fabrics into disrepute?

Who is the one who puts this pressure on the producer to lower, and still lower, the quality of his merchandise, while still making a fabric of seeming worth? The blame lies squarely on the shoulders of the distributers—the retailers and cutters-up—those gentlemen who so vigorously condemn the adulteration of silks.

The buyer is under no illusion as to the fact of the merchandise he orders being heavily weighted, or, if he is, he is not fit for his position. Let him just weigh a heavy but cheap piece of black taffeta or satin, and then look up the ruling quotations on raw-silks, and he will probably find that the total price he is paying for the goods would hardly be as much as the same number of pounds of unmanufactured silk would cost.

Retailers' Advertisements, and Their Expenses.

Then glance at the advertisements of certain retail houses and see what they offer as bargains. Here is one: "27-in. fine, heavy, black taffeta, all pure silk, 59 cents; our regular 69-cent quality." Such a description as this is a lie, and the palming off of such trash on the public as "all pure silk" is a swindle. In some other branches of trade obtaining money under false pretenses is likely to put the persons who do it behind the bars, but this is just what such advertisers are doing. It is here that the deception is practised, and yet these are the moralists who accuse the manufacturers of deceit.

The expense of doing a retail business in the cities has been constantly increasing. Higher rents, finer stores and fittings, more taxes and insurance, free delivery of goods further and further afield, mountains of goods cut up and mailed out as samples, heavy advertising charges, higher wages, and many other things have so increased the ratio of selling expenses that a larger margin of profit than ever before must be looked for.

Silk goods, like all other merchandise, will cost more to make as the raw material market advances, to say nothing of increases in cost due to higher wages, etc., and, therefore, at times, a higher price must be had for the making of any standard quality of goods.

The retailer, however, refuses to consider any price for goods that does not show him a certain average of profit—say 40 per cent. (and he wants as much more as he can get), and he still wants to retail his goods at prices as low as, or lower than, usual, so the manufacturer, with frequently a higher cost, is invited to make even lower prices to offset the increased cost that the retailer is at in doing his business.

Trying to do the Impossible.

The manufacturers struggle madly to do this impossible thing, and between them prices come down to a point where it is not a question as to who will take the least profit but who is willing to make the biggest loss.

Not getting as low a price, perhaps, as he demands, the retailer, instead of placing a large advance order, says that he will wait. Owing to the fact that the jobber has been almost eliminated, and that the great bulk of the goods is sold direct by the mill agents to the retailers, it follows that the mills need orders long before the retailers need goods, and these latter are consequently in a most commanding position.

The retailer, therefore, waits, and waits, for weeks and for months, and meantime the manufacturer is sweating blood, as he must either take the hazard (generally a losing one) of making goods for stock, or see his machinery standing idle and his organization dispersed. The cutter-up is equally insistent in his demands, and equally able to wait, and between them they have the manufacturer by the throat. This is the compulsion that leads to overweighting, and it is due to the refusal of the distributer to pay the price necessary to get decent goods.

Refusing to Overweight Goods.

Some manufacturers will not make goods that will go rotten for any consideration, and they generally suffer in consequence, for along comes some competitor who offers a cloth, grossly overweighted, but which looks and feels all right and which suits the customers' ideas of price, and he walks off with the business. The distributer does not appear to care much as to how durable the goods are, so long as too many complaints about them do not come in.

It is no uncommon thing, either, for a buyer, who has given the go-by to a line of goods of approved merit which he has been handling (and for a difference in price of perhaps a cent a yard), to tell the mill salesman in confidence that he wants the goods, believes they are worth much more than the difference in price, and that he would willingly buy them, but that his principals would find fault with him for doing so. He would, perhaps, be told by them that every one else

was buying this same grade from such and such houses at the lower price, and getting the regular retail figure for them, and that, whether the fabric was quite as good or not, there was no special complaint about it, and that if he bought the higher priced one he would be simply throwing away a cent a yard of the firm's money, and that they would not sanction it.

Cutters-up of goods habitually say that they don't care what is in the goods as long as they look well, feel well, and are fairly strong at the time. Then, when they are cut up and sent out, that is the last they hear of them.

All of these distributers know, or should know, that such goods are going to be unsatisfactory in very many cases, but they are not in the slightest degree concerned about this so long as they do not have to allow too many claims, and these they try to pass on to the manufacturer. What interests them vitally is to increase by every means, and at any cost, their already very liberal profits, and hence they purchase and distribute goods that never ought to be allowed on their counters.

Trade publications, newspapers, and many people who are prominently identified with the trade, are very free with advice to the producers to get away from cheap stuff and make better (and naturally more expensive) goods, saying that such a course is vitally necessary if silk is to be rehabilitated in popular esteem. This advice is all very well, but it seems impossible to get such goods before the purchasing public in any quantity.

The Barrier to the Sale of Sound Goods.

The retailer is the barrier that prevents the manufacturer from making honest goods and the purchaser from getting a chance to buy them. He wants goods that are first cheap, and which appear to be good, as he can then make large sales easily and with a big margin of profit. If you want him to handle and push a line of pure-dye goods, and represent them as such, he would probably decline, as the question would at once be raised by the customer that if these were pure dye what, then, is all the rest of his stock composed of? The cutter-up reasons in the same way.

That purchasers do appreciate good wearing goods is evident from the constant favor which is shown for such goods as foulards, crêpes, Shantungs, etc., which, being piece-dyed, have been free from weighting.

The Weighting of Piece Dyes.

It is much to be regretted that weightings have at last been commercially applied to piece-dyed fabrics. At this writing (January, 1913), chiffons are being extensively adulterated, as are certain satin-faced fabrics made of raw-silk, and this is done in ribbons as well as in broad goods.

The weighting given to such raw-silk fabrics runs up to nearly 100 per cent., which, on silks having a 25 per cent. boil-off, is equal to 24 ounces.

With fabrics made of organzine and tram, it is probably as cheap to weight them in the skein as it is in the piece. Honestly made goods of any kind would have their proper and continued sale, but the consumer has no way of knowing whose goods she is getting, and where a line of poorer goods is substituted by the retailer, for the reason of a difference of a cent a yard in price, she is no wiser, except that she finds that this gown did not wear well, while the last one of the supposedly same quality did, and so she gets the belief that no silks are reliable.

A Suggested Remedy.

Overweighting will continue, and the unloading of inferior goods on the public will continue, just so long as the different makes are unidentifiable. Let the manufacturers, however, each for his own products and each in his own way, go over the heads of the retailers and advertise their goods direct to the public, and have them marked so as to be known. The demand for such meritorious goods would then come on the retailer and he would be compelled to keep them in stock, and instead of the retailer stating how much profit he must have, and the price at which he must buy his goods, the manufacturer would fix the retail price, and might also fix the amount of profit that the retailer would have to be content with.

This has been done in many instances and is a growing custom, and, if it becomes general, the distributers may find that their greediness has been the cause of their being placed in a position where they are compelled to do a large portion of their business on advertised fabrics, and on a very narrow margin of profit.

V

ANALYSIS OF PERCENTAGES AND COSTS OF WEIGHTINGS

The basis upon which the skein silk dyers of the United States make their charges is a peculiar one. It is what might be called the "ounce" method.

How Weightings are Ordered.

Every one knows how the dyers' printed price lists read: "Colors, Pure Dye—25c.; 14/16 oz., 50c., 16/18 oz., 60c.," etc., etc. The understanding is that if, say, 20/22 oz. weighting, listed as 90c. a pound for colors, is wanted, and if the dye order is for 100 pounds, the dyer will weigh out 100 pounds of the customer's silk, on the basis of the ticket, bundle, or scale weight as received by him.

If the silk, from which the lot for the order is to be drawn, has taken up moisture or has dried out, while in store at the dye house, a proper allowance should be made when weighting it out, as it is necessary to do this in order to have the lot check out properly when all of it is used up.

The natural gum, and any soap and oil added in the throwing, is then boiled out of the silk, after which it is treated to weighting baths till the original pound of 16 ounces of silk is brought up to the 20/22 oz. weighting ordered.

In this case, the weight of the dyed silk should not come below 20 ounces for each pound put in work, and, unless by special agreement, a greater weight than 22 ounces cannot be claimed. If the weight comes less than 20 ounces, the customer can claim the price corresponding with what it weighs. If, however, it runs over 22 ounces, even when not specially agreed upon, the dyer cannot charge more for the extra weight.

It has become quite a common practice, of late, for manufacturers to demand, and to receive, from the dyers a couple of ounces more weighting than each of the various prices calls for, but in such cases the discount given cannot be as large as it otherwise might be.

Relation of Weighting to Silk Fibre.

Without regard to this, we will suppose that the customer wants, and the dyer gives, 22 ounce weighting. The silk, when weighted, colored, and finished will therefore have increased in weight in the same proportion as 16 ounces bears to 22 ounces, and this figures out a return weight of 137½ pounds. What, now, is the amount of dyestuff and the amount of silk fibre in this dyed material?

The manufacturer cannot tell unless he knows the conditioned weight and the boil-off of the thrown silk.

The dyer cannot tell, though he knows more than the manufacturer about it, for, while he does not know the conditioned weight, he has found out, in the stripping of the silk from its gum, etc., approximately what the boil-off has been.

Losses Caused by Ignorance of Boil-Offs.

It may be mentioned here, as a matter of first-class importance, that the failure to furnish the dyer with exact information as to the boil-off of the silk is the cause of most serious loss to the manufacturer.

Not knowing anything on this point, the dyer has got to go ahead and do the best he can, and so he prepares stripping baths of certain proportions for Japans, others for Italians, and so on. All of the different lots, regardless of their varying, but unknown, boil-offs, go through the same treatment and, while most of them are satisfactory, there are many lots of such a nature that they cannot stand the almost complete degumming that they may thus get, and which are severely injured.

The result is seen in the hairy and "lousy" lots of silk that give so much trouble, and in the general unsatisfactoriness of such lots. The loss falls on the manufacturer, and the dyer cannot be held very blameable if his customer will not afford him the information necessary for the proper working of the silk.

Variations in Weighting.

To return to our illustration, we will assume that the silk that is being dyed is a Japan tram, having a boil-off in the raw of 18 per cent., and that 2 per cent. of soap and oil was added to it by the throwster, so that it has now a boil-off of 20 per cent.

We will also assume that the ticket, bundle, or scale weight happened to correspond with thrown conditioned weight (absolute dry silk fibre plus any soap and oil added to it and the standard regain of 11 per cent. of moisture), and we will therefore so consider it.

Our 100 pounds is now seen to consist of 2 pounds of soap and oil, 18 pounds of soluble silk-worm gum, and 80 pounds of silk fibre. This 80 pounds, in turn, consists of the normal proportion of about 72 pounds of dried-out silk fibre and 8 pounds of moisture, that together make up the conditioned weight.

What the dyer returns is what he has added to the silk, namely, weighting material, dye-stuff and coloring, plus the net silk fibre treated. This, of course, carries its proper proportion of moisture, affected, no doubt, in a slight but unknown degree, by the manner in which the treatment of the silk will modify its power of absorbing water.

We have now received 137½ pounds of dyed silk, and we are furnished with a bill for 100 pounds, 20/22 ounce weighting, at the list-price of 90c. a pound, making a total of $90.00.

This 137½ pounds, it will be seen, consists of 80 pounds, conditioned weight, boiled-off silk, 20 pounds of dyeing material that has replaced the 18 pounds of gum and the 2 pounds of soap and oil that the silk contained before dyeing, and 37½ pounds more of dyeing material that has been added to the original gross weight of the silk, making, therefore, a combination of 80 pounds of silk and 57½ pounds of weighting, etc. This 57½ pounds of foreign matter is 71⅞ per cent. of the 80 pounds of conditioned weight boiled-off silk, or, as otherwise expressed, the silk has been weighted 71⅞ per cent.

By having had our silk tested at the Conditioning House for weight and for boil-off, we are enabled to order our weighting intelligently, with a view to getting precisely the amount of loading added to our fibre that we desire, and we can then know exactly the percentage of weighting that we are really getting.

We will next suppose that another lot is dyed for 22 ounce weighting, and that we had had no tests of it made, and only knew that the silk was Japan stock, of a fairly well regarded mark, and that it was thrown by a reputable throwster, and that there was nothing about his clearance of the lot that was out of the common, though the weight returned might even have been full—what is commonly referred to as a good clearance.

In this case we will assume that the raw-silk had a boil-off of 21 per cent.; that the throwster had made more waste than usual, and had covered it up with a heavy soaking, having added 5 per cent. to the weight in soap and oil; and that the silk had taken up a further 2 per cent. of atmospheric moisture. These added together give a potential loss of about 28 per cent., and our 100 pounds now consists of 72 pounds of conditioned weight, thrown, boiled-off silk, and 28 pounds of gum, soap and oil, and excess moisture.

The dyer treats the silk and once more returns to us 137½ pounds, dyed weight. As only 72 pounds of this, however, is silk, the remaining 65½ pounds is necessarily weighting, and this represents a

weighting of about 91 per cent., or over 19 per cent. in excess of the weighting of the other lot, and which may seriously imperil the soundness of the fibre.

The dyer, at the same time, is furnishing about 14 per cent. more weighting, for which he receives nothing.

Of these matters of prime importance, many manufacturers are profoundly ignorant, and, by neglecting to test their silk, they pave the way for trouble, damage, and irregular goods.

Europe spends a huge sum of money annually in Conditioning House tests, and there they very properly consider this testing to be just as much a part of the unavoidable and necessary expense of the mill as the fuel for the boilers or the salary of the timekeeper would be regarded here.

Necessity of Systematic Tests.

When the constant, regular, and automatic testing of every bale of raw and thrown silk, used in this country, for weight, size, boil-off, etc., instead of being the exception, becomes the rule, as it will be in the not distant future, we will then be able to produce lines of goods with little or no perceptible variation in the quality of the pieces, instead of, as at present, bringing forward great quantities of goods which, in spite of every care, will include from 10 to 20 per cent. of pieces that are too light and as many that are heavier than they should be.

Dyers' Price-Lists.

The dyers' price-lists can hardly be said to be made on any scientific basis. The costs of different, much used, weightings have been ascertained through practice and fixed at certain levels by competition, and the prices for other weightings have been spaced between them as conveniently as possible. In this way the price-lists have grown up, on the basis of an average satisfactory to the dyers.

The system of charging by the "ounce," as at present pursued, is a gross absurdity.

The dyer undertakes to furnish something of tangible value, for which he should in all cases receive a reasonable return for the service rendered. Leaving out the general expense entailed in conducting his business, he does the specific work of degumming the silk, weighting it, and coloring it.

If, therefore, the silk contains a large amount of gum, soap, etc., the time, labor and expense required to strip it will be greater than for a silk carrying less of these substances, and the cost of bringing up the weight will be largely increased.

Does he make his charge proportionately and logically? Not he. He weights a silk, to a given ounce, that boils-off 30 per cent., at the same price he charges for a silk with a boil-off of 20 per cent., although in the former case he gives far more weighting than in the

latter. The result is that he is charging too little on the one silk and too much on the other.

If he should demand from his customer a higher price for bringing up the weighting of a silk with a heavy boil-off, he knows that his customer could easily find a dyer who would make no such objection, and so he continues to sell his dyeing on the old basis for fear of losing his customer.

Charging for Weighting on Percentage Basis.

The only logical system for dyeing charges is to base them upon the service actually rendered, i.e., upon the specific percentage of weighting added to the conditioned, boil-off, weight of the silk.

If this were done, the dyer would get a proper return for his work in every case. As the customer would furnish him with the Conditioned Weight and Boil-off certificates of the silk, he would know exactly how much the silk would lose in boiling-off, and could prepare his stripping baths intelligently, to the great advantage of the silk. The customer could get exactly the percentage of weighting that he wanted on his silk, and would know that he had got it and was only paying for what he got.

Under such an arrangement as this, it would be very proper that the charges for the boiling-off tests be divided between the dyer and the manufacturer.

It is greatly to be desired that the dyers should afford their customers a price-list based on this idea, and, with the facilities offered to the trade for the testing of silks, by the Conditioning House, there should be little difficulty in getting many manufacturers to adopt it.

Dyeing Costs Affected by Boil-offs.

The seriousness of this matter will be better appreciated when it is considered how greatly the percentage of the weighting on the silk is affected by its boil-off, and how the material, in case of a heavy boil-off, may be grossly overweighted without the manufacturer having the least idea of it. In fact, he can know nothing of the weighting he is getting on his silk unless he has the thrown silk tested for conditioned weight and for boil-off.

To present this in a clearer light I have prepared the following table covering weightings from 14 oz. to 60 oz. and boil-offs from 20 per cent. to 30 per cent. Observe how, on only a 16 oz. weighting, the percentage of tin on the silk may run up to 43 per cent., when the boil-off is 30 per cent.—a not unusual occurrence—while with a 20 per cent. boil-off it is but 25 per cent. On the 60 oz. weighting, the increase under the same circumstances is 67 per cent.

This table merits careful consideration.

TABLE SHOWING HOW THE PERCENTAGE OF WEIGHTING ON SKEIN DYED SILK VARIES WITH THE BOIL-OFF. IT WILL BE SEEN FROM THIS THAT THE OUNCES OF WEIGHTING ORDERED FORM NO GUIDE AS TO WHAT THE SILK WILL BE WEIGHTED TO, UNLESS THE BOILED-OFF, CONDITIONED, WEIGHT OF THE THROWN SILK BE KNOWN.

IT IS OBVIOUS, THEREFORE, THAT THE ONLY WAY TO GET EXACT WEIGHTINGS, AND CONSEQUENTLY REGULAR GOODS, IS TO ASCERTAIN THE CONDITIONED, BOILED-OFF, WEIGHT OF ALL THROWN SILK SENT TO THE DYER, AND THEN TO ORDER, ON THAT BASIS, WHATEVER PERCENTAGE OF WEIGHTING IS DESIRED.

Note.—THE PERCENTAGES ARE, OF COURSE, BASED ON THE BOILED-OFF WEIGHT OF THE SILK.

Weighting ordered.	Weight per lb. returned by dyer.	BOIL-OFFS.										
		20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
		%	%	%	%	%	%	%	%	%	%	%
14 oz.	.875	9	11	12	14	15	17	18	20	22	23	25
16 "	1.000	25	27	28	30	32	33	35	37	39	41	43
18 "	1.125	41	42	44	46	48	50	52	54	56	58	61
20 "	1.250	56	58	60	62	64	67	69	71	74	76	79
22 "	1.375	72	74	76	79	81	83	86	88	91	94	96
24 "	1.500	88	90	92	95	97	100	103	105	108	111	114
26 "	1.625	103	106	108	111	114	117	120	123	126	129	132
28 "	1.750	119	122	124	127	130	133	136	140	143	146	150
30 "	1.875	134	137	140	144	147	150	153	157	160	164	168
32 "	2.000	150	153	156	160	163	167	170	174	178	182	186
36 "	2.250	181	185	188	192	196	200	204	208	213	217	221
40 "	2.500	213	216	221	225	229	233	238	242	247	252	257
44 "	2.750	244	248	253	257	262	267	272	277	282	287	293
48 "	3.000	275	280	285	290	295	300	305	311	317	323	329
52 "	3.250	306	311	317	322	328	333	339	345	351	358	364
56 "	3.500	338	343	349	355	361	367	373	379	386	393	400
60 "	3.750	369	375	381	387	393	400	407	414	421	428	436

How the Dyer may be Mulcted.

Under the present system the dyer is, in a measure, at the mercy of his customer in regard to the dye-stuff he has to furnish at a given price. As his prices are not based upon the conditioned, boiled-off, weight of the silk he is treating, there is nothing to hinder an unscrupulous customer from artificially altering the weight of the silk he sends him, if it is for his advantage to do so.

This can be done by instructing the throwster to increase the weight of the lot by the addition of extra soap and oil, or by moistening the silk, or in both of these ways.

If sufficient weight is added to the thrown silk, so that the percentage of weighting wanted on the fibre will then be had from a weighting of a nominally less number of ounces, the manufacturer will make a material saving.

To show how the dyers may be taken advantage of by those who wish to increase their profits by the free use of the soap bath and the watering pot, I have prepared the following table to illustrate how this works out in practice.

One hundred pound lots are figured on, and, at the artificially increased weights, the percentage of weighting added to the conditioned-weight, boiled-off silk,. for the lower weight dye orders, will be found to exactly equal the weighting got from the original amount of silk at the higher weight dye order. At the same time, the larger number of pounds at the lower price will cost the manufacturer distinctly less money than the less number of pounds at the higher price. This table is not affected by differences in the original boil-off of the thrown silk.

In the medium weighting also, by a freer use of the watering can, a sufficient addition might be made so that two weightings lower could be managed.

The writer does not advocate the use of any such questionable methods, but has presented these phases of the matter to show the necessity of a change in the basis on which weightings are charged for.

It may be objected that the dyer would complain if the boil-off of a lot seemed unusually large. He might, and for that matter he often does complain as it is, but, just the same, he takes the order and dyes the silk to the weighting demanded.

Both dyer and customer, working as they now do in the dark, have no solid basis for valuing the work that is done on the silk and the price that should be charged for it.

TABLE SHOWING HOW THE FREE USE OF SOAP AND WATER MAY BECOME A SOURCE OF PROFIT TO THE ASTUTE SILK MANUFACTURER.

THE IDEA IS THAT BY ARTIFICIALLY INCREASING THE SCALE WEIGHT OF THE SILK SENT TO THE DYER, BY CERTAIN PROPORTIONS, A SMALLER OUNCE WEIGHTING MAY BE ORDERED, TO GET A GIVEN RESULT, AND THE LARGER NUMBER OF POUNDS AT THE LOWER PRICE WILL COST LESS THAN WHAT THE SMALLER NUMBER OF POUNDS WOULD AT THE HIGHER PRICE.

Weighting to order.	Dyers' list price.	Weighting really wanted.	Dyers' list price.	Proportion of added soap & water.	Pounds per 100 added.	Total lbs. to be ordered dyed.	Dyer's bill for total lbs. at weighting ordered.	Dyer's bill for 100 lbs. at weighting wanted.	Saving per 100 lbs.	Per-centage of saving.
	COLORS:									
14 oz.	.40	16 oz.	.50	2/14	$14^{2}/_{7}$	114.29	$45.72	$50.00	$4.28	8.56
16 "	.50	18 "	.60	2/16	12½	112.50	56.75	60.00	3.25	5.42
18 "	.60	20 "	.75	2/18	$11^{1}/_{9}$	111.11	66.67	75.00	8.33	11.11
20 "	.75	22 "	.90	2/20	10	110.00	82.50	90.00	7.50	8.33
22 "	.90	24 "	1.05	2/22	$9^{1}/_{11}$	109.09	98.18	105.00	6.82	6.50
24 "	1.05	26 "	1.25	2/24	$8^{1}/_{3}$	108.33	113.75	125.00	11.25	9.00
26 "	1.25	28 "	1.40	2/26	$7^{9}/_{13}$	107.69	134.61	140.00	5.39	3.85
	BRIGHT BLACKS.									
28 "	1.20	30 "	1.30	2/28	$7^{1}/_{7}$	107.14	128.57	130.00	1.43	1.10
30 "	1.30	32 "	1.40	2/30	$6^{2}/_{3}$	106.67	138.67	140.00	1.33	.95
32 "	1.40	34 "	1.50	2/32	$6^{3}/_{16}$	106.19	148.67	150.00	1.33	.89
34 "	1.50	36 "	1.60	2/34	$5^{15}/_{17}$	105.88	158.82	160.00	1.18	.74
	SOUPLE BLACKS.									
36 "	1.20	40 "	1.40	4/36	$11^{1}/_{9}$	111.11	133.33	140.00	6.67	4.76
40 "	1.40	44 "	1.60	4/40	10	110.00	154.00	160.00	6.00	3.75
44 "	1.60	48 "	1.80	4/44	$9^{1}/_{11}$	109.09	174.54	180.00	5.46	3.03
48 "	1.80	52 "	2.00	4/48	$8^{1}/_{3}$	108.33	195.00	200.00	5.00	2.50
52 "	2.00	56 "	2.25	4/52	$7^{9}/_{13}$	107.69	215.38	225.00	9.62	4.28
56 "	2.25	60 "	2.50	4/60	$7^{1}/_{7}$	107.14	241.07	250.00	8.93	3.57

Variation of Boil-offs.

Boil-offs differ widely. The averages of the Lyons Conditioning House reports will show that Japans lose 18 per cent.—most of the tests running say from 17 to 19 per cent.; Chinas about 19 per cent.—say 18 to 20 per cent.; Cantons 22 per cent.—say 21 to 23 per cent.; and Yellow Italian and Cevenues silks about 24 per cent.—say 23 to 25 per cent. Many lots of each kind will have a boil-off off several per cent. more or less than the above averages, which, of course, represent the bulk of the tests recorded.

The soap and oil added by the throwster is also a very variable quantity—being generally larger than it is supposed to be. Good quality silks with free gums need only a light soaking and could be readily worked with a solution that would return an increase of but 1 per cent., though 2 per cent. would be a normal low average. On the other hand, with hard gums a heavier bath may be required, and, if excessive wastage is to be covered up, any amount may be added, and additions of 5 to 8 per cent. are not uncommon.

Then, again, the silk will take up moisture from the atmosphere if the weather, or the place of storage, be damp, and it may readily gain as much as 3 per cent. in this way.

Differences Between Lots.

It is, therefore, apparent that wide variations may exist in practice without any attempt on the part of the manufacturer to influence the weight.

Thus, one lot of Italian silk might have a boil-off of but 21 per cent.; it might have had only 1 per cent. of soap and oil added to it in the soaking, and it might have been stored in a properly dry place so that its weight was practically the same as conditioned weight, and its boil-off, therefore, would be only about 22 per cent.

Another lot might boil-off in the raw 27 per cent.; it might have had 5 per cent. of soap and oil added to it in the soaking; it might also have taken up 3 per cent. of moisture from the air. These amounts will aggregate a shrinkage in boiling-off and conditioning of approximately 35 per cent.

Here, then, is a difference between two lots of silks, of the same nature, of 13 per cent.; and a manufacturer, knowing the raw boil-off of his silk, could readily arrange to have the throwster add whatever soap, oil, and water seemed to suit the requirements of the case. As these additions could be arranged so as to keep the boil-off within the extreme limit of practice, the dyer would have no proof that he had been finessed against.

Judging from the complaints, voiced now and then by dyers, about huge boil-offs, it is more than likely that some manufacturers have already been clever enough to practice this fattening-up of the silk.

How the Watering Can Affects Costs.

The manner in which the percentage of weighting, and the cost of same to the customer, may be affected by increased moisture in the silk, is shown in a most illuminating manner on Pages 24-25 of a book entitled "The Value of Conditioning," published by the United States Conditioning and Testing Company, under the heading of "Value of Tests in Dyeing."

This example takes three lots of silk, one of 100 pounds Conditioned Weight having a 20 per cent. boil-off, another of the same amount with 3 pounds of water added—making 103 pounds, and another with 5 pounds of added water—making 105 pounds. These are figured out in pure dye, and in 16, 24, 32 and 48 oz. weightings.

The results obtained are so interesting that I make no apology for reproducing here, in full, the section referred to:

"VALUE OF BOIL-OFF TESTS IN DYEING.

Few manufacturers realize what an important difference may result in the cost of their dyeing, and in the percentage of their weighting, from a lack of knowledge of the Boil-off of their Thrown Silk.

We invite careful attention to the following:

BOIL-OFF IN DYEING. Showing that variations may result in practice if Conditioned Weight, and Boil-off Thrown certificates are not used as the basis of computation.

The following illustrations are all based on 100 lbs. of Conditioned Weight Thrown Silk. The Boil-off in each of these cases being 20%, leaves 80 pounds of Conditioned Weight Boiled-off Thrown Silk.

The 100 pounds Conditioned Weight is supposed to weigh 103 and 105 pounds, scale or ticket weight, for the purpose of this illustration. The cost of Dyeing and the returns are shown for

I. Pure dye at 30c. per pound.
II. 16 oz. dye at 50c. per pound.
III. 24 oz. dye at 80c. per pound.
IV. 32 oz. dye at $1.00 per pound.
V. 48 oz. dye at $1.50 per pound.

I. Pure Dye at 30c. per pound.

105 lbs. at 30c.	$31.50
103 " " "	30.90
100 " " " (Conditioned Weight) ...	30.00

Conditioned Weight saves $1.50
80 lbs. of Boiled-off Silk Dyed. Saving 5%.

II. 16 oz. Dye at 50c. per pound.

		Silk		Weighting		Return	Bill
A.	105 lbs. at 50c.....	80	+	25	=	105	$52.50
B.	103 " " "	80	+	23	=	103	51.50
C.	100 " " "	80	+	20	=	100	50.00

5 lbs. weight gained on A. for $2.50 = 50c. per lb. no saving.
3 lbs. weight gained on B. for $1.50 = 50c. per lb. no saving.

III. 24 oz. Dye at 80c. per pound.

		Silk		Weighting		Return	Bill
A.	105 lbs. at 80c.....	80	+	77½	=	157½	$84.00
B.	103 " " "	80	+	74½	=	154½	82.40
C.	100 " " "	80	+	70	=	150	80.00

7½ lbs. gain on A. for $4.00 saves $2.00 = 2½% on dyeing.
4½ lbs. gain on B. for $2.40 saves $1.20 = 1½% on dyeing.
% Weighting on original 80 lbs. silk, A—96.8%
% Weighting on original 80 lbs. silk, B—93.1%
% Weighting on original 80 lbs. silk, C—87.5%

IV. 32. oz. Dye at $1.00 per pound.

		Silk		Weighting		Return	Bill
A.	105 lbs. at $1.00...	80	+	130	=	210	$105.00
B.	103 " " " ...	80	+	126	=	206	103.00
C.	100 " " " ...	80	+	120	=	200	100.00

10 lbs. gain on A. for $5.00 saves $5.00 = 5% on dyeing.
6 lbs. gain on B. for $3.00 saves $3.00 = 3% on dyeing.
% Weighting on original 80 lbs. silk, A—162½%
% Weighting on original 80 lbs. silk, B—157½%
% Weighting on original 80 lbs. silk, C—150%

V. 48 oz. Dye at $1.50 per pound.

		Silk		Weighting		Return	Bill
A.	105 lbs. at $1.50...	80	+	235	=	315	$157.00
B.	103 " " " ...	80	+	229	=	309	154.50
C.	100 " " " ...	80	+	220	=	300	150.00

15 lbs. gain on A. for $7.50 saves $15.00 = 10% on dyeing.
9 lbs. gain on B. for $4.50 saves $9.00 = 6% on dyeing.
% Weighting on original 80 lbs. silk, A—293¾%.
% Weighting on original 80 lbs. silk, B—286¼%.
% Weighting on original 80 lbs. silk, C—275%.

Therefore:

So long as the price of dyeing is based on ticket bundle or actual weight, the manufacturer will, as illustrated, find it profitable to arrange that

I. All silk of 16 oz. dye and under should be soaked lightly in throwing and kept very dry.

II. All silk for 16 oz. dye and over should be soaked heavily in throwing and kept moist.

To know the real return, however, the Conditioned Weight Boiled-off Thrown Silk must be used as the basis of figuring or your silk may be overweighted 10% or more without your being aware of it."

Figuring the Waste Made in Throwing.

When figuring the clearance on a lot of thrown silk, for the purpose of ascertaining what loss has been made in throwing, care should be taken to see that the proper method is employed.

Some will figure this by taking the differences in the percentages of boil-offs, and then applying this to the weight of the raw or thrown silk with, of course, an erroneous result.

The only right way to pursue is the one followed by the Conditioning Houses. In this the weight of the conditioned, boiled-off, thrown silk is subtracted from the weight of the conditioned, boiled-off raw-silk, and the relation that this difference bears to the weight of the latter shows the percentage of the loss made.

No silk manufacturer, large or small, who wishes to know as exactly as possible what his goods cost him, and who does not desire to waste large sums of money annually, can afford to neglect the subjecting of *all* his silk to regular and comprehensive tests.

Scientific, and Unscientific, Tests.

Owing to the peculiar nature of silk, its elasticity, variations in size and in the proportions of gum that it contains, and its capacity for absorbing moisture, it requires the finest equipment and the greatest knowledge, precision, and care in the making of these tests, if they are to have any value at all. What may be termed "home made tests," which so many people rely on, are generally worse than useless for they only mislead.

It is for the purpose of furnishing accurate tests, made on a scientific basis and under exact and constant conditions, that testing establishments, or Conditioning Houses, as they are called, for silks and all other textile materials, have been established in various textile centres throughout the world, and American manufacturers are fortunate in having at their service the excellent Conditioning House that exists in New York.

Owing to unfamiliarity with the technique of the subject, it often happens that manufacturers, who are induced to start making tests, do not know how to make use of the information that the conditioning tickets give them; in fact, they too often have hardly any idea at all of the meaning of the figures.

Others, again, make their tests in a random manner, spending, perhaps, quite a sum of money, but getting no *complete* information about any one lot of silk, and so losing, in great part, the value of the information paid for.

The Value of Conditioning.

To give the most thorough insight into the principles and methods of testing silk, and to show how the information obtained should be applied in practice, the book, already referred to, entitled "The Value of Conditioning," was published in 1908 by the United States Silk Conditioning Company, whose name has since been changed to the "United States Conditioning and Testing Company," the present writer being the author of a very substantial portion of this book.

It is to be hoped that every manufacturer, after a careful reading of this work, will have a keener appreciation of how seriously this subject affects his pocket.

The "Combination Test."

For the purpose of encouraging manufacturers to order their tests in a comprehensive manner, there has also been devised what is called the "Combination Test," in which groups of bales are tested for variation in size and average size, conditioned weight raw and thrown, and boil-off raw and thrown.

The information so arrived at shows, by the conditioning of the

raw-silk, just what weight the manufacturer should pay for, and the weight upon which the throwster should base his charges; by sizing tests, it shows the yardage per pound of the raw-silk and its limits of variation in size; by giving the conditioned weight of the silk after throwing it shews what percentage of its weight is water, and, by boil-off tests, it shows the amount of gum in the raw-silk and the amount of gum, soap, etc., in the thrown silk, so that, by figuring these percentages from the raw and thrown conditioned weights, the exact loss made in the throwing can be arrived at. By the knowledge of the boil-off of the thrown silk, the manufacturer can also tell exactly what percentage of weighting to order, so that the amount of weighting on his fibre will be no more and no less than he desires.

Without this knowledge he is in the dark. Thus, if he sent three lots of silk to the dyer to be weighted to 30 oz., intending to use them in the same line of goods, he would, if the lots boiled off 20, 25, and 30 per cent. respectively, have his fibre in turn weighted 134 per cent., 150 per cent., and 168 per cent., and, apart from the risk of overweighting, as the weighting material does not bulk up as the silk does, he would necessary have irregular groups of goods.

If, however, he knew the boil-off of these three lots, and was ordering his weightings by the prevailing "ounce" system, he would order the 20 per cent. boil-off lot dyed in 32 oz., the 25 per cent in 30 oz., and the 30 per cent. in 28 oz., and in each case he would have the same percentage of weighting, namely 150 per cent., on the fibre, as may be seen by the foregoing table, and his merchandise would be correspondingly regular.

Forms Used in Connection with Tests.

With the object of simplifying the recording and working out of the information given by the "Combination Tests," the United States Conditioning and Testing Company has devised a loose-leaf ledger, into which all of the information for each lot can be entered, and into which can also be inserted the various documents pertaining to the lot, such as the duplicate invoice of the raw-silk, the chop ticket, the throwster's report and clearance, the Conditioning, Sizing, and Boiling-off certificates, etc.

All of the details of a lot are shewn on the two sides of one leaf, and, when a lot is all worked up, its leaf, together with its documents, is removed from the book and filed away.

By this means, all of the information about each lot is concentrated in the same place, where it can be instantly referred to, and anything that is out of the usual can be at once detected.

Copies of these forms are presented herewith:

ALL THIS INFORMATION IS NECESSARY FOR INTELLIGENT USE OF EACH LOT

SILK LOT COMBINATION TEST RECORD

Lot No. 783

Conditioning Tickets Filed Nov. 5th — November 2 1908

Invoice Filed Nov 3rd

Thrower's Report Nov. 11th

Chop Filed Nov. 11th — Best No. 1 Quality

5 Bales Japan Raw Silk 13/15 Average Deniers. From Nippon Co.

Chop or Filature Five Figures Weight Terms Cond. Wgt. + 2%

Bale Numbers	Gross Weight	Invoice Weight	Thrower's Opening Wt.	Conditioned Weight	Bale Numbers	Gross Weight	Invoice Weight	Thrower's Opening Wt.	Conditioned Weight
CH 179	138 25	136 00	136 25	132 37	Brought Forw'd				
180	137 75	135 50	134 50	133 73					
181	138 75	136 50	135 00	133 34					
182	138 75	136 50	135 75	134 85					
183	138 25	136 00	136 00	132 10					
	691 75	680 50	677 50	666 39	TOTAL				666 39

Forward

Add 2% to Conditioned Weight 13.33

Lbs. to be charged, Limit 679.72

Boil Off Raw 16.76 %. Boil Off Thrown 22.66 %. Difference 5.90 %

Average, Regular Sizing 14.22 deniers. Average, Compound Sizing 14.06 deniers.

THROWN RETURN

NOTE—ALWAYS INSTRUCT THROWSTER, WHEN RETURNING SILK, TO PACK IN SAME NUMBER OF BALES AS HE RECEIVES.

Bale Numbers	Net Bundle Ticket Weight	Conditioned Weight	Boiled Off Weight, lbs.	Bale Numbers	Net Bundle Ticket Weight	Conditioned Weight	Boiled Off Weight, lbs.
P.T. 500	102 40	96 29		Brought Forward			
501	102 50	96 43					
502	101 45	95 31					
503	202 90	190 64					
504	219 98	207 63					
	729 24	686 22	530 72	TOTAL		686 22	530 72

Forward

Made and for sale by U. S. Silk Conditioning Co., and by W. F. Vanden Houten Co., 409 Pearl St., New York. OVER.

FRONT SIDE OF PAGE FROM LOOSE LEAF RECORD BOOK.

ALL THIS INFORMATION IS NECESSARY FOR INTELLIGENT USE OF EACH LOT

SILK LOT COMBINATION TEST RECORD

Estimated yds. to lb. Raw 317.538 on Compound Sizing.

Estimated yds. to lb. Thrown 314.692 on Skeins returned, in terms of single thread.

Deduct from Raw yds to lb. 3% for shortening in twist plus difference in % of Boil Off Thrown and Boil Off Raw result is **APPROXIMATE** yds. per lb. which should be returned Thrown, figured from average bundle weight.

Lot No. 783

CLEARANCE

Total Conditioned Weight Raw	666.39 lbs.	
Boil Off Raw 16.76 %	111.69 lbs.	
Net Boiled Off Raw	554.70 lbs.	554.70 lbs.
Total Conditioned Weight Thrown	686.22 lbs.	
Boil Off Thrown 22.66 %	155.50 lbs.	
Net Boilec Off Thrown	530.72 lbs.	530.72 lbs.
Difference	23.98 lbs.	

Difference divided by Net Boiled Off Raw equals Loss in % 4.32 %

DYEING
ON 25% BOIL OFF
EQUALS 12 OZ. NET SILK

Percentage Weighting on Boiled Off Silk

14 oz. =	16⅔%
16 " =	33⅓%
18 " =	50 %
20 " =	66⅔%
22 " =	83⅓%
24 " =	100 %
26 " =	116⅔%
28 " =	133⅓%
30 " =	150 %
32 " =	166⅔%
34 " =	183⅓%
36 " =	200 %
38 " =	216⅔%
40 " =	233⅓%
42 " =	250 %

ENTER FOR EACH DYE LOT

Figure Order for Dyeing by % on Conditioned Weight Boiled Off Thrown Silk.

Throwster's Bale Numbers	Boiled Off Weight, lbs.	% Dye Ordered	Return Dyed, lbs.	Number of Skeins	Throwster's Bale Numbers	Boiled Off Weight, lbs.	% Dye Ordered	Return Dyed, lbs.	Number of Skeins

REMARKS.—On working of Silk in actual use

Made and for sale by U. S. Silk Conditioning Co., and by W. F. Vanden Houten Co., 409 Pearl St., New York.

REVERSE SIDE OF PAGE FROM LOOSE LEAF RECORD BOOK.

It will be seen at once that such a record as this can be kept by any intelligent clerk, and so the time of his principals need not be taken up in working out the results.

They can see by a glance at the salient points—the limit of weight that should be charged for as compared with the invoice weight, the boil-offs raw and thrown, the regular and compound sizings, and the loss shown by the throwing clearance—whether all appears to be right, or if some point needs investigation.

The form accommodates 20 bales of raw-silk, as this is the limit to which any one Combination Test is applied, and the figures here given are taken from actual practice.

VI

COTTON YARNS, AND THEIR USE IN SILK MANUFACTURE

Almost all silk manufacturers, from time to time, have to make use of cotton yarns, and frequently these uses are on an extensive scale.

To make a proper selection of this material, when it is required, is a necessity, if the goods made from it are to be right in quality and in price, and yet it is a matter to which, in many cases, but slight attention is paid by those who use it.

As but few silk manufacturers have had any training along cotton lines, they have, of course, when purchasing cotton yarns, to put themselves very largely into the hands of those from whom they make their purchases, generally yarn agents, or brokers, who cater to the silk trade.

Value of the Yarn Dealer's Advice.

Beyond the fact that fairly stiff prices may sometimes have to be paid, this does not, on the whole, work badly, as these yarn dealers understand very well about what sorts of yarns are generally required for certain kinds of goods, and are thus in a position to advise their clients intelligently, that is, if their clients are not above taking advice, as is the case with many of them.

Others, again, are so secretive, that their dealer is left quite in the dark as to the purpose for which the yarn is needed, and the manufacturer will often load himself with a lot of unsuitable yarn which his dealer could easily have saved him from buying had he been consulted.

Such persons deserve to suffer the losses that are thus entailed, for the selecting of yarns is a technical matter, requiring judgment and experience, and when those without the necessary knowledge have

got to do the purchasing, and refuse to confide in an experienced and trustworthy dealer, they are inviting any loss that may fall upon them.

At times, questions will arise that are of importance, and yet many silk manufacturers, owing to a lack of knowledge of the cotton-spinning trade, may be very much at sea regarding them.

It is with reference to some of these moot points that this article will concern itself.

Proper Yardage Per Pound.

Take, for instance, the yardage per pound, for any given count, that the buyer has a right to demand from the seller—a question that directly affects the cost of his goods.

It is manifestly impossible for a spinner always to spin exactly to count, and, as the thread runs a little finer or coarser, a number of tests on the same lot will show varying sizes.

Irregularities in size will be more numerous in the single yarns than in two or more ply, as, by joining a number of threads, it tends to equalize the size.

The thickness of a two-ply yarn will not necessarily be just twice that of the single, but will be markedly affected by the twisting it receives.

Twists Employed in Cotton Spinning.

The great bulk of the cotton yarns are spun into regular warp and filling twists, and there is also a good deal used of extra-hard warp yarn, as well as a large volume of hosiery twist, which is very soft.

A standard number of turns of twist is generally given, both for single and for ply yarns, according to the count, and, of course, in selecting cotton for any yarn, the length of its staple must be well considered.

The regular twist put into single cotton yarns is 4 times the square root of the count.

Some twists are what are known as "balanced," as when a yarn has, say, twelve turns of twist in the single and twelve turns in the two-ply. The effect of the second-time twisting is to untwist the turns put in during the first twisting, so in a balanced twist all of the twist is supposed to have been eliminated from the single yarn.

How Twists Affect the Length.

This untwisting of the single leads to a lengthening of the two-ply yarn beyond what the single would count, but after the maximum of lengthening has taken place a shortening begins, becoming more accentuated as the twist increases, and rising to a large perecentage in the case of hard-twist yarn.

The table presented herewith was published some years ago by the "Textile World Record," of Boston, having been copied from a German paper.

It shows in graphic form how the count is affected by the twist, and a line drawn from one corner to the other, practically crosses each count at the twist which gives the standard 840-yard length.

TABLE SHOWING HOW THE COUNTS OF 2-PLY COTTON YARNS ARE AFFECTED BY THE SECOND TIME TWISTING, THE LENGTHS OF THE SKEINS IN THE SINGLE BEING 840 YARDS.

TURNS PER INCH—SECOND TIME TWIST. MEASUREMENTS IN YARDS.

Count in Singles.	8	10	12	14	16	18	20	22	24	26	28	30
12....	840	832	825	817	810	800	790					
14....	843	838	833	824	815	806	798	773				
16....	848	843	838	831	823	816	809	787	772			
18....	856	850	843	836	830	822	814	805	796	763		
20....	862	855	848	841	835	833	828	822	816	786	761	
22....	862	858	852	846	840	837	835	829	823	800	775	752
24....	863	860	856	852	846	840	837	832	829	809	790	769
26....	863	862	859	856	850	846	840	836	831	816	802	788
28....	864	863	861	858	856	849	843	840	836	824	812	801
30....	865	864	862	860	857	852	847	843	839	831	822	813
32....	866	865	863	861	859	855	850	845	841	835	830	826
34.....		866	864	862	860	857	853	848	844	840	836	832
36.....		...	865	863	861	859	855	849	846	843	840	837
38.....		...	...	864	862	860	857	853	849	845	842	839
40.....		...	...	...	863	861	858	854	850	846	843	840

If two single threads are doubled and twisted in the same direction as the twist of the single, the resultant ply yarn becomes brittle and shrinks in length.

Thus, if two 840-yard hanks of 1/32 are doubled, and given 18 turns reverse twist, the length is increased to 855 yards. If twisted in the same direction as the singles, the length would shrink to 720 yards.

The yarn from which the above table was worked out was made from first quality American cotton, 1¼-inch staple, and was spun on ring frames. The number of turns of twist in the single yarns was four times the square root of the count. Yarn was spooled for twisting, and was twisted dry.

When a spinner starts to fill an order for a stated size of two-ply yarn, he will, therefore, spin his single threads to a count that, when doubled and twisted to the twist ordered, will give him the yardage per pound demanded by the count. Thus, for a 2/40's yarn, his singles may have to be spun to 38's in one case, to 40's in another, and to 42's in a third, according to the twist, so that the finished yarn will measure 20 times 840 yards per pound.

Yarns for Moirés, and Reverse Twists.

For use in fabrics that are to be subjected to the moiréing process, hard, well rounded, threads are desirable, and three, or more, ply yarns are consequently used for this purpose. It is the fashion to use reverse twists in these yarns, though for what good reason is not clear to the writer, as, in practise, no difference is apparent.

The probable explanation of this custom may be found in the fact that when cotton yarns for moiré purposes were first called for largely by the American silk trade, they were wanted in a hurry, as is usually the case with yarns for moirés. These special twists were not to be had offhand from the yarn spinners, but there was at the time a lot of suitable thread yarn in the market, and thread yarns are made with reverse twist, for special reasons. Thus, the ball was started rolling, and, as the yarns proved to be all right, re-orders have been coming in right along on the "same-as-last" basis, and so the custom has fastened itself on the trade, while the ignorance of most silk manufacturers regarding cottons has made them afraid to change, and has caused them to keep on demanding this reverse twist.

Testing the Counts of the Yarns.

To determine the count of any yarn delivered to them, manufacturers can make fairly satisfactory working tests if they are equipped with accurate reels and scales, and if the tests are made by an intelligent and experienced man.

A number of representative samples should be taken, and a number of reelings and weighings from each should be made with much care and accuracy, and such tests should be made either at a time or in a place when the atmospheric conditions are normal. Care should also be taken to see whether the yarn has been stored in an unduly dry or unduly damp place, and, in either event, or in case nothing is known on the subject, the skeins drawn for testing should be hung up for a few hours in some place where the humidity was normal, to give them a chance to return to their natural condition.

If the tests are sufficiently numerous, according to the size of the lot, and the foregoing precautions are carried out, the average size arrived at should be fairly accurate.

Should really exact tests for weight or for size be needed, either as a basis of sale or purchase, or for establishing a case before a court or an arbitration committee, the services of a testing or conditioning house should always be secured, and, by having the tests made on a standard conditioned weight basis, the variations caused by moisture are eliminated.

In the reeling of the skeins for testing, great care should be taken to see that only a reasonable tension is put upon the yarn—a very nice matter to decide.

Now, while the spinner of the yarn will know what stock he should

use, and to what fineness he should spin it in order to give the proper length per pound, how is the weaver to know the limits of what he should get, and what is he to do if the yardage falls appreciably short of what it should?

Causes of Too Coarse Counts.

The spinner may have found that a lot of cotton in work was not what it should be, and, with all his skill, he could not draw it out to the count and make good yarn of it, so he may have had to spin it coarser. Or, owing to advancing prices of cotton, he may have tried to use a lower grade, and so have run up against the same difficulty. Or, again, he may intentionally spin the yarn off in count, so as to use less labor, increase production and use a lower-cost cotton, counting on his customer never knowing the difference, or, if he should find it out, not being able to enforce any claim against him.

Deception Regarding Size of Fine Yarns.

In low counts, there is little temptation to deceive in these matters, but in fine yarns deception may be very profitable, for to spin, say, 140's will require much better cotton and much more labor than to spin 130's, with, of course, a corresponding difference in output; but 130's or even lower, is often delivered for 140's, and never a question is raised. In fact, while silk manufacturers have pretty generally been taught to see that silk requires testing for weight, count, etc., they seem to have let cotton go by default, and are often the losers thereby.

When tests for strength and elasticity are to be made, it is obligatory that the atmospheric conditions be right, as otherwise they may be most misleading.

In the silk trade, 2/80's cotton is often used. This is the count at which, in the tariff, there was a change to a higher rate, and, to avoid this increase, the imported yarns were spun to 2/78—two and a half per cent. coarser. This count is frequently sold as 2/80, and many manufacturers regularly figure on it as such.

Representatives of yarn houses have made most conflicting statements to me as to what yardage should be expected on different counts, one man properly stating, for instance, that a 2/150 must be 75 times 840 yards, and another saying that 69 times 840 yards (the count of 2/138's) is all that should be expected on account of take-up in twist, while others gave lengths between these.

Regarding Harness Twines.

It may be noted here that such special twists as 9/120's, largely used for harness building, are spun to count in the single, and then take up more or less in the twisting.

Such twists as 12/80's (usually 12/78's) 12/60's, and 12/50's, are also much sold for use in making thread harnesses.

These harness yarns will generally run from 5 to 10 per cent. less

yardage per pound than their nominal counts would call for, owing to shortening due to the twist put into them. Users of such yarns should make careful tests of the count of each lot delivered.

Necessity of Care in Ordering.

Much confusion is created by careless ordering, and exactness in stating details on an order is necessary. If a 2/100's is called for from a spinner, and he is asked to have it bleached—probably adding so much a pound for the bleaching—it will be a finer yarn than 2/100 when delivered, by just the percentage of its loss in weight in bleaching; but if a bleached yarn of 2/100 is asked for, the spinner will spin to a sufficiently coarser size to give the right count after the bleaching.

Mercerized yarns are largely bought by silk manufacturers on the grey-weight basis, plus so much for bleaching and mercerizing. In this case, the purchaser cannot well tell just what return weight he should get.

Changes in Mercerizing.

Yarns in mercerizing gain in length, but also increase in specific gravity, though this gain in length is usually proportionately greater than the increase in weight; so yarns, after mercerizing, generally reel to a slightly finer count than before being processed.

The singeing, or gassing, of yarns makes them appreciably lighter or finer.

Effect of Dyeing Upon Weight.

Cotton, when dyed, is considerably modified in weight according to the coloring used. The writer has observed that carded peeler 2/20's and 2/40's, cotton yarns, when dyed fast to scouring, would regularly alter in weight about as follows: One hundred pounds grey weight would come back, in aniline black, 110 pounds; logwood black, 100 pounds; dark green and dark cardinal, 99 pounds; navy blue and brown, 98 pounds; medium blue and dark slate, 95 pounds; light slate and light grey, 92 to 93 pounds. These yarns would be warm from the dye house and would take up something in moisture, but the proportions are interesting.

Customs of the Trade Regarding Accuracy of Spinning, Etc.

In this country, there is no settled basis on which claims for difference in size may be based. True, there has not been much complaint made, and American spinners keep to the counts of their yarns very well; and, of course, the bulk of the fine numbers used are spun abroad, and it is in these that differences in count are most expensive and most frequent.

Southern-spun cottons will, presumably, not reel so correctly as Eastern cottons, on account of the difference in the quality of the labor.

It is hard to say what the decision would be in a case at law on a nice question of count. Of course, no court would compel a man to

accept 20's in place of 40's, but how if the yarn was 34's, or 36's, or 38's?

The "custom of the trade" might be made the basis of a decision, but no well-accepted custom has yet grown up here. The nearest thing that might be said to approach a custom, is the opinion of many prominent yarn men that cotton yarns ought to be spun within 3 per cent. of their nominal count. This would make the limits for a 1/50 between 48½ and 51½.

In England, the matter is better settled, and a yarn there must not vary more than 2½% either way. In practice, one number above and one below—for fine yarns—will be about the variation for singles, and two numbers for two-ply. Spinners do not usually vary on the fine side, but if they do, and their weights are light, they may be required to make up the short weight. If, on the other hand, their yarn is coarser, they may be made to give enough extra skeins to make up the proper yardage.

Raw Cotton Classifications.

There are a great many gradings in raw cotton, as may be seen by the Cotton Exchange classifications, and each is at a different price. They vary in fineness, strength, length of staple, color, cleanliness, etc., etc. Markets vary, and spinners try and make the lowest grade possible do for their work, and, as the price rises, they often are tempted to buy grades lower than is judicious. A very trifling reduction in quality may be just enough to make unsatisfactory yarn, and this, of course, is passed along to the weaver.

It is also true that a great deal of the cotton used to-day in silk mills could be made of a lower grade of stock without detriment to either the quality or quantity of the product, though mills are naturally afraid to change from a tried and satisfactory article to an unknown one.

The following list will show the various classifications in raw cotton at present recognized by the New York Cotton Exchange. The standard grade, upon which quotations are made, is that known as "Middling."

NEW YORK COTTON EXCHANGE INSPECTION BUREAU.

NEW YORK DIFFERENCES IN GRADE.

	Cents	
Fair	1.50	on
Strict Middling Fair	1.30	"
Middling Fair	1.10	"
Strict Good Middling	.68	"
Fully Good Middling	.57	"
Good Middling	.46	"
Barely Good Middling	.35	"

Strict Middling	.24	"
Fully Middling	.12	"
Middling	Basis	
Barely Middling	.17	off
Strict Low Middling	.35	"
Fully Low Middling	.55	"
Low Middling	.80	"
Strict Good Ordinary	1.40	"
Good Ordinary	2.15	"
Strict Good Middling Tinged	.35	on
Good Middling Tinged	Value of Mid.	
Strict Middling Tinged	.15	off
Middling Tinged	.30	"
Strict Low Middling Tinged	.85	"
Low Middling Tinged	2.00	"
Middling Stained	.90	"

New York, November 20, 1912.
There can be no revision until February 5, 1913.

About 75 per cent. of all the American cotton sold, will normally grade between Fully Good Middling and Strict Low Middling, inclusive, the proportion of the better grades produced being limited.

These qualities are all used by the ordinary yarn spinners, as are also the grades from Good Middling Tinged to Strict Low Middling Tinged, these tinged grades being unsuitable for certain purposes on account of their color, but otherwise good.

Strict Good Middling Tinged is in the higher class, while Strict Good Ordinary and Good Ordinary are used for twines and similar purposes, and Low Middling Tinged and Middling Stained are applied to very inferior uses. Fully Low Middling and Low Middling are poorer than what regular yarn spinners desire to handle.

If a cotton broker buys a contract for a quantity of cotton, he may have delivered to him some of all or any of these grades, and he then tries to place them with his manufacturing clients according to their varying needs.

In New York, these classification differences are determined three times a year. In New Orleans they change them constantly.

The question as to the sufficiency or insufficiency of the price differences established between the various grades from time to time, is a very debatable point. Sharp differences of opinion concerning it will prevail, and the variations allowed, say, on the New Orleans Cotton Exchange, may be considerably different from those prevailing in New York.

On a sale of raw cotton, the seller is permitted to deliver grades above or below the grade contracted for, by paying the difference in price, as established at the time by the Exchange.

If good spinnable cotton is scarce, the manufacturer may have to accept, against his contracts, lower grades which may be very unsatisfactory, regardless of the allowance for difference in grade.

About these different qualities of cotton, silk manufacturers know little, and probably care less. They speak glibly of peeler, Egyptian, and Sea Island cottons, and of carded and combed yarns, and that is about all. They know that for cotton-backs a combed, or double-combed, yarn is needed for light colors—as being free from much dirt or speck, while carded, or double carded, yarn will answer for the dark shades, and for blacks a distinctly cheaper yarn will answer.

Sea Island Cotton.

There is a good deal of cotton sold as Sea Island, that is really from the Sea Islands, but which, from seed and from cultivation, is away below what its quality should be; and there is an immense amount of yarn sold as Sea Island, the cotton in which never saw that region, though probably a good deal of it is grown from Sea Island seed, planted somewhere else.

This Sea Island seed has also been extensively planted in upper Egypt, making a white Egyptian cotton of very satisfactory character. Some splendid cotton from Sea Island seed is now grown in Barbadoes—second to none in the world.

The average white American cotton loses, in waxy products, etc., in bleaching, about 3 per cent., while the regular yellow Egyptian cotton will lose about 7 per cent.

Allowance for Tubes.

Great quantities of yarn are bought on paper tubes for weaving purposes, and it is customary to charge the tubes in as yarn. The finer counts are generally wound into smaller cops, and on them the tare to be figured on, as represented by the weight of the tubes, is about 4 per cent., while, in the coarser sizes, the tubes will probably amount to about 7 per cent., and will often weigh 1 or 2 per cent. in excess of this. This allowance for tare is very frequently overlooked.

If cops are to remain long in storage they should be kept in a properly moist place, but if stored in any naturally very dry place some means of humidifying the air should be adopted, or else there will be heavy waste in the weaving, from the dried, and consequently loose, yarn being knocked off the tubes.

Length and Diameter of the Cotton Staple.

From the book, entitled "Cotton," by C. M. Burkett and C. H. Poe (1906), I quote the following figures as to the length and diameter, in inches, of the fibre of certain cottons, stated to have been arranged by "Evans."

Variety	Av. Length of Staple	Av. Diameter of Staple
Sea Island	1.61	.000640
New Orleans	1.02	.000775
Texas	1.02	.000763
Upland	.93	.000763
Egyptian	1.41	.000655
Native Indian	.89	.000844

Because cotton is a cheaper material than silk is no reason why it should not be as accurately tested, and its attributes as carefully studied. By careful attention to this end of the business, much loss and waste may be avoided and profits substantially increased.

VII

SHOULD A MILL DO ITS OWN THROWING?

Manufacturers, as a class, are apt to believe that the usual prices they have to pay for throwing are excessive; that deliveries are unnecessarily slow; that too much waste is made in the process; and, finally, that the work is none too well done.

These complaints, and many others, are made to throwsters by people who know little or nothing about the processes of throwing, and many of these manufacturers are convinced that it would be a good thing for them if they did their own throwing.

Let us consider what advantages they would expect to gain, and then see how likely they are to attain them.

Advantages Hoped For.

They feel sure that a heavy reduction in cost is to be effected, and look forward to a net saving of anywhere from 10 to 40 per cent.; that they will get their throwing done just when they need it and as they need it; that they will get their lots through quicker; that they will make much less waste; and, lastly, that they will get much better work.

It may be admitted at the start that there are instances where many or most of these advantages can be realized, and perhaps the instances may be numerous, but in very many cases not one of them will materialize.

Relative Employment of Spindles and Looms.

The demand for throwing fluctuates greatly, and it is apt to be either a feast or a famine. At the same time, the employment of spindles is generally steadier than the employment of looms. A throwster is likely to have in his outfit just as many spindles as his engines will turn, and if he wishes to add to them, with a view of in-

creasing his product, he is at once confronted with the necessity of considerably enlarging his power plant—an extremely costly and time-consuming undertaking. He knows well that, long before he could get into action the motive power to drive new spindles, the pressing demand would be past, so he contents himself with doing the best that he can, and his customers have to wait more or less, and new business he has to decline. When a throwster makes an enlargement, therefore, it is more often done by his building and equipping an entirely new mill, perhaps in a new town where help has to be trained, and, as such a project requires much capital and much work, the throwster is likely to make haste slowly.

Not so the weaver. When his goods are in active request, and he believes he sees a steady demand for some time to come, he thinks little of buying another fifty or hundred looms, and, if he has no space to spare, he will install them in rented premises and will have them turning out goods in short order. He expects, of course, to get silk thrown for these new looms by simply calling for it, and, as other mills are in similar case, there is quickly created an excessive demand for throwing with no new spindles to supply it.

Thus it is that the installation of spindles lags behind the installation of looms, and the throwster is consequently in a more independent position than the weaver. Also, if broad silk weaving is dull, ribbons may be good, or vice versa, and from one or the other the throwster will get work.

The Different Operations in Throwing.

The operations of throwing cover the opening, weighing, and examining of the silk; the opening of the skeins and the soaking, followed by the wringing out of the water; the unfolding of the damp skeins and the rubbing of the gums where it is deemed necessary; the drying and the allowing the silk to regain its natural moisture; then follow, for organzine, the winding, first spinning, doubling, second spinning, reeling, stitching of the skeins, examining, bundling, packing, and shipping. For the tram there is, of course, only one spinning.

It will be seen from the above that there are many operations to be attended to.

Spinning Necessary for Organzine.

The work which takes the larger part of the power used, and which requires a great number of expensive spinning spindles, is the spinning (or twisting) of the organzine.

If organzine is to be thrown with 16 turns of twist per inch in the single, and 14 turns of reverse twist when two ends are doubled together, it follows that the twist in each inch of the raw single thread (if no allowance be made for take up in twist), will be 16

turns, plus one-half of 14 turns, equal to 7, or 23 turns of twist per inch in all.

Few manufacturers realize what this twisting means. How many know that a single pound of 13-15 denier silk, averaging 14 deniers, will measure about 319,000 yards, a length of over 181 miles? A pound of such silk would give a continuous thread reaching from New York to Philadelphia and back. Now, when 23 turns have to be put into every inch of this great length, we reach the enormous total of over 264,000,000 turns of twist in one pound of 13-15 denier organzine.

A spinning spindle, running 10,000 turns a minute, for 55 hours a week, without stopping an instant for any cause, would require 8 weeks, even at this great speed, to twist up a single pound.

Hence it is that great power and many spinning spindles are required in the throwing of organzine.

Questions Affecting Location.

Bearing such facts in mind, the manufacturer begins to lay his plans. In his mill buildings he will probably have little unoccupied space and, of course, will have no spare margin of power sufficient for the throwing. New buildings must therefore be erected, and suitable power producing equipment provided. Where shall these installations be made?

Allowing that land be available, one would naturally wish to build the throwing mill beside the weaving mill, where there would be great economy in management, saving of transportation, better supervision, etc. Here, however, one is confronted by a serious difficulty. Weaving is a high branch of the textile art, as are most of the preparatory processes, warping, twisting, etc. The wages paid are in accordance, and it takes many years to produce first-class workers in these fields. The operations of throwing, however, are more easily and quickly learned, and the degree of skill required is far lower. Therefore, the relative price that such work should command is much less.

Considerations Regarding Labor.

If you have the throwing mill beside, or near to, the weaving mill, all the operatives in the former will think themselves very hardly used if they do not get about as much wages as the latter, and they are therefore in a chronic state of discontent, and are all the time drifting away whenever they can get a job in one of the weaving mills in the vicinity. Then, in order to hold the help, it is often necessary to pay the hard-silk workers nearly as much money as the dyed-silk workers, a sum far higher than should be the case, and which makes the cost of the throwing very dear, labor of course being the chief element which enters into its cost.

Thus, it may be necessary to look for a location in some town that may be free from this objection, and so some of the expected benefits must be sacrificed at the outset. Also, when the location se-

lected is at a distance from the parent mill, everything will depend upon the faithfulness and capacity of the manager selected for the post, and such a man it is not easy to find.

Whatever location is selected, one thing should be positively assured, and that is a full and constant supply of female labor. Such a condition may exist in a small town for a time, but when other industries come to the place every one is left shorthanded, and the price of the labor is bid up, for there is no growth of population to give the supply needed.

Therefore, large towns or cities of good size, which are growing rapidly, would seem to be the most favorable locations for this end. In such places, the price that suitable labor costs will, in the long run, be probably not much greater than in country villages, and where help is plenty a full product can be got. This help, in any case, would need to be trained, and from the time a mill of fair size was started up it would likely be six to twelve months, according to circumstances, before a full and perfect output could be counted on.

It is very undesirable to locate a throwing plant near silk weaving mills, for the reason already stated, nor is it desirable to get near any other textile works, thread works, or any establishments in fact where female labor of a higher grade, and consequently earning higher wages, is employed. A location, however, in those parts of a city where the industries employ principally male labor, such as iron-works, tanneries, machine-shops, silver manufacturing, lumber mills, etc., might be advantageous, for in the families of these male workers would be many unemployed girls who would be glad to get work in a throwing mill where they could earn wages equal to, or better than what they would make as shop girls or servants. If the population in the vicinity was fairly dense, most of the help might live within walking distance of the mill, and the saving of 60 cents a week in carfare is a consideration.

Land, Buildings and Power.

The cost of the land, in or about a town, will not, of course, be very cheap, but to be in the midst of a large laboring population far outweighs all other considerations.

It is not easy to rent a suitable building, for even if one be found it will rarely have a sufficiently large power plant to do the work, and no one wants to install his own plant on some one else's property. Outside electric power, at the prices generally charged, is too expensive to consider, and the throwster must make his own power. This being so, and the consumption of power being great, the location selected should be made with this point well in mind. Cheap coal is needed, and, if the mill has a railroad siding, the cost of hauling will be saved. Steam, gas or turbine engines may be used, and a location near a stream from which water can be taken for the condensers, or scrubbers, is desirable. Natural-gas belts lie too far away,

and water powers are scarce and often not reliable. Oil for fuel is dear and has disadvantages.

The erection of a mill demands that numerous points be well considered. A building of one story has many advantages, though, of course, it covers more ground, and it is undesirable to go higher than two stories. It may be of brick or of reinforced concrete. The lighting, both natural and artificial, is of great importance. Roofs, skylights, floors, ventilation, heating, sanitation, and many other points are all problems in themselves.

A matter of much moment is the question as to whether electric transmission of power, in whole or in part, will be economical under the circumstances, and if so what system, voltage, and kind of current should be used.

It is desirable that the buildings be laid out so that there is a minimum of handling of material as it advances from one process to another. Also that the transmission of the power from the engine-room to the work be as simple and direct as possible, and, again, that it be as easy as possible for the foreman to keep each part of the mill floor constantly under his eye.

Other Matters of Moment.

If there is no natural source of water supply, it may be necessary to sink a well and pump the water for the engine, etc., as city water generally costs so much as to make it expensive.

A good system for moistening the air should be installed, for it increases the quantity and improves the quality of the product.

It may be thought desirable to put in a sprinkling plant, with pump, etc., for fire protection, which would mean much added expense, and there may be a water tank, and stand pipe and hose, to provide.

When the building is ready, the shafting and transmission machinery must be installed. Careful attention to this important work will save much money in operation. Good and proper sized material, well erected, and with carefully aligned shafting and suitable sizes of pulleys and belting will be money well spent.

Machinery and Hours of Operation.

Then comes the throwing machinery, and the number of spindles of each sort to be provided will depend on the output of specific sizes, and of specific twists, which the mill is designed to produce. There is the question whether the mill will run during the day only, or night and day, and, if the latter, whether six nights a week or only five; also whether, during the night, the organzine spinners alone will run, or if tram spinners or preparatory machinery will also be in operation. Another factor is the speed at which the frames can be run, which again depends on what degree of skill the workers have, how the qualities of the silk may be expected to average, and what experience may have

shown to be the highest speeds at which a good and economical product can be secured.

Speeds of Machinery.

With a high-class plant, kept in excellent condition, speeds such as the following are practicable.

1st time	spinners.....	12,000 R.P.M.
2d time	"	8,000 "
Doubler	"	9,000 "
Combination	"	9,000 "
Tram	"	6,000 "

Winders-ave. of 175 yards per minute.

Doublers vary much, but usually run slower than winders.

Reel flies, 400 turns per minute.

Organzine, after first spinning, may be doubled and twisted on the "down spinner," receiving about 3 turns of twist. It can then be given the rest of its twist on the second time spinner, speeded up to 10,000 r.p.m., and run without flyers.

Power Taken in Spinning.

The power needed for belt spinners running at 10,000 r.p.m. is usually upwards of 1¼ h.p. for each 100 spindles. For combination spinners, 100 spindles will require about 3 h.p. or over, with a speed of 8,500 r.p.m.

The percentage that the actual output may be expected to bear to the theoretical must likewise be considered.

Different Types of Machines.

Then, what types of machinery shall be bought? Shall the spinners be belt or band spinners? Shall the spindles be of this or that type; shall single-deck or double-deck frames be used; shall there be some doubler-spinners in the outfit; or some of the types of spinners that deliver completely thrown organzine from the one machine?

What sort of winders shall be used; this or that make or style; single or double deck? Shall the doublers be upright, or the old style; high speed or not? Shall the tram spinners be used which double at the same time, or shall the usual single or double deckers be employed? How many flies shall each reel have? Finally, what are the best average speeds to run all these various machines at?

Intelligent answers to these questions require sound judgment and much knowledge and experience, and on their proper answer the welfare of the enterprise will largely depend, to say nothing of the fact that the capital required will be much more or less according to the decisions arrived at.

If tussahs are to be handled, a far larger proportion of winding spindles will be needed; and if much crêpe twist is required the spinning spindles must be enormously increased.

Other Equipment Needed.

Then come questions as to the styles of bobbins, spindles, swifts, etc., and the materials of which they shall be made. A large sum of money has to be locked up in bobbins alone.

There is needed a hydro-extractor, a bundling press, soaking tanks, and a host of things required for the mill equipment from scales to oil tanks, or from fire pails to clocks. Office furniture and equipment must be provided, as well as partitions, bins, shelving and a current stock of the supplies that the mill consumes, soap, oil, banding, paper, belting, and a score of other things.

Capital Invested and Operating Costs.

The outlay of capital that will confront any manufacturer who contemplates erecting his own throwing mill is large. He must arrange for land, buildings, a very expensive power outfit, and a well and pump, heating plant, lighting plant, humidifyer system, transmission machinery (with or without motors), belting, the throwing machinery proper, the accessory equipment of the machinery, the general mill equipment, the furniture and fixtures, and the current stock of mill supplies. To this must be added the architect's and consulting engineer's fees, the organization expenses, and the loss that the mill will make at the outset while the help is being trained.

In the operating of the plant the great item of cost, as already stated, is the labor. Then there is the cost of the management, and the office and other salaries. Then the power, light, and heat expenses. There is interest, insurance, taxes, transportation charges, depreciation of machinery and buildings, repairs to machinery and buildings, office expenses, traveling, a long list of supplies constantly being consumed, and many sundry expenses.

Conditions Necessary for Profitable Operation.

For any mill of moderate size, say up to 300 looms, the throwing of its own silk could hardly be specially profitable in any event. In larger mills, if the business were thoroughly understood and well managed, there might be a respectable profit in doing this work, if the department could be kept running full continuously.

Should there be slack work, which is a condition that might arise at any time, or should the demand for goods take such a turn that more raw-silk, spun-silk, cotton or other yarns would go into their manufacture, and less thrown-silk, then the throwing branch, running with a limited output, would probably be found to be making no money or, more likely, would be falling behind its expenses.

It is not a bad plan, however, when a large mill is arranging to do its own throwing, to put up a plant that will only take care of half, or at most two-thirds of the regular throwing required, the remainder of the work being given to outside throwsters.

The result will be that the throwing department can then be run full, probably all the time, and consequently at the maximum of efficiency.

Some throwsters will say that they would not desire the business of a mill where the work coming to them would be cut off, in whole or in part, whenever business got slack, but if some mills would not take the work many others would, and an arrangement of this sort will be found to be of very great advantage.

Serious Risks to be Taken.

A manufacturer, unskilled in the throwing art, has a formidable task before him, and, if he undertakes it, at every step he will have to rely on what some one else tells him. Should he be ill advised, or unfortunate enough to commit the care of the throwing mill to a poor manager, he will find that he has locked up a small fortune of capital, is making more waste, poorer work, and at a higher cost than what he could obtain from any respectable commission throwster.

By continuing to have his work done outside, he need only send to be thrown what he wants for his current requirements. Should he have a hurry call for a lot of goods, he could send some bales to each of several throwsters and accumulate a good stock quickly. He can also guard himself from bad work and excessive waste by a free use of the Conditioning House facilities.

Finally, by putting his money into looms, if he has proper capital to operate them, he is likely to make much more money in this field that he does know, than by trying to exploit the throwing end of the business, a field that he does not know.

Market Prices for Throwing.

In this connection, a few words concerning the ordinary market prices for throwing may not be out of place, and these prices will vary widely at times.

The charges made by first-class concerns who do good throwing, and who keep the waste down to a minimum, may vary from a basis of, say, about 57½ cents a pound for 2 thread, 13/15 denier organzine, and, say, about 27½ cents a pound for 4 thread tram, when business is very depressed, to around 72½ cents and 35 cents respectively when business is good and prices high.

Figures as low as 47½ cents for the organzine and 25 cents for the tram may be quoted by many firms in bad times under the stress of competition.

As such prices will usually shew a loss to the throwster, the manufacturer, who is so ill advised as to be willing to risk his silk with any concern making such irrationally low prices, should see to it that every pound, both raw and thrown, is tested at the Conditioning House both for weight and for boil-off so that he may know how much of his silk

he is actually getting back. Coupled with this should be tests to shew whether or not any insoluble materials had been added by the throwster to the soaking bath.

If the deliveries of every low-priced throwster were checked off in this fashion, there would be very few such impossible prices quoted.

Approximate Prices and Wastages to Use in Calculations.

For the ordinary purposes of cost calculating, the following figures may be taken as representing reasonably low average prices for good throwing, and reasonably low wastages.

	Regular Organzine.			*Regular Tram.*	
10/12	Denier	85c. a lb.	2 Thread	37½c.	a lb.
11/13	"	80c. "	3 "	32½c.	"
12/14	"	70c. "	4 "	32½c.	"
13/15	"	65c. "	5 "	30c.	"
14/16	"	60c. "	6 "	30c.	"
16/18	"	55c. "			

For 3 thd. organ. add 5c. a lb. For Cantons add 5c. a lb.

[Silks, such as Tsatlees, Kakedas, Tussahs, etc., vary greatly, and throwing prices vary also.]

4 thread, 70 turn, hard-twist Canton Tram....$1.25 a lb.
3 thread, 70 turn, hard-twist Canton Tram....$1.50 a lb.
Singles, 13/15, 60 turns, hard-twist raw-silk..$2.00 a lb.
Grenadine twists average from $1.25 to $2.25.

Wastages to be expected.

Regular organzine	1¾	to	2½%
Regular tram	1¾	to	3 %
Canton tram	4¼	to	6 %
Crack tussah chops			3½%
Lower grade			5 %
Press-packed tussahs	7½	to	10 %
Crêpe twists (except Cantons)	2	to	3 %
Tsatlees	3	to	5 %

[As wages, which have been low, in the silk-throwing centres are steadily advancing, higher prices for throwing are likely to prevail in the future.]

VIII

SHOULD A MILL DO ITS OWN SILK PRINTING?

All fancy-goods mills, or mills that make a portion of their product in fancies, may, from time to time, require to bring forward lines of surface or warp print goods.

There are not many concerns on the market who do a commission printing business, and much of the time there is little enough work for any of them.

Delay in Deliveries of Prints.

When print effects come into vogue, lots of manufacturers take them up and look to these market printers to do the work, and, of course, each manufacturer wants his work done in a hurry. The printers, crowded with work, no doubt do the best they can, but that best is, at such times, far from being satisfactory to the bulk of their customers. The getting out of new patterns, the making of the samples, and the bringing forward of the goods ordered, may each be delayed to an unbelievable extent, and a manufacturer may see the cream of the season's business lost to him, and may even be badly stuck with goods, late for delivery, that are cancelled.

Damages to be Allowed For.

Goods printed in the piece, as well as printed warps, are subject to a great many kinds of imperfections and damages in the process, and such damages can and do cause extremely heavy losses to the manufacturer. The printers have no relish for making good these big losses, and while they will allow some claims, of course, yet they are generally trivial compared with those not allowed.

It is but fair to state that silk printing is a very technical, difficult, and hazardous trade and it is only in the exceptional years that there is much money in it, and if the printer had to guarantee the absolute

perfection of all the work he did, he would either have to double his prices or go into bankruptcy from the losses he would have to allow.

Be this as it may, the manufacturer, who has to get his printing done outside, will often have occasion to feel anything but pleased at the service he receives, and he may sometimes think that it would be a good move to put in a printing plant of his own.

Equipment Required for a Plant.

It is the purpose of this article to point out what a manufacturer might have to provide in the way of plant and appliances for such work, and to outline briefly what the work consists of.

The equipment for a fair-sized broad silk plant might consist of the following: Two presses, of eight colors each, with their equipment of endless rubber or felted-wool blankets, mandrels, color pans, color rollers, doctor blades, etc., and with special engines or motors to drive them; a mandrel forcer for pushing the copper rollers onto the steel mandrels; a steaming kier, or "cottage," for steaming the printed goods to set the colors; a well equipped drying room, or other chamber, for drying the goods after they pass from the press; a measuring machine; several take-up and let-off machines for rolling and unrolling the goods and grey cloths in the various stages; some dye jiggers; many vats, or tubs, for different uses such as for stripping the gum from the silk piece goods, washing the silks after the steaming process to rid them of their loose color, washing the huge amount of grey cloths, which are used as a backing for the silk while being printed, cleaning the color pans, etc., most of these tubs having suitable apparatus for revolving the goods in them; a large upright, or horizontal, can drying machine with many copper cylinders for drying the grey cloths, printed warps, and printed piece goods; a large hydro-extractor; a small one-color printing press and a small steaming kier, for experimental work; one large double-jacket copper kettle, with automatic mixer, for mixing and boiling the gums and starches used as a base with which to mix the colorings; some smaller kettles of similar kind for color mixing; all necessary power transmission machinery and belting; a large assortment of stone crocks, copper utensils, and vessels of various kinds; a well equipped chemical laboratory; a big stock of heavy cotton grey cloths, and cheese cloths; a large supply of colorings of all sorts, acids, and other chemicals, gums, starches, oils and what-not.

It is also very desirable to have a tentering machine in this department, for fabrics dried and stretched on such a frame are markedly superior to those run over a can dryer, and are more regular in width. An effective machine of such a kind, however, is very expensive and uses up much space. A suitable one may cost from $3,000 to $6,000 and require a space 50 to 90 feet long, and perhaps 8 to 10 feet wide.

Cost of the Equipment.

The cost for such an equipment as outlined might be from $12,000 to $20,000 and a space of 8,000 to 10,000 square feet of space should be sufficient to comfortably house it.

With so many wet processes, it is desirable that part of the space occupied be on the ground floor. It is quite customary, however, to have the dry room on a floor above, and sometimes the drying is done in a tower built upwards through the roof.

Storage of Rollers and Chemicals.

A thoroughly dry and secure place should be arranged for the storage of the large stock of engraved copper rolls that has to be carried, and good arrangements for conveying them to and from the presses should be made, so that there will be little or no chance of damage to them. The supports of the floor they are kept on should be substantial, as they are very heavy.

A safe and convenient storage place for the chemicals should be provided.

Water, Sewerage, and Steam Supply.

An ample supply of suitable and very clear water must be always available, and, if the water may come muddy at times, filters must be provided.

Sewer connections should be direct and of generous size, so that there will be no risk of choking up.

As a great deal of steam is used in the stripping, dyeing, steaming, drying cans, drying room, kettles, engines, etc., a boiler of good size must be employed and a considerable coal consumption figured on.

Operations of Printing.

Coming now to the processes of printing, they may be broadly divided into three operations: first, the preparation of the goods for printing; second, the printing of the goods; third, the steaming, washing, and drying.

If only dark shades are to be produced, and no delicate colors or whites are required, a very simple soap bath will strip off the gum in the goods and the work can be proceeded with; if, however, the pattern consists of delicate shades, three, or more, separate soap baths, followed by a final alkaline bath and a rinsing, may be needed to get the silk sufficiently white. Should an absolute white be wanted, the silk will have to be bleached as well, which may be done with Sulphurous Acid, or better still with Peroxide of Hydrogen, or Peroxide of Sodium.

In these processes, great care in the arrangement of the tubs and their mechanism, and in the handling of the goods, has to be taken to avoid the damages known as chafe marks, which are principally due

to the displacement of the silk fibres when wet, and which, once made, are very difficult to remedy.

The printing of silk can be accomplished in three ways: first, by printing a resist on the goods and dyeing them afterwards; second, by dyeing the goods first and discharging afterwards; third, by printing the pattern on direct.

Resist Printing.

The first of these processes is used in two ways: A, by printing on a resist which, after the goods are dyed and steamed, will destroy the coloring matter and form a white; B, by printing on a resist which will prevent the fibre from taking up the color, wherever the resist is, when the pieces are dyed afterwards.

In this case, the resist is composed of waxy substances, which must subsequently be dissolved out with benzine.

The "B" process is not to be recommended as it involves working with large quantities of the benzine, which, being highly inflammable, is very dangerous.

Extract Printing.

The second method of printing is very important, as in printing the discharge you can not only produce white but color effects. The selection of the colors is simple and they are mixed with the discharge. The goods are first dyed in the ordinary way in the color that is wanted for the ground, and they are then dried, and the discharge is printed on them. After being again dried they are passed through the steaming apparatus, washed well, and finished.

Direct Printing.

The third and most usual method is the printing of the pattern direct upon the white cloth. In blotch printing, that is, when the ground is in solid color, it is very difficult on some fabrics to get a clear effect, and mottled grounds in such cases are common. By using the first or second process this trouble is overcome and an absolutely clear ground can be got.

The engraved rollers, mounted on their mandrels, are arranged in the press in proper order and so that the impressions that they make will fit to a hair's breadth, and also so that the pressure given by each and all of them will be the same, and the same at both ends.

Under each of these rollers is a copper pan with the proper coloring mixture in it for that roller. This color is conveyed to the engraved roller by an intermediate wooden roller and the surplus color is scraped off the face of the engraved roller by the doctor blade, a long polished knife of steel, with a straight and true edge, which lies against it.

Covering the big cylinder of the printing press, against which the rollers work, is a heavy endless rubber or woolen blanket which acts

as a cushion and which extends above the machine for a short distance and, passing over a roller, returns to it.

With the roll of goods to be printed, there is also fed into the press a heavy cotton cloth which acts as a sort of blotting pad to take up the surplus color squeezed through the silk. After leaving the machine these cloths separate, the cotton being led to a rolling machine where it is rolled up for use again or, if necessary, it is then sent to be washed out. The silk passes at once to the dry room and it is dry before it emerges.

To set up a pattern in a press, adjust the rolls to a nicety, put in the colorings and test everything to see that all is right, may take the printer and his assistant half a day or more, even if only a single sample is to be made, while a big length of goods to be printed may be run through in five minutes, so the speed at which a press can be run has but little to do with its product.

In printing silks, it is necessary not to dry them at too high a temperature, and also to leave the pieces, after drying, for a time before they are steamed.

The Steaming Process.

The silk is now taken to the steaming kier where it is put in, hanging in festoons from sticks at the top. When warps have been printed, they are accompanied in their passage with an equal length of cheese cloth, and this envelops and protects them during the steaming, etc. The steam should be live steam and at ordinary atmospheric pressure, and the goods, when entering the steaming apparatus, must be warm so that no steam may condense and drop on the goods, producing stain. The condensation of some steam in the kier must be expected, and the goods be carefully guarded against any drip.

Most printers think it necessary to have 5 or 10 pounds of pressure when steaming the goods, but the writer's experience is that if the door of the kier be just closed to, with some cotton or woolen material stopping the gap, so that only a little steam can escape, better results were obtained than when there was pressure.

After steaming, the goods msut be carefully and thoroughly washed, with a full supply of water sluicing the loose color away, in which case the white will remain clear, whereas, if the water did not run off freely, or if too little were used, it would become colored from the dyestuffs and would convey a distinct tinge of color to the white.

The goods are now taken to the hydro-extractor and the water is whizzed out of them, and they are then dried on the hot cylinders of the can dryer or on the tentering frame. Should they require any finish or sizing it can be put on before the drying.

Employees Required.

The staff of such a department must include a first-rate color mixer, who, of course, should be a good chemist. Such men are very scarce

and are rather expensive. Also a thoroughly competent printer, not a cheap man either. The number of other employees will depend on the amount of work being done, and, while there will be quite a few of them, they will be mostly cheap men, though, if dyeing is to be done, there should also be a dyer who knows his business.

Each color mixer has his own experience and views as to colors and color makers, and, if a new color mixer is engaged, he will frequently be unable, or unwilling, to use more than a small part of the colors on hand and will want new ones ordered.

Much of his time, and much expensive material, will be spent in experimental work. He should therefore be required to put all samples, and full formulæ for reproducing same, into a book, the property of his employers, so that if he should leave they will not lose the benefit of the experience that has been so acquired at their expense.

Block Printing Facilities.

It may also be desirable to have some block printing facilities in the department. For this purpose a specially constructed table, very true and level, is needed, a color box in which to ink the blocks, and a supply of pattern blocks, etc.

These blocks can be, say, 8 to 12 inches square, are made of hard wood, and the pattern work is edged with brass and stands out in relief. A good block printer will get through quite a yardage in a day. It is economical to use blocks if orders are likely to run small, and sometimes it is well to have roller patterns duplicated in blocks, so that samples and small duplicate orders can be brought forward quickly and cheaply in that way. It will be necessary, however, to have on the staff a man skilled at that work, though he may be used in other directions when there is no block printing to do.

Copper Rollers and Their Cost.

The cost of the copper rollers is a huge expense in a printing business. The makers of such rollers charge for them 10 cents a pound above the price of ingot copper, and, when they are finally turned down till too thin for further use, or if scrapped for any other reason, the makers will take them back at the ruling price of ingot copper, if accompanied with an order for an equal quantity of pounds of new rollers on the above basis.

A mill will carry a certain number of standard patterns always on hand, polka dots, rose buds, etc., and will always be engraving new patterns and turning off ones that are passé.

The engraving may be done by means of the pantograph and acid etching, or by the more expensive, and better, milling process. This work may cost from $8 to $20 a roller, without including the cost of the mills when they are used.

The artist's sketches from which the designs are made, may cost, say, from $5 to $15 each.

A common size of roller will be 28 inches long and of a thickness that will give a weight of about 140 pounds per roller, and the number of rollers to a pattern, running from one to eight, may be averaged as five.

If, therefore, a mill had on hand the moderate number of one hundred patterns, the cost would figure as follows, taking copper at 15 cents a pound, which, plus 10 cents, would make the rollers cost 25 cents a pound.

Five rollers per set, at 140 pounds each, equal 700 pounds, which at 25 cents a pound makes $175. To this add, say, $15 a roller for the engraving, making $75, and $10 for the sketch, and we thus have each pattern costing the average amount of $260. The one hundred patterns would thus represent an investment of $26,000, over and above the total cost of the plant.

Capital That Must be Invested.

A manufacturer, starting his own Silk Printing department on such lines as these, may consequently be confronted with a fixed investment of $40,000, more or less, in addition to his building, boiler plant, water supply, etc., and he will have an expensive staff that he must carry (for his skilled people, at any rate, cannot be laid off whenever it suits him), and he must drag all the current expenses of the plant besides.

Risky Business to Go Into.

When prints are in active request, which is perhaps in one year out of five, or more, this is all right. Or a broad-silk manufacturer may get printing work from friendly ribbon manufacturers, or vice versa, to help out.

But where is he when prints are not wanted? Sampling all the time and no orders but trivial ones dribbling in now and then, always hoping for an improvement, and always showing a smart loss at the end of each season.

The department would do all right, of course, if the mill should keep it supplied with goods to print. If a couple of hundred looms were kept going, say, on foulards, which were regularly printed and sold, if it were possible to get out at a profit on them, then the doing of one's own printing might be a very safe and profitable enterprise.

Any manufacturer, however, who goes into printing, and who is not prepared to give this department full and constant work of some kind, will probably find that he has a very large white elephant on his hands, and will wish that he had never gone into it.

PRINTERS' PRICE LISTS.

The following prices, which are some current quotations of one of the large concerns which do printing, will serve to shew how such work is charged for.

Special prices may be made to meet special conditions, however.

PRICE LIST.

SURFACE PRINTING.

	Width	*1 Color*	*Each Extra Color*
Habutais	to 21″	5½c	½c
Foulards	to 27″	6c	½c
Grenadines	to 36″	9c	½c
Marquisettes	to 40″	12c	1c
Charmeuse	over 40″	15c	1c
Crêpes de Chine	over 40″	15c	1c

	1 Color	*2 or 3 Color*	*Multi-Color*
Mulls—to 27″	4c	4½c	5c
" —to 36″	5c	5½c	7c
" —to 40″	6c	6½c	8c

For Cotton and Tussah, or Cotton and Schappe goods, add 1c extra.

WARP PRINTING.

Width	*1 Color*	*Each Extra Color*	*Double Warp*
27″	6c	½c	Add 50%
36″	8c	½c	" "
44″	9c	1c	" "

When only single warps are printed, ½c extra.
Weighted warps printed at customers' risk.

WATERPROOFING.

Width, 21″	Price, 1½c
" 27″	" 2½c
" 36″	" 3c

IX

SHOULD A MILL DO ITS OWN FINISHING?

This question is one with many sides. Silk finishing, as a business, is conducted on a large scale by various firms, and the work, on the whole, is done by them at reasonable rates and in a generally satisfactory manner. A manufacturer who may be wondering if he should or should not put in his own plant for finishing may well hesitate.

Lack of Knowledge of the Processes.

He may know little or nothing of the processes, and, if he should not get the right man for a foreman, his product might come on the market improperly finished and severe losses be entailed thereby. He is unaware of the value or amount of the machinery necessary, the space required, the power and heat needed, or the labor that must be employed. If goods are spoiled, there is no one on whom he can make reclamation.

Advantages of Outside Finishing.

The outside finisher is prepared to finish for him any fabric from taffeta to moiré antique, and, if his own product were varied, he could hardly expect to maintain a plant that would care for all the different cloths that he might get out. The outside man, also, getting business from many sources, is likely to be much better informed as to the kind of finish that is going to be wanted for the season, and this guidance he would lack if he were doing his own work.

He may feel, too, that, when getting his finishing done on commission, he knows the exact cost of the work, and that it will be the same whether his output is large or small. Should he assume the responsibilities connected with doing his own work, he would have a natural fear that the occasional slack work that has to be looked for might turn an expected profit into an actual loss.

Considerations such as these are apt to make a man feel that he will be wise to leave well enough alone, and if he has any money to spare to put it into additional looms instead of into a finishing plant.

It is the purpose of this article to point out what a broad-silk manufacturer has to consider if he desires to finish his own goods. It is not intended here to go into a detailed description of the machines, or of the work done by them, but simply to indicate their functions in a general way.

Objects Aimed At in the Finishing.

The results to be attained are the stiffening or softening of the goods, the making of them thinner or fuller to the hand, the smoothing, stretching, polishing, singeing, moiréing, embossing, etc., etc., according to the requirements of the trade and the fashion of the day. Be it noted, also, that, as silks are finished dry, any imperfections occurring in the weaving or other previous processes will not be covered up or minimized by the finishing.

Machinery and Processes Employed.

To attain the desired results, various machines are needed, those in common use being the spray machine, quetsch, paper-drying machine, button breaker (upright and horizontal), knife breaker, cylindering machines of different kinds (and which may be equipped with expanding rollers for stretching out the cloth to its full width and getting rid of wrinkles), calender, hydraulic press, singeing machine, polishing machine, brushing machine, tentering frame, sewing machine, folding and measuring machine, embossing machine, etc., etc.

The spray machine, as its name indicates, is intended to spray the goods with a sizing mixture finely atomized. This sizing is composed of various materials, gums, glues, gelatines, waxes, starches or what not, each finisher having his own preparation and generally imagining that there is no other mixture equal to it.

The "quetsch" derives its name from the German "quetschen," to squeeze, and is a machine in which the sizing from a trough can be applied to the goods by means of a series of rollers mounted one above the other.

Goods that require excessive gumming, such as grenadines, may be finished "au mouiller," as it is called, in which case the fabric is completely saturated with the sizing, the surplus size being squeezed out.

This is accomplished by passing the goods, under pressure, between a pair of rollers, the lower one of which is revolving in a trough of size.

The name is taken from the French "mouiller," meaning "to saturate."

After the spraying, the goods, being damp, are rolled up with dry, hot paper, which dries the fabric but dampens the paper. This is where the paper-drying machine comes in, which dries out the paper and puts it in shape for use again.

The spraying fills the air with a gummy vapor, and this process is, therefore, usually carried on in a room partitioned off. In this room a waterproof floor is needed, and provision has to be made for keeping the room pretty clear of steam.

On account of the all-pervading gum, the ventilating and drainage of the spray room are often quite difficult to arrange satisfactorily.

The goods, if gummed, after having been unrolled from the paper they are wound up with, will be found to be stiff and papery. To soften them, without robbing them of the dressing they have absorbed, is the function of the button breaker. The knife breaker accomplishes a similar object, and it also has a polishing effect on the fabric, but strips it of rather more dressing than does the button breaker.

An excellent breaker, of recent design, is one in which the cloth passes between bars having deep spiral flutings (alternately right and left), which produce a breaking effect similar to the old fashioned hand breaking.

Goods with plenty of silk in them are not usually much gummed, unless the fashion of the day demands some unnatural stiffness, or unless the weave be of a character where the threads are liable to slip, as gumming them would help to prevent this. The cheaper grades of goods are generally well sized, and this added thickness and stiffness serves to make them satisfactory for uses where otherwise they would not be acceptable. While it is necessary to add to the body of many goods by sizing them, so as to give a commercial article at a low price, yet the gumming generally detracts from the lustre and silkiness of the cloth.

Silk goods also, are readily softened by heat and by pressure, and for these purposes cylindering machines, tuiles, calenders, presses, etc., are employed.

The effect of heat and pressure is to make the fabric softer and more lustrous, but at the same time it loses much of its apparent fulness or hand. Cloths with plenty of silk in them can stand this and be greatly helped by it, but for poor or thin cloths it would not do, as it would make them too flimsy.

In the calenders, the goods are squeezed between ponderous rollers of metal or paper, some of which rollers can be heated if desired. The movement of the rollers can be so arranged, if required, that a friction, or rubbing, can be given to the goods as they pass through.

In the cylindering process, the cloth is run over hollow metal cylinders, either hot or cold, thus acquiring an added smoothness or lustre.

There are machines with a combination of friction bars, heated cylinders, steam jets, and expanding rollers, specially designed for removing wrinkles and smoothing and lustreing the goods, which are known as smoothing machines.

The "tuile" imparts the same finish as a hot ironing. Its main feature is a hollow steel cylinder, steam heated, enclosed in a specially

woven blanket cover, and which revolves in a sort of iron cradle or hollow (being the upper part of the hollow base of the machine), which also is heated from the inside by steam.

The cylinder carries the fabric with it, and irons it against the polished surface of the hollow, or cradle, in which it rests.

Tuile is the French word for tile, or the hollow gutter tile, suggestive of the deep hollow in which the blanketed cylinder revolves.

Everyone is familiar with the hydraulic press, its ponderous character, the enormous power it exerts, and its hollow, steam-heated plates. Such a machine needs a very solid foundation, and is usually erected on a basement floor, though it may pass up through the floor above. If put on any floor above the basement, most substantial support must be provided.

Goods in such a press can be given either a hot or cold treatment. The advantage which such presses are believed by many to possess, over any machines of a rotary character, is that the goods can remain under pressure for such a length of time that the finish given acquires a permanence that it might otherwise not attain.

Screw presses, driven by power, can also be used and are fairly effective if well mounted, but the hydraulic press is much the best. Calenders and presses, be it noted, are not only very heavy, but are very expensive machines.

For umbrella silks, good polishing is necessary, and, in fact, it improves nearly all fabrics. The machines which give the best results in this work are expensive, and the older types take up considerable room and give a very limited output.

Some polishing machines of recent construction are much more economical of space, and will give a very satisfactory output of well polished goods, 2,000 yards a day, of certain fabrics, being polished.

To some fabrics, a fairly satisfactory polish can be given by a steel blade or edge, set where the reed should be in a loom, and over which the goods are passed, back downwards, while the machine runs at high speed.

Cotton-back satins require a special treatment for filling up the backs and making them firm and smooth. This entails, among other apparatus, the use of a dryer which takes up much space and uses considerable steam.

The application of the heavy dressing to the backs of these goods is known as "en règle" finishing. Règle is French for "rule," and the reference is to the scraper or rule which, by the height at which it is set, governs the amount of the finish that is to be imparted to the goods.

Some goods, on account of their hairy character, require to be singed, a process with some drawbacks to it, and which must be regarded as a necessary evil and to be avoided if possible. A good type of gas singeing machine will be needed for this purpose.

Another machine that properly belongs in the finishing room is the tentering frame. This is used for the drying, and holding out to a fixed width, of goods that have been piece dyed and which are still in a damp state. It is principally employed for thin and stretchy fabrics, such as crêpes, chiffons, grenadines, etc., but other firmer and heavier goods, that are commonly dried on heated cylinders or between steam coils, can be finished on the tentering frame to the decided improvement of their appearance.

In their larger sizes these machines will be 60 to 90 feet long, are driven by special engines, and have automatic clamps, the cost of one being from $3,000 to $6,000. They have the advantage of a large output at a low labor cost, but only a very big product to be handled would justify the installation of such a machine.

Moiréing and Embossing.

The moiréing, or watering, of silk is an important branch of the business. Various sorts of calenders and presses are used in this work, and numerous devices are employed to produce the different moiré effects that are demanded from time to time. Those who intend to bring out moiré fabrics, when they may come into fashion, must equip themselves with the proper outfit well in advance (for it takes time to provide it), and, if they wait till the goods are wanted, the fashion will be out again before they can get ready.

There is also the process known as embossing, for impressing small pattern effects on the surface of goods by passing them, under pressure and with heat, between suitably engraved rollers. This process is sometimes applied to soft, thin goods, and also to velvets, though not many silk goods are treated in this fashion.

Special treatments of various kinds have to be employed from time to time to get particular effects on one or the other of the multitude of silk fabrics.

A good railway sewing machine is needed. Also a brushing machine, and a folding and measuring machine. A large number of wooden rollers and iron mandrels have also to be provided.

Supplies Required.

For a finishing plant, the sum invested in the stock of supplies is not very considerable, as the commodities used are not high priced. The stock will consist of a large number of rolls of finishing paper, a few barrels of glue and other sizing materials, and a stock, cut to the exact sizes needed, of the white paper for the inside, and the buff-and-white paper for the outside, in which the pieces are to be put up. The other supplies required are of a minor nature. Such paper as is needed can be bought at from three to six cents a pound, and the glue will cost from ten to fifteen cents a pound.

Analysis of Costs.

It is very seldom that, in private finishing departments, any reliable information can be produced as to the actual costs of the different processes, or the cost of treating different fabrics.

The following figures, showing the amount and cost of the supplies only, used in finishing 19 inch plain taffetas, were prepared by the writer some years ago, and may be of interest in this connection.

SUPPLIES USED IN THE FINISHING OF 100 PIECES OF 19 INCH TAFFETA.

Sizing material.	16.80 lbs. Glue @ 10c.	$1.6800
	8.00 lbs. Glycerine @ 16c.	1.2800
	2.40 lbs. Olive Oil @ 25c.	.6000
Cotton sewing thread (7,200 yds. per lb.), 195 yards=195/7200 lbs. @ $1.00.		.0270
Green Stitching Cotton, 2/4's, mercerized, 22.2 yards = 1/76 lbs. @ 80c.		.0106
100 Sheets, 18½ x 36, Inside white book paper, = 13¾ lbs. @ 5¾c.		.7906
100 Sheets, 19¼ x 24, Outside buff-and-white paper, = 25 7/16 lbs. @ 4½ c.		1.1460
150 Yds. Red Tape, @ $2.50 per 1,000 yds.		.3750
	Total	$5.9092

There is also something to be added for wear and tear of finishing paper, lap cloths, etc., and for water used for size, steam, and spray-room cleaning, as well as for the gas used in the calendering, and also something for transportation charges on the supplies.

The additions will bring the cost up to a trifle over 6 cents per piece.

Expenditures made in connection with such matters as power, heating and lighting, could hardly be segregated for such a calculation.

Floor Space and Power Needed.

The floor space needed for a finishing plant is not excessive. It should be very well lighted both naturally and artificially. Four to five thousand square feet of area should be sufficient space to house a good plant suitable for finishing the product of from 500 to, perhaps, 1,000 broad silk looms, unless the output was of so diverse a character as to make a large variety of special machinery necessary.

The aggregate power that is annually consumed in a finishing plant is not large, as not many of the various machines will be in operation at the same time. Few of them, excepting calenders and presses, require very much power to drive them. In spite of this, it is necessary to provide such a sufficient supply of power that, if most of the machines were in operation at once, there would be enough to go round. A unit

of from 20 to 30 horse-power would probably be sufficiently large, under any ordinary circumstances, to provide for the necessary power for such a plant as referred to above.

Pipe connections, in various parts of the room, must be made for water, steam, gas, etc., and gas is often very freely used.

Necessary Equipment and Its Cost.

The cost of machinery equipment will vary widely. Should a mill, even a large one, be producing only goods of a simple and uniform character—fabrics, for example, that might only require gumming and breaking—then a very small amount of machinery would suffice; but should the product embrace a large variety of cloths, each needing some special treatment, it would follow that a whole lot of machines would be absolutely necessary.

An individual manufacturer who finishes his own goods has, in this respect, an advantage over the job finisher, for, while the former has only to provide the exact number, kind, and width of machines needed to handle his own products, the latter has got to be prepared at all times to finish any and all kinds of goods that may be sent to him, and, consequently, he requires to have a much more diversified plant, and to employ an unduly large staff with a consequent loss in the cost of the labor.

The cost of the finishing machinery for a mill with 500 to 1,000 looms, might amount to between $6,000 and $15,000, according to the nature of the work to be done, and provision would also have to be made for the transmission machinery, piping, blowers, ventilators, etc., and the small equipment—scales, measures, and so forth.

The Kind of Foreman Needed.

The foreman must be a man with good experience, and he should have both intelligence and judgment. He should be able to convey clearly his ideas and instructions to his assistants. Unless the plant is a very large and busy one, there is nothing to prevent his doing his full share of the manual work of the department by running a machine as the occasion requires.

When the goods come each day to the room to be finished, he should inspect them, or oversee their inspection, and should have them separated into groups such as light, average, and heavy, and he will then issue the necessary instructions as to the treatment to be accorded each group. One of the principal aims in good finishing is to correct, as far as possible, the unavoidable differences in the pieces as they come from the looms, reducing somewhat the "hand" of those that are too heavy, and bringing up the weight of the light ones, and so securing a good degree of uniformity in the finished product. As the goods are being finished, the foreman must follow them up to see that they correspond closely to the standard samples to which he is working.

Overhead Charges.

At the moderate rates charged by the commission finishers, it is apparent that a mill must be of fair size to warrant it in expecting to do its own work more cheaply, as, outside of the sinking of capital in the plant, there is the cost of the interest on same, the depreciation, rental value of space occupied, and salary of foreman, all of which amount to quite a charge on the business, and which goes right on whether the mill be running slack or not. When these, and other fixed charges, are added to the labor and expenses directly applied to the goods, it will generally be found that, for a medium to small sized mill, there is no profit, but rather a loss, in running such a plant.

As to where the dividing line comes, the opinion seems to prevail among broad silk manufacturers that, for plants of about 300 looms or less, there is little or no saving to be made in doing one's own finishing, and that it is then better to have this work done outside by a public finisher. From about 400 looms and upward the case is different, as the unit cost for fixed charges is then greatly reduced.

In installing the plant, the manufacturer will provide machinery that will finish the bulk of the fabrics he produces, and such occasional lines of goods as he may make that require special or difficult treatment, and of which the quantity is not large, he will have done outside.

Advantages Over the Commission Finisher.

The job finisher, in his general expense, has to include a large number of items that are already carried by any manufacturer contemplating doing his own finishing. He must provide for partners' salaries, bad debts, for a wagon delivery service, for his business office and its expenses and for the salaries of the clerks, for one or more outside men or salesmen, and, of course, he also properly expects to make a profit on his work.

These many and heavy expenses should all be saved when a mill does its own finishing, and, if the plant is large and the output full and steady, the manufacturer may reasonably count that, with good management, and an experienced man in charge, he can cut the costs of his finishing from one-third to one-half by doing it himself.

Other Advantages in Mill Finishing.

He may also look forward to having his goods finished more quickly, and to the facilities which he will have for the speedy getting out of samples, sample pieces, and hurry orders, advantages of moment if realized.

In addition, he can have a personal knowledge of the treatment his different fabrics are receiving, and has also the assurance that there is no chance of any special styles or fabrics that he is working on becoming public property before he has fairly got them on the market himself.

Character of Finish and Its Importance.

I have reserved till the last the discussion of the most important question of all, a question beside which the nominal cost of the finishing sinks into insignificance, and that is, the character of the finish obtained.

Good finishing department managers are very, very scarce, and about the only thing open for a manufacturer to do is to take a chance on some one and try him out, and then keep on trying till he gets a good man, if, indeed, he ever gets one.

This is an expensive experience to have to go through, and, if he begins by hiring away from some one else a man of acknowledged standing, he would have to pay a much higher price than his business would warrant.

It goes without saying that the big commission finishers, who must have the best men, do have them and are able and willing to pay them high prices, and do not let them get away from them.

The public finisher also, knowing the latest market requirements, can turn out the finishes desired as soon as they are called for, and without expensive delays for experimenting.

These difficulties have induced different manufacturers, who had installed their own finishing departments, but who constantly found themselves outclassed by the work of the public finishers, to abandon them.

The difference between a first class finish and an inferior one will readily mean a difference of 10 per cent. in the selling price of the goods, and what figure does a saving of half-a-cent a yard, in the cost of the work, cut in comparison with this?

Let the Specialist Do the Finishing.

Any one contemplating doing his own finishing may well consider whether the money that he would have to invest in the plant would not bring him in a better return if expended for looms, instead of plunging into a branch of the business that he has no knowledge of, saddling himself with the constant burden of finishing problems and difficulties, and, above all, running a serious risk of having his goods so indifferently finished as not to command the market price that they otherwise should.

Finishers' Price Lists.

The large finishing establishments publish, from time to time, printed price lists of their charges. As it may be of interest, I am presenting herewith one of the price lists current at this writing—January, 1913. It may be said, however, that large customers often get material reductions from such printed prices if their business, on particular articles, is so considerable as to be attractive.

FINISHERS' PRICE LIST

Class of Goods	Width	Price
Surrah	36″ and 40″	1½ Cents
"	26″ and 27″	1¼ "
"	18″ and 20″	1 "
Satin Brocade Dress goods S. Lining	20″	1½ "
" " " " "	27″	1¾ "
" " " " "	36″	2 "
Gros Grain	36″ and 40″	1¾ "
" "	27″	1¼ "
" "	20″	1 "
Foulard	36″ and 44	2 "
"	24″ and 26″	1½ "
" Waterproof	42″ and 44″	3 "
" "	36″	2½ "
" "	24″ and 26″	2 "
Tie Silk (Crefeld Fin.)	36″ and 40″	3 "
" " " "	24″	2½ "
" " All Silk	36″	2 "
" " " "	24″	1½ "
Fold and Paper per piece		25 "
Tissue Paper	36″ and 40″	½ "
" "	19″ and 26″	¼ "
Rubbing only		1 "
Singeing only		1 "
Napping	over 50″	20 "
"	42″ and 44″	15 "
"	36″ and less	10 "
Moire Velours	18″ and 22″	4 "
" "	24″	5 "
" "	26″ and 27″	6 "
" "	36″	8 "
" "	44″	10 "
Antique Velours	18″ and 22″	6 "
" "	24″	7 "
" "	26″ and 27″	8 "
" "	36″	10 "
" "	44″	12 "
Moire Française	18″	5 "
" "	24″	6 "
" "	27″	7 "
" "	36″	10 "
Moire Reserve (Pekin)	18″ to 24″	12 "
Moire Antique (All Silk)	18″ to 24″	10 "
" " " "	24″ to 30″	12 "
" " " "	36″	15 "
" " " "	44″	20 "
Louisine Moire. Moire Soliel	20″ to 24″	10 "

For framing goods ½c per yard will be charged.

An extra charge for Doubling and rolling on boards or rollers will be made.

No freight, express charges or discount will be allowed.

(OVER)

(CONTINUED) FINISHERS' PRICE LIST

Class of Goods	Width	Price
Cotton-Back	40″ and 42″	3½ Cents
"	36″	3 "
"	27″ and 30″	2¼ "
"	20″ and 22″	1¾ "
"	27″ and 30″ Slipper Satin Furback Finish—½c extra.	3 "
Lining	30″	2 "
Sleeve Lining	40″	3 "
Knee Silk Lining	9″	1 "
Chiffon Taffeta	36″ and 40″	1½ "
" "	26″ and 27″	1¼ "
" "	20″	1 "
Stripe or Fancy Taffeta	36″	1½ "
Fancy Taffeta	20″ and 26″	1¼ "
Millinery Taffeta	36″	1⅛ "
" "	19″ and 27″	1 "
Reg. Taffeta	36″	1¼ "
" "	20″ and 27″	1 "
Umbrella Taffeta	48″	3 "
" "	36″	2 "
" "	24″	1½ "
Messalines	42″	2 "
"	36″	1½ "
"	26″ and 27″	1¼ "
"	18″ and 20″	1 "
Duchess	36″ and 40″	2 "
"	26″ and 27″	1½ "
"	18″ and 20″	1 "
Peau de Cygne	36″ and 40	1½ "
"	26″ and 27″	1¼ "
"	18″ and 20″	1 "
Peau de Soie	36″ and 40″	1½ "
"	26″ and 27″	1¼ "
"	18″ and 20″	1 "
Satin Majestic	36″ and 40″	2 "
" "	26″ and 27″	1½ "
" "	18″ and 20″	1 "
Armure	36″ and 40″	2 "
"	26″ and 27″	1½ "
"	18″ and 20″	1 "
Faille	36″ and 40″	2 "
"	26″ and 27″	1½ "
"	18″ and 20″	1 "
Bengaline	36″ and 40″	2½ "
"	26″ and 27″	2 "
"	19″ and 21″	1¼ "
Tussah	36″ and 40″	2 "
"	26″ and 27″	1½ "

X

SHOULD A MILL DO ITS OWN DYEING?

When silk mills are small, or of moderate size, no thought of operating a dye-house comes into the minds of the owners, who are only too glad to avail themselves of the excellent dyeing facilities, and reasonable prices, afforded by the commission dyers.

With increasing size, and with keener competition to meet, which necessitates constant study as to how savings can be effected, many manufacturers will begin to consider this possibility.

They observe the great and steady growth of certain large dyeing firms, and see the huge establishments that they conduct, and are thus apt to believe that there is a large profit in the prices that they pay them for their dyeing, though really the net profits may be relatively very small.

What a Manufacturer Expects to Gain.

Without any real data to guide him, a manufacturer may jump at the conclusion that he could save 20 to 40 per cent. of his dyeing bills by doing the work himself.

He argues that a large part of the general expense, which the dyer has to charge on his costs, is already paid for in his own organization. There will need to be no provision for partners' salaries, bad debts, soliciting business, or for office management, with but little for transportation, and that a host of smaller expenses, from subscribing to local charities to watering the streets, will have already been provided for.

He may also call to mind, over the years of his experience, work done by the dyer that has been unsatisfactory, and he may recollect many lots that were shady, off-color, "sticky," hairy, streaky, tender, irregularly weighted, weighted above or below the weighting ordered,

of slow or late delivery, poor color matches, damaged skeins, mixed silk, or what not.

All of these drawbacks he believes he can overcome if he has his own dye-works, and he also thinks of the convenience of having a dye-house on the premises, where he can have orders quickly and exactly filled, give such special instructions as he may desire, and get out any needed sample lots in short order.

Volume of His Dyeing Bills.

His dyeing bills may have been large. Supposing that he has a plant of 500 looms, and is working exclusively on skein-dyed silk, he might dye up, approximately, 100,000 pounds of thrown silk per year, which would probably be dyed in a variety of weightings, but most largely in 16/18 oz., bright, for organzine, and 22/24 oz., bright, for tram, in colors.

Presuming these weightings to represent the average of his uses, and allowing that half of the silk used was tram and half organzine, we can approximate what the amount of his dyeing bills would be.

The 50,000 pounds of organzine, weighted to 16/18 oz. in colors, would be charged for at the list price of 60 cents a pound, amounting to $30,000.00. The same amount of colored tram, weighted to 22/24 oz., and listed at $1.05 per pound, would amount to $52,500.00, making a total dyeing bill for the year of $82,500.00, at list prices.

Customary Discounts.

A discount from the list prices is usually allowed by the dyers, which may vary according to the standing of the customer, the volume of his business, and whether his orders are in fairly large lots or in a multiplicity of small ones.

For good customers, this discount may be, say, 10 per cent. on colors and 15 per cent. on blacks. Certain dyeing charges, such as those for fast alizarine dye, ombré or shaded dye, moiré finish, steam stretching, or extra lustre, may be charged for net, without discount.

Houses using great quantities of some few particular weightings, such, for instance, as are ordered by certain firms that specialize in black silks, may have some further reduction made to them.

Dyers' Price Lists.

It may here be noted that a dyer's price list by no means represents the relative cost to him of the various dyes and weightings. It just grew up, and convenient gradations were made, from one weighting to another, by the different dyers, in which the measure of the cost was modified by the willingness of the customers to pay. Different dyers had somewhat different lists, but they finally got together and united on one uniform price list, which has since formed the basis of practically all the skein-silk dyeing transactions. Some of these list prices are regarded by the dyers as very profitless, others are more than satis-

SKEIN DYERS' PRICE LIST

COLORS

Boil-off, ordinary, per lb	$ .12
Boil-off, scroupe	.15
P. D. Brights, 10 lbs. or over	.20
P. D. Brights, less than 10 lbs	25
14-16 Tannin Weighted Brights	.45

TIN WEIGHTED
Brights and Souples

14-16	$ .50
16-18	.60
18-20	.75
20-22	.90
22-24	1.05
24-26	1.25
26-28	1.40
28-30	1.55
30-32	1.70

TIN WEIGHTED TWIST

30-32	$1.70
32-34	1.90
34-36	2.10
36-38	2.40

UMBRELLA DYES
Brights and Souples

P. D.	$ .50
14-16	.60
16-18	.70
18-20	.85
20-22	1.00
22-24	1.15
24-25	1.35
26-28	1.50
28-30	1 65

TAILORING AND HATBAND DYES

P. D. Brights	$ .50
14-16 "	.65
P. D. Souples	.50
18-20 "	.65
20-22 "	.75
22-24 "	.90

SOUPLES

P. D.	$ .25
16-18 Sugar Weighted	.35
16-18 Tannin Weighted	.35
18-20	.45
20-22	.55
22-24	.75
24-26	.90
26-28	1.10
28-30	1 25

TUSSAH

Boil-off	$ .20
Colors	.50
Colors, full bleached	.75

VELVET DYES

Spun or Schappe	$ .35
Extra for bleaching	.15

OMBRES

5 shades	$ .75
5-10 "	1.00
10-15 "	1.25
15-20 "	1.50
20-30 "	1.75
30-40 "	2.00

OMBRES WEIGHTED

14-16 Extra per lb	$ .25
16-18 " " "	.35

ALIZARINE DYES

10 lbs. or over	$ 1.25
Less than 10 lbs	1.40
MOIRE FINISH, extra per lb	.10
Steam Stretching	.05
Extra Brilliant, or Metallic	.10

BLACKS

Hard or Gum, per lb	$ .40

BRIGHTS

P. D	$ .45
14-16	.50
16-18	.60
18-20	.70
20-22	.80
22-24	.95
24-26	1.10
26-28	1.20
28 30	1.30
30-32	1.40
32-34	1.50
34-36	1.60
36-40	1.80
40-44	2.00

SPUN AND SCHAPPE

P. D.	$ .45
16-18	.50
18-20	.60
20-22	.70
22-24	.85
24-26	1.00
26-28	1.10
28-30	1.20
30-32	1.30
32-36	1.40
36-40	1.60

SPUN AND SILK TWIST
"SPECIAL BLACK"

28-30	$1.70
30-32	1.85
32-36	2.00
36-40	2.25
40-45	2.50
45-50	2.75

TUSSAH

P. D.	$ .45
16-18 Special Blue Black	.75

ORGANZINE

Double Dye, extra per pound	$ .15
Triple Dye, " " "	.25

TAILORING DYES
ACID AND BURNING TEST

P. D. Bright	$ .45
14-16	.60
P. D. Souple	.50
16-18 "	.60
18-20 "	.70
20-22 "	.80
22-24 "	.90

UMBRELLA DYES

Bright, extra per lb	$ .10
Souple, " " "	.15

MOIRE FINISH

Bright, extra per lb	$ .10
Souple, " " "	.25
Steam stretching per lb	.05
Extra Brilliant or Metallic	.10

SOUPLES

P. D	$ .45
18-20	.50
20-22	.60
22-26	.80
26-28	.90
28-30	1.00
30-32	1.05
32-36	1.20
36-40	1.40
40-44	1.60
44-48	1.80
48-50	1.90
50-56	2.25
56-60	2.50

TERMS—30 days net or 1 per cent. discount for cash within 10 days.

factory; the average, however, is what they consider, and that average is fairly profitable.

The skein-dye price list which is presented here is one issued by one of the great silk dyers, under date of June 1st, 1912:

So far as the public knows, each dyer can make what discounts he pleases from the list, and everyone would be interested to know just what discounts his competitors were actually receiving, but probably few receive appreciably better terms than the percentages above quoted.

Allowing that our manufacturer enjoys this 10% discount, his dyeing bill would then be $82,500.00, less $8,250.00, or $74,500.00 net a year. If, therefore, he argues that he should make a profit of, say, 30 per cent. by doing his own dyeing, amounting to the tidy sum of $22,375.00 on the above business, he is very likely to decide that he should put in his own dyeing plant, and may begin forthwith to cast about for a suitable man to take charge of it.

Whatever man he might consult would probably be interested in getting the position, and would be very likely to overstate the possible profits and to minimize the drawbacks, and, as to the ultimate amount of the total necessary investment for plant and other expenses, and as to the actual annual charge of conducting the business, such a man might have very incorrect ideas.

Location for a Dye-house.

Supposing that the manufacturer concludes to go ahead with the project, the first question, of course, is where to locate the dye-house. He may have expected to have it built on land adjoining his mill, but he will find at once that the question of water is the principal and dominating factor. He must have a bountiful supply of water, of a suitable character, procurable at little or no cost—except for the pumping, etc.—and the amount required in silk dyeing is unbelievable.

Importance of the Water Question.

From time immemorial dyers have settled in certain favored localities where the water was of a superior character, and to this day the excellence of the work produced at many such places is largely attributed to the water.

While modern methods of water rectification have reached high efficiency, yet, none the less, a full supply of suitable water is a sine qua non. If such a supply is to be found where the mill is located, or can be conducted to it from a distance without too great expense, the problem will be much simplified, but this is unlikely to be the case, and the manufacturer must look further afield for a location.

When finally selected, it may be on the margin of a lake, pond or stream, and, in connection with such natural supply, he is pretty sure of having to sink numerous wells, then or later, either to supplement the ordinary available flow, or as a reserve at times of low water.

In case the water to be found at short distances below the surface is pure and suitable, these wells need not be deep, but if this upper flow is unsuitable, then expensive deep wells may have to be sunk. Deep well pumps, too, are sometimes very troublesome to keep in order, so it may be well to raise the water by pneumatic pressure, which is a method now much used.

Impurities in Water.

In connection with the water supply, extensive tanks or cisterns in which to permit the water to settle, when rains have made it turbid, are often provided. There may also be tankage needed in which to chemically treat waters that contain undesirable matters in solution, and filtering facilities may have to be provided on a large scale.

The suspended matter in the water may be either organic or mineral. Among the mineral elements frequently found in water are silica, alumina, oxide of iron, lime, magnesia, potash, soda, sulphuric acid (in the form of sulphates of lime, etc.), chlorine, calcium carbonate, and carbonic acid, free, as well as combined in bicarbonates, etc.

The presence of elements such as the above in the water, in appreciable quantity, may cause much trouble to the dyers, and means must often be employed for neutralizing them. Constant tests are necessary of the waters being used, as their condition frequently changes.

Hardness of water is due principally to its containing salts of lime and magnesia, which, in conjunction with the fatty acids of soaps, form insoluble stearates, palmitates, oleates, etc., which are extremely objectionable.

Land, Buildings, Etc.

Considerable land is required for dye-works' purposes, as a variety of buildings are necessary, mostly one-storied, and there should be railway trackage into the property, and considerable yard room for handling wagons and teams. Ample coal storage space is a requisite, and there should be proper stabling accommodations, and suitable and commodious storage houses for the various acids, mordanting or weighting materials, coloring substances, and chemicals, so largely required in dyeing operations, with proper arrangements for handling them mechanically, as far as possible.

Then, there are the dye-houses proper, and a different dye-house is usually provided for the black dyeing. The boiling-off, or stripping, of the silk may be done in a separate building, or in a wing of the color dye-house.

Power and Steam Required.

The boilers, engines, and pumps must be housed in still other buildings, and, while the power required is moderate, the demands on the boilers are excessive. Steam, everywhere, is needed in immense volume, and the boiler plant, and the piping connected therewith, will cost much money.

It is desirable that only anthracite coal be employed as fuel, as the sooty smoke from bituminous coal would injuriously affect any light colored silk with which it might come in contact.

The Operations of Skein Dyeing.

It may be convenient to describe here briefly what the usual operations are in skein dyeing, without attempting to go much into detail.

Before the silk is sent to the dyer, it is thrown or twisted, and the thrown silk reaches the dyer in bundles, usually weighing about 20 pounds. The dyer stores the silk until the manufacturer orders it dyed. The dyeing ordered may be pure-dye or weighted, bright or souple, color or black, etc.

Raw-silk contains a natural gum, averaging, in the case of different Asiatic silks, from about 18 to 22 per cent. of its weight, and for European yellow silk from about 22 to 26 per cent. During the throwing process, certain additions of solube soap and oil are made to the weight of the silk, usually aggregating from 2 to 5 per cent.

After the opening up of the bundles, and the weighing or counting out of the quantity of silk to be dyed, the first operation in dyeing consists in the "boiling-off" of this soluble gum, soap, and oil, the process being also known as "stripping."

This is effected by working the skeins for an hour or two in a hot bath, in which olive-oil soap has been dissolved. A second bath may also be used, the second bath of one lot being made the first bath for the next lot. The silk, after having been thus processed and rinsed, is brilliant in appearance and of a light creamy color, and is known as boiled-off silk. If the silk is for whites, it may be treated in three baths, and put through a bleaching process in addition.

Should the silk have been ordered "pure-dye," it is immediately passed on to a vat in which the necessary mordants and coloring matters have been dissolved, and, after being colored in this, has no more wet processes to go through.

If weighting has been ordered, it is necessary to add the loading to the boiled-off silk before the coloring is done.

Silk has the capacity for absorbing and retaining considerable amounts of various substances which are used for giving to it added bulk and weight, and when these agents have been employed the silk is said to have been weighted.

Various Weighting Agents.

Some, which have been largely employed at various times, are sugar, tannins of different sorts—gall, sumac, gambier, etc.—and salts of various metals—tin, lead, iron, aluminium, etc. At the present time, the salt of tin known as stannic chloride is greatly used in the weighting of silk that is to be dyed into colors, and an iron base is used in preparing the blue-black shade of black silk so generally used.

The tin liquor used in weighting is expensive, and care must be exercised not to waste any, and to recover all possible from that which has been used. It is prepared by dissolving tin metal, in granulated form, in a solution of muriatic acid, dangerous hydrochloric acid gases being given off during the process, for the carrying away of which special arrangements must be provided. The resulting solution is colorless, except for the possible suggestion of a greenish tinge. The vats in which it is used have to be lined with lead, and the workmen who are in attendance use india-rubber gloves. This weighting agent can be bought in fluid form or in the form of crystals, soluble in water, but the big dyers prepare it for themselves.

Loading the Silk.

For each two ounces of weighting, the silk is given one pass through a tin bath. That is, when the boiled-off silk skeins are entered into the bath, and worked for the proper time, the 12 or 13 ounces of boiled-off silk remaining from the pound of thrown silk absorb about two ounces of the tin salt, which would then be known as 14 oz. weighting, the weighted silk still being without color.

The silk is removed from the tin bath and wrung out, generally being whizzed in a hydro-extractor lined with hard rubber, and the expressed liquor is recovered and pumped back for further use.

Then the skeins are washed, a good form of washing machine being one in which the silk is held at a stretch between two sets of perforated porcelain rollers, which are made to revolve slowly, and, while thus held, water is squirted through the skeins from the perforated rollers as well as being squirted against the skeins from other sources. The washing is most thorough, perfect rivers of water flowing through and over the skeins, the washing assisting in fixing the tin salt in the fibre, as well as preparing the silk for the next operation.

Insufficient or faulty washing is the cause of much of the trouble that is experienced at times with weighted silks, for if, after the processes are finally completed, any free acid remain in the fibre, it will not take long for the silk to rot. When a dyer has not great quantities of water at his command, or when his water costs him appreciably, there is always a temptation to slight this washing, with a consequent risk of trouble for his customer.

After the washing, the silk is wrung out and then entered in a bath of phosphate of soda. This treatment makes the silk once more receptive to the tin, and, after another washing, it is once more treated to a tin bath, taking on two ounces more of the metal and becoming now 14/16 oz. weight.

Thus, alternate baths of tin and soda are employed, with thorough washings between, and the weight is raised 2 ounces at a time to 16/18, 18/20, 20/22, 22/24 oz., etc.

The limit of this weighting is determined by how much mechanical

stress or injury the silk can stand in the enormous amount of working that it experiences in these continued processes, as well as by the proportion that the weighting bears to the fibre. If this is too great, the silk may be injured or destroyed, either at the time of dyeing or by subsequent deterioration of the fibre.

Weightings of 14/16 oz. for organzine, and 20/22 oz. for tram, in colors, are, in the opinion of the writer, about as high as should be gone to if goods are to stay sound on the shelf and in the garment, for a proper period of time. Higher weightings than these are universally used, but to the disadvantage of the silk.

As the mordants used for blacks are of a different and less destructive character, much higher weightings can there be got.

This whole matter of weighting silk is a high-class chemical and mechanical art, and requires the most complete equipment, and the most experienced and conscientious management, if it is to be properly done.

Other treatments, and additional weighting agents, are also employed in connection with the above described processes, but it is not necessary to go into them here. The tin and phosphate dips can also be given by the use of hydro-extractors instead of vats, with much advantage in the matter of cost and time, and lessening also the stress upon the silk.

Special Dyeing Operations.

Silk from which all of the gum has been discharged is designated as "bright." In dyeing "souple" silk, the major portion of the gum is allowed to remain on the fibre, which consequently gives it greater firmness, and silk treated in this way has a characteristic touch, and has much less lustre than the "bright" silk.

In ombré dyeing, a series of graduated shades of the same color is dyed, so that shaded effects can be produced. This work requires nice management to get the proper graduations, which may number from 5 to 40. Fast dyes are made from alizarine colors, which are expensive, and the silk is not weighted.

In the dyeing of blue-black, the mordanting agents used increase the weight considerably, the 12/13 ounces of boiled-off silk finishing up on the first treatment as 16 oz., and such silk is frequently represented as being pure-dye, because the color cannot be produced in any other way. Be this as it may, a pure-dye silk should be pure silk fibre, plus a negligible weight of coloring matter, and if silk has had added to it 4 ounces in the pound, of iron, it is certainly a loaded silk, whether the weighting has been added to it incidentally or intentionally.

Special dyes are prepared for special purposes, and dyes for umbrella silks, linings, hat bands, velvets, tailoring purposes, etc., etc., are regularly produced. Many classes of dye-stuffs must be employed, according to the colors wanted, and the conditions to be met, and a dyer, to be abreast of the times, must be a high-class chemist and colorist.

Coloring and Finishing.

After the weighting comes the coloring of the weighted silk, and the washing off and brightening of it. Where silk has been much worked, as in the case of heavily weighted blacks, it is apt to be harsh and dull, and a bath with oil and soap may be employed to render it supple and lustrous. The drying follows, which must be carefully and judiciously done.

Other processes, having for their object the smoothing out and stretching of the skeins, and bringing up the lustre of the silk, are steam-stretching, lustreing, stringing, etc., after which the skeins are twisted into rolls, carefully bundled and packed, and are ready for shipping.

Bleaching.

When silk is to be dyed in light shades, or white, a bleaching process may be necessary. For this purpose, specially constructed brick chambers must be provided, in which the silk is exposed to the fumes of burning sulphur. A better and more permanent bleach is produced by the use of the peroxides of hydrogen and sodium, but these processes are very much more expensive than the sulphur bleaching.

Dye-House Equipment.

The equipment of the dye-houses will include endless tubs and vats of copper, or of wood with copper or canvas lining, no iron being allowed to come in contact with the liquors. Lead-lined vats are needed for the tin liquors, and a large quantity of copper vessels and utensils must be supplied.

To the vats will be carried, through suitable pipes, water, steam, boil-off liquors, or mordants, as required, and ample sewerage will be needed. Floors should be of special construction, channelled to drain off waste waters quickly, and covered by suitable gratings. Ventilation is important, and special arrangements for keeping the dye-houses clear of steam are desirable.

In the power transmission, belts should be avoided where subject to damage from dampness and steam.

Sewerage Difficulties.

The question of sewerage is one of steadily growing importance. Year by year the objection on the part of the authorities to permitting dye-house wastes to run off into water courses is becoming more pronounced. It seems only a question of time till the burden of disposing, in some other way, of their waste waters will be thrown upon the dyers, and it will mean a serious additional expense to their business.

Color Matching, and Lighting.

Good lighting is imperative, and, where color matching is done, any artificial light used should approach as near to the quality of day-

light as possible. A special room for color matching is needed, so arranged as not to be subject to the influence of any reflected light. Sometimes such rooms, and everything in them, are covered with black cloth, and lighted by a skylight in the roof so as to avoid any trouble from reflected light.

Other Facilities Needed.

The drying room must be of such construction and arrangement that the process proceeds with precision and regularity, as irregular drying will affect the colors.

There must be a first-class laboratory, provided with every kind of equipment for testing and experimenting.

Vats for the storage of liquors, and pumps for circulating them will be needed.

How Soap is Handled.

Soap is used on a large scale and the big establishments make their own, and this entails much tankage, and a considerable number of containers on trucks, into which the liquid soap is run to solidify, and, after it solidifies, the sides and ends of the containers can be removed and the soap cut up in bars and stored away to dry.

The waste soap can also be recovered and worked up again, and, though it is dark and streaked with all sorts of colors, it can be used for blacks.

Recovery of Tin.

In great dye works, the waste waters from the washing machines, containing some of the tin, are led into a series of underground cisterns, where the tin is precipitated with lime, and the precipitate is then dried, and, by smelting it, the tin is recovered and used over again. Such economies are not practicable except for very large concerns.

A fire-proof silk vault is a requisite, and ample space must be allowed for the receiving and shipping of the silk.

Special Machines.

The labor of turning silk by hand is considerable, and there are many machines that do this work satisfactorily, but they are rather infrequently used in silk dye-houses.

Special machinery, also, is built for dyeing cotton in skeins and in cops. Many of the other machines needed have already been referred to, among them being the hydro-extractors, of which a number will be required.

Methods of Water Extraction.

Water may be mechanically removed from textiles by wringing, squeezing, and hydro-extracting. Grothe is quoted as giving in his "Appretur der Gewebe," 1882, page 616, a series of comparative tests

of the amount of absorbed water removed from silks by these three agencies, as follows: (The hydro-extractors in these tests were run for 15 minutes.)

Silk piece goods—	Wringing,	45.4%
" " "	Squeezing,	71.4%
" " "	Hydro-Extracting,	77.8%
Silk Yarns—	Wringing,	44.5%
" "	Squeezing,	69.7%
" "	Hydro-Extracting,	75.5%

Moisture may also be removed by vacuum suction, and this is very suitable for light fabrics, and is quicker than hydro-extracting.

Piece Dyeing and the Equipment Needed.

When piece dyeing is to be undertaken, it has its own difficulties, and, while much of the equipment is similar to that needed for skein dyeing, it requires a lot of machinery suitable for handling goods in the piece, as well as a full equipment of finishing machinery for treating them after they are colored.

Thus, one would need vats for boiling-off, bleaching, and coloring, with dye-jigs and other arrangements for handling the pieces mechanically; dryers of the cylinder or can types, or drying cylinders in connection with steam pipes, or tentering frames; apparatus for finishing cotton-back satins, nets, etc., and spreading or smoothing rolls and appliances.

For the finishing, there will be needed spray machines; paper dryers; cylinders; breakers; polishing, singeing, doubling, calendering, moiréing, and folding and measuring machines.

All this means a very costly equipment.

The ease with which the goods can be damaged in piece dyeing is surprising. The cheap labor commonly employed is responsible, also, for many of these damages—"crows' feet," "chafe marks," torn selvages, etc.—which are so provoking and expensive to manufacturers.

Facilities Required.

Of course, every dye-house will not have or need all the equipment and facilities referred to here, but the big dyers do have them, and it is by the use of these facilities that they make whatever profit they do on their operations.

The man who wants to dye his own silk must, in any event, provide most of them if he wants his work done right, and the mere recital of them shows the magnitude of the undertaking.

Water Requirements.

As to the quantity of water needed, it may be said that one of the great silk dye-houses, when dyeing 20,000 to 25,000 pounds of skein silk a day, consumes the almost incredible volume of 7,000,000 gallons of water in the processes.

Attendant Risks and Drawbacks.

Instead of effecting economies by doing one's own dyeing, the result may be quite the reverse. There will be an expensive organization with high-priced chemical talent; much apparatus and machinery standing at times; no one to fall back on for mistakes or damages; liability for injury to workmen; new and vexing problems to take the time and thought of the firm away from other parts of their business; the sinking of large sums of capital which could be more profitably employed elsewhere; and the inability to conduct many processes on a sufficiently large scale to be profitable.

It must not be forgotten that the various branches of dyeing are looked after by specialists, and, to get the best results, specialists are absolutely necessary.

The great commission dye-houses will have particularly trained men in charge of their various departments,—stripping, tin-weighting, coloring, black dyeing, etc., and so can rely always on high-class work. What private dye-house could afford to employ such a staff?

In skein dyeing, a number of manufacturing firms who have ventured into that field, have, after a longer or shorter time, concluded that profits did not lie that way, and have given it up.

As to piece dyeing, the experience of one great house that tried it and abandoned it, was that unless they were prepared to run their mills for the benefit of the dye-house, it was a losing proposition.

What Experience Teaches.

Therefore, unless a manufacturer's business is very large, and of a fairly constant character, he had better leave dyeing alone; and, in fact, unless one of the partners or head men has been trained as a dyer, and knows the trade well enough to manage the dye-house himself, it had better be left alone anyway. "Let the cobbler stick to his last" has always been good advice, and a good manager in the other departments of silk manufacture may make but a sorry figure when conducting what is practically a chemical works.

Piece Dyers' Price Lists.

The figures presented herewith will shew what some of the large piece dyers are charging to-day for the dyeing of certain fabrics.

PIECE DYERS' PRICE LIST FOR DYEING AND WEIGHTING CHIFFONS, VOILES, AND SIMILAR FABRICS.

1912–1913.

	Width	55–90 Single	95–120 Single	75–85 Double	90–100 Double	105–120 Double	75–85 Double Double	105–120 Double Double	90–100 Double Double
Chiffon Finish	40–44	3	3¼	3¼	3½	3¾	3½	3¾	4
Chiffon Finish	45–48	3¼	3½	3½	3¾	4	3¾	4	4¼
Elastic Ordinary	40–44	3¼	3½	3½	3¾	4	4	4¼	4½
Elastic Ordinary	45–48	3½	3¾	3¾	4	4¼	4¼	4½	4¾
Voile Finish	40–44	3½	3¾	3¾	4	4¼	4¼	4½	4¾
Voile Finish	45–48	3¾	4	4	4¼	4½	4½	4¾	5
Dry Goods Finish....	40–44	3¾	4	4	4¼	4½	4¼	4½	4¾
Dry Goods Finish....	45–48	4	4¼	4¼	4½	4¾	4½	4¾	5
Neck Wear Finish....	40–44	4	4¼	4¼	4½	4¾	4½	4¾	5
Neck Wear Finish....	45–48	4¼	4½	4½	4¾	5	4¾	5	5¼
Weighting:									
10–15% N.	40–44	4	4½	4¼	4¾	5	5	5½	6
10–15% N.	45–48	4½	5	4¾	5	5½	5½	6	6½
15–30% A.	40–44	4¾	5¼	5	5½	6	6¼	6½	7¼
15–30% A.	45–48	5¼	5¾	5½	6	6½	6¾	7	7¾
30–45% T.	40–44	5½	6	5¾	6¼	6½	6½	7¼	8¼
30–45% T.	45–48	6	6½	6¼	6¾	7¼	7¼	8¼	9¼
45–60% S.	40–44	5½	6¾	6½	7	7½	7¼	8¼	9¼
45–60% S.	45–48	6¾	7¼	7	7½	7¾	7¾	8¾	9¾
60–75% I.....	40–44	7	7½	7¼	7¾	8	8	9	10
60–75% I.....	45–48	7½	8	7¾	8¼	8½	8½	9¾	10¾

PIECE DYE PRICE LIST.

Dyed and Finished.

24 inch C. B. Satins. Colors, 5c.; black, 4c.; bleaching, extra.. ½c.
36 inch " " 7c.; " 6c.
For goods 16 to 25 lbs. per 100 yds.; bleaching, extra. 1c.
For goods 16 to 25 lbs. per 100 yds.; cross dye, extra. 1c.
36 inch C. B. Satin. Tailoring black ..... 8c.
36 inch " Imitation yarn dye ..... 8c.
36 inch Peau de Cygne. Light quality..... 6c.
36 inch Satin Liberty " " ..... 6c.
40 inch " " " ..... 8c.
23 inch Crêpe de Chine..... 4c.
36 inch " ..... 8c.
40-44 inch " .....10c.
24 inch Crêpe Météor ..... 7c.
40 inch " " .....10c.

(OVER)

(CONTINUED)

24 inch	Cotton	and	Silk	Bengaline		6c.
27 inch	"	"	"			7c.
36 inch	"	"	"			10c.
42 inch	"	"	"			12c.
48 inch	"	"	"			15c.
24 inch	Silk	and	Wool	Poplin		6c.
27 inch	"	"	"			7c.
36-40 in.	"	"	"			8c.
43-45 in.	"	"	"			9c.
46-48 in.	"	"	"			10c.
36 inch	Crêpe	Charmeuse				8c.
40 "	"	"				10c.
32 inch	Pongee,	silk	or	schappe	filled, Dyed	4c.
32 inch	"	"	"	"	Boiled off	3c.
36 inch	"	"	"	"	Dyed	4½c.
36 inch	"	"	"	"	Boiled off	3½c.

XI

POWER TRANSMISSION IN TEXTILE MILLS.

Many articles on the above subject have been appearing in the various technical publications, particularly with reference to electrical transmission, but, of those that the writer has seen, none have been written by textile manufacturers, and it seems to him that, in consequence, too great stress has been laid upon some points and not enough upon others.

It is needless to say that a textile manufacturing establishment, having to meet, as it does, the keenest and fiercest competition, must be so organized as to produce the greatest number of properly made commercial units at the minimum cost per unit, and produce them on time. Any money, in reason, spent in the furtherance of this end, is money well spent, but any other expenditure, whether for beauty, convenience, novelty, pride or what not, must be considered with care and, at the best sparingly made, as active capital is so vital to a business that every dollar unnecessarily locked up is a drawback.

Electric Transmission Problem.

The introduction of electric transmission has solved many problems and created many others. Like all other things, it has both advantages and drawbacks, and, as every mill has different conditions to be met, each case must be decided on its merits, and the writer will attempt to point out some of the features to be considered.

Methods of Generating Power.

Everyone is aware that, aside from water powers, the power transmitted electrically has first to be created by combustion.

The power may be generated in internal combustion engines, using gas, gasoline, kerosene, or alcohol as fuel.

It may be produced by steam turbines, condensing or non-condensing, using high-pressure steam, superheated or otherwise.

The most efficient form of prime mover that we have at present, from a fuel-consumption standpoint, is the gas engine, using producer-gas as a fuel.

A gas-producer outfit, of fair size, will develop a horsepower from less than 1 lb. of anthracite pea or buckwheat coal, being about half the amount usually required for a high-class steam plant.

If electric transmission is to be used, the high speed of a gas engine lends itself well to the purpose.

The prime mover in most general use in textile mills is, however, the steam engine, driven by steam from horizontal tubular boilers, using coal as a fuel, and it is with power outfits of this kind that comparisons are here intended.

Crude petroleum has, in the past, been largely experimented with, and considerably used as a fuel in place of coal, but its use has not proved as economical as was once hoped.

Disadvantages and Advantages.

To transform power into electrical form and then back again into useful work is attended with considerable expense, and there must, therefore, be equal or greater savings or advantages to warrant its employment.

Suppose, for instance, a one-story spinning mill, with a line-shaft, running along one side, carrying pulleys which drive the spinning frames. Now, if the engine house extended out from the building about midway in the length of the shaft, and if an engine had its fly-wheel belted directly onto a pulley on the shaft, the loss in transmission would be very slight.

On the other hand, where scattered mill buildings have to be supplied with power from a central power-house, and it has to be conveyed by rope or belt drives, the loss of power so entailed may be extreme.

In such cases there will be endless heavy shafts, pulleys and belts, straight or crossed, to be driven, and a serious amount of space is taken up by the belt ways.

Sometimes, in high-class mills, belt-towers have been built out from the mill buildings proper, and separate belts have been run from the power house to each floor, to avoid putting objectionable belt holes through the floors and to eliminate the belt slippage entailed by belting from floor to floor.

In occasional instances, mill buildings have been grouped round the power house like the spokes of a wheel round the hub, and power has been carried to each by rope-drives.

Rope Driving.

Relatively few people in this country are familiar with the use and possibilities of rope-driving, and frequently, where such installations have been made, there have been complaints regarding them.

This is often because those to whom the care of the rope-drive is committed know little about ropes, though thoroughly familiar with belt transmission, and unintentional neglect, leading to trouble, makes noticeable the fact that ropes require attention just as belts do.

By means of ropes, power can be transmitted and subdivided in endless ways, and at all angles, and with excellent efficiency.

Comparison of Rope and Belt Drives.

Criticism is sometimes heard about ropes stretching and needing resplicing, but it is also a fact that the ordinary grades of belting stretch, during their life, almost as much as good ropes, and need resplicing quite as often, while failures under load are more frequent with belts than with ropes.

It is regarded as good shop practice to figure that a first-class belt will stretch 6 per cent. during its life, and 40 per cent. of this during the first three months.

The expense of the upkeep for transmission appliances is greatly affected by the duty placed upon them. It is shown that a grade of belting that will wear 5 years at 120 pounds radial load, would wear 15 years at 90 pounds, or 30 years at 70 pounds.

It has also been stated that, comparing an ideal belt-drive from the prime mover to the main shaft (with a distance of about 50 feet between centres), with an ideal rope-drive for the same purpose, the maintenance of the belt-drive will cost 5 per cent. per annum, against 8 per cent. for the rope-drive.

This would be when run under fair conditions, and when installed with low cost of maintenance as a special end in view.

Against this must be set the fact that the first cost of the belt-drive, in such a case, will be about 50% greater than the cost of the rope-drive.

When 6% interest is charged on this difference in cost, disregarding any provision for depreciation, it will be found that the charge for interest and maintenance on the belt-drive will be about 17½% more than on the rope-drive.

Longer distances between centres would give figures more favorable to ropes, and shorter distances would favor the belts.

Another consideration is, that the scrap value of the worn-out rope is about 15% of the new cost, and of belt about 10%.

Transmission by Gears.

A common practice in English mills has been to carry the power from floor to floor of a building by vertical shafts, with bevel gears

connecting with the line shafting on each floor, using, in any event, much power, even if the design, cutting, and alignment of the gears was perfect, and, if faulty in any of these respects, the waste of power would be excessive.

This method insures regularity of speed in the line shafts on each floor, so long as the speed of the prime mover is constant.

In all cases where, owing to the distance or the direction to which the power has to be transmitted, heavy initial expenditure would be entailed for the necessary appliances, as well as much waste of power in the process, the substitution of electrical transmission will be of the greatest advantage.

Cost of Power.

The cost of power in each mill will vary, depending on size, character, and condition of plant, cost of coal and water, price of labor, etc., etc.

As a fair approximation, it may be stated that, in silk-weaving mills of reasonable size, using good types of engines and boilers and running non-condensing, employing good engineers and firemen, and paying for anthracite No. 1 pea coal about $4 per gross ton delivered, the cost per brake horse power per annum may run from $45 to $55.

This figure will include coal, water, oils, repairs and supplies, engineer and fireman, together with 6% interest on the total power plant investment, 10% depreciation on the boilers, engines, piping, etc., and 2½% depreciation on the power house and stack.

It does not include anything for the general shafting, or steam piping, through the mill, but stops at the main jack shaft.

The power cost, above stated, will probably be found to represent from three-quarters to one and one-quarter per cent. of the total net cost of the product of the mill, though in small plants, or in those not operated with proper efficiency, it may rise to 2½%.

On the other hand, in power plants of larger size, and thoroughly equipped, the cost may be brought down to $30, $25, or even lower, per horse power per annum (approximately 3,000 H. P. hours); and for large plants which run night and day, such as throwing mills working on organzine, considerably lower figures than the above are attainable.

Such power plants, however, are exceptional in silk mill work, and we must consider the average plants, and as they actually are.

In cotton mills, which conduct all the operations themselves from the raw cotton to the finished cloth, the cost of the power required is customarily assumed to be 6 per cent. of the total cost of the product, and, of this amount, 60 per cent. is consumed in the spinning alone.

Advantages of Forced Draught.

The employment of forced draught, with automatic regulation, may enable important fuel economies to be effected, and will allow of

proper draught being obtained when the size of the stack would otherwise have been insufficient.

By the use of such a system, the writer was enabled to switch from No. 1 pea coal at $4.00 per gross ton delivered, to No. 3 buckwheat (fresh mined coal) at $2.40 per gross ton delivered, and used no greater weight of the latter than of the former.

While it will be seen from the following record of tests made on these fuels that the No. 3 buckwheat had about 3% less calorific value than the No. 1 pea, yet the more complete combustion of the fine size under the forced draught fully offset this difference.

Tests of Samples of Coal.

Sample of Pea Coal contained 12,724 B. T. U. (British thermal units) per pound of coal. Ash, 12 per cent.

Sample of No. 3 Buckwheat contained 12,332 B. T. U. per pound of coal. Ash, 15.3 per cent.

Another sample of No. 3 Buckwheat contained 12,383 B. T. U. per pound of coal.

Moisture	3.9	per cent.
Volatile and combustible matter	6.1	" "
Fixed carbon	75.5	" "
Ash	14.5	" "
Total	100.00	

Questions Affecting Electrical Installations.

Many questions arise when the subject of electric transmission is considered.

There is the comparative cost of installation, or, if the mill be an old one, the cost of the necessary changes; the question as to whether there will be a saving or a loss in power; the liability to break-down, and the steadiness of the power; the attendant expense for labor; the liability for personal injury; the interchangeability of the power and the advantage of being able to run any part of the mill by itself; the questions of fire hazard; of ability to place machinery wherever convenient; of circulation of dust; of improvement in the quality of the product; of increase in production; and many other considerations.

When an old mill is having electrical equipment installed, the subject is still more complicated, and in many cases it will be found advantageous to continue to drive, as usual, those parts of the plant that are in close relation to the prime mover, while, to the more remote parts, the power will be delivered electrically.

If a power plant is being laid out, ab initium, and electric transmission is being arranged for, a generator capable of transforming at best efficiency all of the energy that the engine is capable of exerting should be supplied. The current may be direct or alternating; the

speed and voltage are matters for consideration; in an induction motor, different cycles or phases may be preferred; and the generator may be direct-connected or belted.

Each mill building may have but one motor in it, the power being conveyed to other floors by belts; or there may be a motor on each floor; or a motor may be mounted on the end of each line shaft; or there may be a motor for each individual machine, or for groups of machines.

Alternating or Direct Currents.

The first question that arises is as to the character of the current. Alternating (or induction) current motors maintain a constant speed, corresponding with the engine and generator speeds. Direct-current motors are subject to some variation in speed due to the amount and shifting character of the loads, the degree to which the motor has been heated, etc.

As constancy of speed in textile mills is very important, the alternating-current motor lends itself best to this work, while the fact that it has neither commutator nor brushes greatly simplifies its use. For use on individual looms, the alternating-current motor is the only one to be considered.

Textile Printing Requirements.

In the case of machines for textile printing, the direct-current motor has advantages.

In this work, the operator must be able to vary the speed at will, and double-angle steam engines are largely used for the driving, the speed being controlled by the throttle.

Direct-current motors can thus be used with special advantage for this purpose, and the methods provided for speed control are wonderfully sensitive and efficient.

Questions Concerning Kinds of Currents.

Where a different kind of current from that supplied by the main generator is required, as for certain kinds of lighting, special generators may be driven by motors.

If direct-current motors are used, the change in their speed, due to heating up, is a matter to be reckoned with.

In from two to four hours after starting, the speed may have gradually increased by 5 to 10 % as the motor has heated up, which would cause the machinery that was being driven to go too fast, or else it would have to be started too slow, so as to allow for the subsequent speeding-up.

To correct this tendency, there has to be introduced into the field circuit a resistance box, or rheostat, which has to be frequently regulated to correct the increase in speed.

The speed will also change with changes in voltage, and heavy loads

being thrown on or off the generator, as the work in the mill varies, will affect the speed of the motors.

The commutators and brushes of direct-current generators and motors also require attention, while alternating-current machines, which have no commutators, are free from this trouble. Brushes must be adjusted to prevent sparking, and must be renewed from time to time, and commutators must be trued up on the lathe, at intervals.

Voltage for Lighting.

The voltage to be selected is a matter for careful consideration, and it should be such as to lend itself readily to whatever lighting system is to be adopted.

Alternating currents can be transformed into any needed voltage.

Direct current cannot, and so a voltage suitable for the lighting intended must be selected. Incandescent lamps are not usually made for voltages over 220, and are more generally used at 110 volts. Direct-current electricity may, therefore, be usefully employed with voltages of 110, 220, or 500. The latter is very satisfactory for power transmission, on account of the much smaller sizes (and consequent lower cost) of the wiring required, and a rather better efficiency can be looked for from the apparatus than from the lower voltages. While arc lights can use 500 volt current, yet, in taking off incandescent lights, it is necessary to wire in series two 220 volt lamps, or four 110 volt lamps, a style of wiring sometimes objected to by Boards of Fire Underwriters, though for very flimsy reasons if the installation has been properly made. Still, if an inspection certificate is necessary to obtain insurance, this point must not be overlooked.

Danger from Electrical Shock.

It should also be remembered that the danger to life from a heavy electrical shock is greater in the case of alternating current than in the case of direct current.

The effect of electrical shock will vary with the individual, the surface of contact, the amount and voltage of the current, and whether the current can pass freely through the person or not.

There are therefore no exact rules that can be laid down, but it has been stated that alternating electric currents are dangerous above 500 volts and direct currents above 800 volts.

Speeds of Generators and Motors.

When the speeds at which generator and motors are to run is considered, it is to be observed that, as the speed becomes slower, so does the size, and the consequent cost, increase.

Thus, taking motors of fair size, say from 50 to 150 H. P., we would probably find them made for speeds of 200 to 300 R. P. M., 550 to 650 R. P. M., and 850 to 950 R. P. M. There is a considerable difference in size, and a distinct difference in cost, between each speed,

the slowest ones being the biggest and dearest, and the fastest ones being the smallest and cheapest. Be it remarked, also, that the efficiency of the faster ones is somewhat the greater.

In small motors, say from 5 H. P. down to ¼ H. P., speeds ranging from 1,200 R. P. M., to 1,700 R. P. M., may be looked for, but, in these, alternatives in speeds are rarely offered.

Direct-Connected or Belted Types.

This brings us to the question as to whether the generator should be direct-connected or belted. If the former, its speed would, of course, be the same as that of the engine, which, even with a high-speed engine, could hardly be over 300 R. P. M., and engines built for connecting with generators cost more than belted types.

Should there be space available, a belted generator may be found more desirable, as an engine running at 300 R. P. M., may be belted onto a dynamo speeded at 900 R. P. M., and a considerable saving in the cost of the generator be thus effected, though the cost of the belt and its upkeep must also be taken into consideration.

Another consideration that tells somewhat in favor of the belted type is, that, should anything go wrong with a direct-connected generator, it puts the engine out of business for several days or more, while repairs are being made, but, if the trouble occurs with a belted generator, another one of similar character, whether new or second-hand, can nearly always be located in the market by the active use of the telephone, and it may be got promptly on the ground and into action while the damaged one is undergoing repairs, and an expensive shut down of the plant may thus be avoided.

The chances of a breakdown, however, in a well designed and properly maintained power plant, whether electric or other transmission be used, are somewhat remote.

Speeds of Prime Movers.

The question of the speed of the generators is closely interlocked with the speed of the prime movers.

Owing to its great speed, a steam turbine lends itself well to electric transmission. On the other hand, a turbine is not economical unless it runs condensing, and, if it does, there is no exhaust steam available for the heating.

For turbine work, it is most important that the highest possible vacuum for the condensers be maintained, and 28 inches, or over, should be aimed at, as the efficiency will then be much greater.

Turbo-generators are coming more and more into vogue, and, when better understood, are certain to be very widely used.

High speed engines are specially useful for electrical transmission and, on account of their speed, much smaller and less costly generators can be used than would be the case with the slower speed engines, such as those of the Corliss type.

The latter are generally considered to be more economical, but the writer has no fault to find with high-speed types, having used engines of this character for many years, and he has found them very satisfactory from every standpoint, and extremely economical in the matter of upkeep.

Incompetent, lazy, or careless engineers, are generally responsible for such complaints as may be made about high-speed engines, if built by first-class concerns.

Boiler Pressures.

A great many boilers are in service carrying but 80 or 90 lbs. of steam, such as was formerly customary, but practically all modern fire-tube boilers will carry at least 125 to 150 lbs., with higher pressures for water-tube boilers.

Engine efficiency, also, is being much increased by the use of superheated steam.

Subdivision of Power.

We now come to the question of the subdivision of the power.

Take a three-story mill, for instance, requiring 30 H. P. to drive it. A 30 H. P. motor on the middle floor, belting up and down to the two other floors, would have a greater efficiency, and therefore consume less current, than would be the case if there were a 10 H P. motor on each floor, and the combined cost of the three 10 H. P. units would be much greater than the cost of the 30 H. P. one. Nevertheless, there are many reasons in favor of the separate motor for each floor.

When a separate motor is provided for each line of shafting on a floor, it can be either belted on, or mounted on the end of the shaft. In the latter case, as the motor will generally have a much greater speed than is required for the shaft, it has to be geared down to the proper speed, and it is well to have the gears run in oil to reduce noise and friction.

Again, motors may be directly applied to individual machines, and these machines may be ones that are intermittently running and stopping, as in the case of looms or finishing machinery, or those of a kind that run continuously and with little or no change of load, such as spinning frames.

Machines may also be driven in groups, sufficiently small that, if there is a motor failure, there will not be many units put out of action.

Advantages and Disadvantages of Different Drives.

We will now consider some of the advantages and disadvantages to be reckoned with in these differing installations.

Statements have been made in print that, with the individual motor system, buildings could be made of lighter construction, as the weight of the shafting, etc., and the drag of the belts, would be eliminated. The writer believes, though, that no prudent owner, or builder, would desire to weaken his structure for any such reason, nor would the

underwriters favor such a plan. In those mills, however, where an outside belt tower conveys the power from the engine to the shafting on the different floors, thus eliminating any belt holes in the floors, the cost of such a structure could have been avoided.

Losses from dripping oil, falling on raw material or finished product, have been spoken of as incidental to belt driving, though none but the most slovenly management would permit such a thing. Every bearing should be provided with a proper cup or can for catching the drip, if there be any.

In the chances of injury to workpeople the argument is in favor of the motors, as people occasionally are killed or injured by being caught in the shafting or belting, while it is very rare to hear of a death in a mill from electric shock.

The labor cost of inspection and upkeep will probably average about the same, for while, on the one hand, shafting and gearing must be oiled and kept clean, and belts dressed and taken up, yet, on the other hand, the motors and their wiring will also need proper and constant surveillance if trouble is to be avoided.

The heat developed and radiated off, due to frictional losses, will be much more noticeable in the case of the motors than in the case of belting, even if the waste of power was equal in both cases. A large portion of the heat due to frictional losses in a belted outfit is developed in belt ways and other spaces apart from the work rooms, while the heat lost in the shafting overhead rises to the ceiling and is not felt by the workers on the floor. Motors, however, are usually on the floor, and the heat given off by them is very sensible to those who are about.

By using individual motors, some space required for the storage of change pulleys and spare shafting and hangers, will be saved, as well as the space required for jack shafts, belt ways, etc., but, on the other hand, some room will be needed for storing extra gears for changing speeds, as well as spare armatures and motors.

The belting employed to drive machinery circulates dust, interferes with light, obstructs movement, and necessitates fairly high ceilings. The individual motor drive eliminates these objections.

Motor driven machines may be placed in any part of any building, and arranged in any angle or in any position,—an immense advantage compared with the rigidity of the conditions under which shaft-driven machinery must be operated.

Value of Electric Records.

Another good feature about motor driving is that, by making tests with a recording watt meter, the exact amount of power being consumed by each machine is ascertained. By this means, when certain machines are using too great an amount of power, as compared with

others of the same kind, due to internal friction losses or other causes, the trouble is brought to light and steps can be taken for its correction.

The electrical records that can be taken of each individual machine will also shew the exact number of minutes per day that it has actually run, and just when, and for how long, the different stoppages have occurred. A careful study of these records is of extreme help to the management in locating the causes of diminished production. Such records act as an ever-present reporter of the movements of the work people.

The power taken by each department can also be definitely known, and each can be charged with its exact share when the overhead charges are being apportioned.

Electrical Units.

It may be explained here that the watt is the unit of electrical output, 1000 watts being expressed as 1 kilowatt. The volt is the unit of electro-motive force, the ampere is the unit of electric current strength, and the ohm is the unit of resistance. In direct-current motor work, the amperage multiplied by the voltage gives the output in watts, 746 watts being the equivalent of one mechanical horse power.

Flexibility of Electric Power.

A great advantage given by electric transmission is that each floor can be operated separately, or independently from the rest of the plant, and they can be run overtime, or at nights, or on holidays, without having any other machinery turning in the mill. Should an accident occur, or should it be desired to stop the machinery on a floor for any other reason, it can be promptly done by simply throwing the switch.

Again, should any one be furnishing power to a tenant, or buying power from a landlord, the exact amount to be paid for will be shown by the meter, and all controversies on the subject will be avoided.

Outside Current and Its Cost.

Furthermore, should the engine not be running, and should it be desirable or necessary to run one machine, one floor, or the whole mill, from the outside or town current, it can be so arranged.

Whether it pays to make large use of the outside current or not will depend on its price.

Many power companies pursue the shortsighted policy of charging rates for current that make it cheaper for the manufacturer to produce his own power. Such charges, even with the maximum discount for quantity used, will, in a number of instances known to the writer, amount to a rate equivalent to $90 per H. P. per annum.

In other cases, a different policy is pursued and very attractive rates —perhaps as low as $25 per H. P. per annum, are made—prices much lower than the individual could produce it for himself.

Here, great advantages present themselves, as not only is the power very cheap, but the capital that would otherwise be sunk in the power plant can be used as working capital or put into productive machinery.

Points of Vital Moment.

We now reach the consideration of those more vital matters which will control the decision of the manufacturer, such as cost of installation and upkeep, consumption of power, and improvement in the quality and quantity of the work done, and which the writer believes will, in the last analysis, tell strongly in favor of the individual motor to drive the individual machine.

Where the question is one of belting a generator onto the engine or the main jack shaft, and installing a motor in each building to drive it, in place of erecting lines of heavy shafting, carrying great pulleys and huge belts, for transmitting the power from the engine to the different buildings, it may well be that the electrical outfit may cost no more, or perhaps may cost less, than the mechanical equipment, besides possessing the other advantages previously alluded to.

In the further subdivision of the power in each building, or on each floor, by using individual motors, the case is different, as the cost of such motors, with their wiring, switchboards, etc., will probably be much in excess of the cost of the line shafts, pulleys, hangers, and belts. As there is great variation in the size, character and price of such motors, as well as great differences in shafting layouts, it is impossible here to give proper comparisons of cost, but it is safe to state that, for the minor transmission, the motor installation cost will be substantially in excess of the cost of shafting and belting.

This is not to assume that the cost is in any sense prohibitive, but to emphasize the fact that, on the difference in cost, an annual allowance of 6% interest and, say, 7½% for depreciation, must be figured on, as well as to make clear that some extra capital must be sunk for the sake of securing substantial advantages in operating.

Where electrical distribution of power is planned in an old mill, and where heavy and costly transmission apparatus has to be abandoned in favor of generators and motors, the relative cost will seem higher than in the case of a new installation.

Power Lost in Transmission.

Great claims of saving in power are made by over-enthusiastic writers on this subject, and comparisons are usually made with antiquated plants. It is well known that a very large amount of power is required to run the transmission machinery of any mill, with none of the machines in operation. According to the arrangement of the buildings, the character of the equipment, the good or ill alignment of the shafting, and the tightness of the belts, this load will generally vary from 30% to 40% of the total power used when all the machinery is running.

We will assume that this averages 35% and, as a matter of fact, this is just about what may be normally looked for.

Now, how does the individual motor drive compare with this? The generator, whether direct-connected or belted, will not have a greater efficiency than 92%, so here we have a loss of 8%. The small motors, ¼, 1/3 or ½ H.P. will probably not average over 70% efficiency, and may be very much less. Then there is the drop in the line, or loss of power during its transmission through the network of wires, which in such work may amount to, say, 4%. The total of these losses compute to 38%, as against, say, 35% loss in shafting and belts.

It must be observed that the indicator cards taken of the transmission apparatus at "no load" may be misleading as to the power consumed that is not actually applied to work, as frictional losses in the shafting, etc., increase with the load.

In a belt-driven plant the looms will not be in operation, in most cases, more than two-thirds of the time. That is, one-third of them will be always standing from one cause or another. The shafting losses for all of them go on just the same.

With the individual motor equipment, when the looms stand, the frictional losses of their motors, etc., stop also, so here we have a substantial advantage for the motors.

Requirements for Loom Motors.

Again, when a motor is provided for a loom, that motor must be able to take care of the heaviest work that that loom is likely to be called on to do, and therefore the average size of the motors provided must be greater than the average loads put upon the looms, so that, as regards the work of revolving the armatures, the electrically driven looms consume more power than they otherwise would.

All this shows that no saving in power cost, or power consumed, is to be expected when an electric installation is projected, the power taken being much the same in both cases.

For an electrically driven silk weaving plant, there should be motors totalling 40 to 50 H. P. for each 75 to 100 broad looms.

The most important question, and the dominating one, is how the production is affected.

Improvements in Motors.

The use of induction motors, and improved contrivances in connection with them, has eliminated many difficulties that formerly presented themselves in the direct driving of looms by motors. The loom can be started at speed, so that the shuttle is driven properly home into its box and the danger of a "smash" is obviated; devices have been introduced to take the shock off the loom or the motor when the loom "knocks off"; the loom builders furnish looms arranged for motors to be attached to them, and the motors are so attached to the looms that they can be adjusted up or down, in a vertical direction, so as to al-

low the introduction of a larger or smaller intermediate gear with a consequent alteration in the speed. These gears may be enclosed in a locked metal boxing, and the changing of the gears and the consequent speed of the loom may be a matter of only two or three minutes.

Such change pinions as are now usually provided will alter the speed of the loom 7 picks per minute for each tooth. If a regulation as low as 4 picks could be got, it would be more desirable.

Irregularities of Speed.

As the engine and generator speeds will be constant, so will be the speeds of the induction motors, and variations in speed will not be so liable to occur when each unit has its own motor, as would be the case with belt transmission, where considerable loads thrown on or off some part of the system may affect the speed of the whole. In well designed mills, when the engine is not overloaded, this will not be a wide variation, but still it does make a difference, and its elimination will help the production not a little; and where the cost of labor per yard is so great, a small percentage of increased product means a large annual saving.

Recent tests, made in some up-to-date English plants, have shown that, with engines running at full load, there might only be a variation of engine speed, due to the shifting loads, of 3%, while at the loom countershafts it would rise to as much as 20%.

By attaining a constant speed, the breakages of loom parts, and the consequent loom stoppage, would be minimized, and, with the more regular strain upon the warp threads, broken ends would be much less frequent.

An irregular, jerky pull on the warp threads is a potent cause of breakage.

By the correction of the above difficulties, actual increases in production of 5% have been demonstrated.

In belted plants, there is always a loss of speed, of a widely varying amount and generally quite unrecognized by the management, due to the varying tightness or slackness of the machine belts, and other belting through the mill. This belt slippage is estimated to average from 3% to 6% over the whole range of machinery of ordinary plants. The tightness of belts is, furthermore, greatly affected by the weather.

Regulation of Speed.

The ability to regulate the speed of a loom by a simple and easy change of pinions is the great thing. When a loom might do better if running a bit slower, or if it might be speeded up a little to advantage, it will probably, under belted conditions, be left to run as it is (unless the change may be likely to be permanent), as to alter it would necessitate a troublesome change of pulleys and a mutilation of belts. The motor drive alters all this.

There are many phases of this question of the change of speed of

individual looms. If a weaver knows that his loom is to be run faster he may be afraid that it will be too fast, and his mental attitude will make the extra speed unprofitable. If, however, it could be raised, say, four picks each week, thus working him up to it, till the desired speed was reached, much good might be done.

A new fabric might be put in work and a variety of speeds tried, till the most advantageous one was hit upon.

When warps of extra good quality came in the looms, speeds would be raised accordingly, while, when a poor lot was causing trouble with ends breaking down, the speed would be reduced to the point where the best production was got.

Each make or width of loom, each pattern or weave, each lot of material, each warp, and each weaver, has its or his own individuality, and the ability to quickly, easily, and accurately adjust the speeds, so that the maximum product may always be maintained, is an advantage of the first importance.

The same remarks will apply to other machinery, winders, spinners, etc., but in the weaving lies the great profit.

Possible Increase in Production.

It is not too much to hope that, between the constancy of speed that it is possible to maintain, and the improved results from the individual adjustment of the looms, an increase of product of at least 10% over and above the ordinary average, may be obtainable.

Even if only a 5% increase were achieved, the results would be most gratifying. Thus, if a mill had an output of 2,000,000 yards a year, on which was a net profit of 3 cents a yard, and on which a figure for general expense of 7 cents a yard had to be allowed, equal to $140,000 a year, this increase of 5% would reduce the proportion of general expense on the output by $7,000, while the 100,000 yards increased product at 3 cents profit per yard, would make $3,000 more, or $10,000 in all, even if the wages were not reduced to correspond with the increased output. Interest and depreciation on any additional installation cost, must properly be deducted from these figures.

Cleanliness of Mill and Fire Hazard.

Individual motor drives will give a somewhat cleaner mill, and this, combined with steadiness of speed, and lessened warp breakage, should lead to a greater cleanliness and perfection of the fabrics made.

This greater cleanliness of mill tends slightly to reduce the fire hazard, but, with the amount of wiring entailed by the numerous motors, the fire hazard is not likely to be less, and will probably be greater, than with belt-driven plants.

The whole subject of electrical transmission, and particularly of the individual motor drive, merits the most careful consideration of all progressive manufacturers.

Who to Deal With.

In conclusion, it may be said that persons contemplating such installations should deal with no one except those first-class electrical concerns which have made a specialty of such work, and whose experience and resources enable them to furnish an equipment which will be right and suitable in every particular.

In such cases, any reasonable difference in first cost is of very little moment, so long as one has the assurance that the installation will be made right and will work right; and in the writer's opinion, a properly laid out weaving plant, driven by individual motors, will give an appreciably lower manufacturing cost than a belt-driven plant, if all of its possibilities are taken full advantage of.

XII

HUMIDIFICATION IN TEXTILE MILLS.

In the successful operating of a mill, one of the most important points is the securing of a full, steady and well made product. Any deficiency in this respect is a serious matter, and every intelligent manufacturer is constantly spending much time, thought, and money in his efforts to increase his output.

Percentage of Theoretical Output Obtainable.

General experience has shown, in a rough sort of way, about what percentage of the theoretical product can be obtained in actual practice for different classes of goods and for mills run under various conditions, and every mill should be able, under normal circumstances, to come approximately near to this percentage.

In very well managed mills, and under favorable conditions, this production can be largely increased, and it is towards this goal that all mill men are striving, and on their success depends largely the prosperity of the concern.

Among the many causes that combine to keep down the production below what might be expected, one of the most important is unfavorable atmospheric conditions.

Hygroscopic Character of Textile Fibres.

All textile fabrics are hygroscopic in character, that is, they have the power of absorbing moisture to a greater or less degree, and no fibre is more affected by moisture than is silk.

The moisture present in textile fibres, under normal conditions, will vary from locality to locality, from season to season, and from day to day.

As these variations cause changes in weight, it was long ago seen

that some standard basis must be adopted to apply to commercial transactions in these materials.

A series of standards was, in time, evolved, which are supposed to represent the average normal moisture that the materials should contain, and these amounts are expressed in percentages of regain. This means that, if the materials are reduced to a condition of absolute dryness, and the allotted percentage for the moisture is then added, the results will be the standard normal weight of the material, or the "Conditioned Weight," as it is called.

Standard Percentages of Regain.

The principal allowances for natural moisture are as follows:

Carded wool and wool waste	18¼%
Worsted yarn	18¼%
Wool yarn	17%
Cotton, raw or in yarn	8½%
Linen, raw or in yarn	12%
Tow, raw or in yarn	12½%
Jute, raw or in yarn	13¾%
Mixed yarn of wool and cotton	10%
Mixed yarn of wool and silk	16%
Spun silk, or schappe, and carded silk	11%
Raw-silk, and thrown silk	11%

The Bradford Conditioning House allows a regain for worsted tops, combed in oil, of 19%, while, if combed without oil, they allow the standard figure of 18¼%.

The explanation is, that there was an old "Trade Custom" allowance of 19% in the district, which was continued for the local trade, which customarily uses tops combed in oil. The great bulk of the exported tops are combed without oil and the allowance on these is 18¼%.

Tests Made at the Arlington Mills.

At the Arlington Mills, at Lawrence, Mass., some most interesting data were obtained on the fluctuations of atmospheric moisture.

A skein of worsted yarn was left exposed for a full year in an open shed, where no artificial heat ever came, and from which wind, sun, and rain were excluded, but which was otherwise exposed to the outside influence of the atmosphere.

From May 1st, 1895, to May 1st, 1896, accurate weighings were taken ten times a day, at approximately the same hours, for every day in the year except Sundays and holidays.

The great variations observed in the weight of this skein of yarn were remarkable. The moisture in it ranged from about 7% to as high as 35% of its total weight, often with a variation of 15 to 20% in 24 hours.

The greatest absorption was in the early morning hours, and the

least was between three and four o'clock in the afternoon, the average difference being about 2%.

The following monthly averages of the moisture recorded are of interest:

			Greatest change in 24 hours.
May,	1895	14.86%	8.2%
June,	"	16.87%	10.0%
July,	"	18.05%	9.1%
August,	"	17.31%	8.7%
September,	"	17.29%	12.1%
October,	"	16.76%	11.3%
November,	"	22.02%	19.1%
December,	"	19.28%	16.1%
January,	1896	17.40%	15.1%
February,	"	17.21%	17.3%
March,	"	17.21%	16.4%
April,	"	14.15%	12.2%
Average for year		17.45%	

Further information on this interesting subject can be found in "Tops," published by the Arlington Mills, 1898.

Elasticity of Yarns Largely Dependent Upon Moisture.

When yarns are reasonably moist, they exhibit a proper elasticity, and, as they get dryer, they lose much of this property, very dry yarns being extremely deficient in this respect and therefore giving very unsatisfactory results in work.

When such a very hygroscopic material as silk is subject to such changes in atmospheric moisture as are detailed above, the importance of some means to keep it always in a properly moist condition is apparent.

Advantage of Damp Localities for Textile Manufacturing.

From time immemorial textile machinery has been operated in damp places. Mills have been located along water courses not only on account of the uses of the water for power and other purposes, but because such locations were damp, while sites on dry, wind swept uplands have been avoided. Great textile centres have grown up in favorably damp localities, such as Lancashire, New Bedford, and Bombay.

In many cases, mills have been built into hillsides, where water trickling down the walls has supplied the required humidity, and hand looms for ages have been operated in basements and cellars.

All this goes to show that the necessity of conducting textile operations in a moist atmosphere has always been recognized, but in the great growth of industry in modern days, locations have had to be selected

from other considerations, and many are the mills that are built in dry, and even in extremely dry, localities.

Effect of Humidity on Mill Operations.

When the atmosphere, and consequently the textile fibre, is properly moist, every department of the mill, be it carding, spinning, winding, warping, or weaving, works at its utmost efficiency, and should turn out a full and perfect product.

Observe the difference when cold, dry, brisk days come, and when the moisture in the air is at a minimum. Then we find threads breaking and snapping in all directions, machinery stopping, trouble everywhere, and bad temper prevalent.

When there is plenty of moisture present, the rapidly moving silk is also not so susceptible to electrical influences, but, when dry, it is quickly electrified, and loose ends are flying in all directions, getting caught together, and becoming a regular nuisance.

How Production and Costs Are Affected.

In most localities where there are textile mills, the majority of the days in the year will be reasonably moist, some will be too much so, and a considerable number will be too dry, to a greater or less extent, and these dry days cut down the production seriously and are consequently very expensive for the mill.

Consider what this means in money. A 500-loom mill may be turning off 7,000 yards a day, on which is an earning of 6 cents a yard for expenses and 4 cents for profit, amounting to $700 in all. If, now, on an extra-dry, cold day, the production falls off 20 per cent., and it easily may, it means a loss of $140 to the mill, which could be entirely saved if the air could be kept damp, and this is a loss that may occur on very many days in the year. It is obvious that no pains or money should be spared to diminish such an evil as this.

Not all the rooms in a mill will be equally dry, and the conditions in weave sheds, which are often partly sunk in the ground, are generally more satisfactory than in the higher stories of a mill. Mr. Edward Atkinson, if my recollection serves me, in one of his published works, writes of a cotton mill where, for the same goods, and under exactly the same conditions, the production for a period of ten years averaged 15 per cent. more in the weave shed than in floors higher up. Part of this, no doubt, was due to the more solid and level foundations for the looms in the shed, but the greater part must unquestionably be attributed to moisture.

Difficulties During Damp or Dry Hot Weather

Some trouble is experienced in very damp days, particularly those days in summer when the humidity is excessive, warps and harnesses are sticking, and everything feels damp. Hot and all as it is, it may be necessary, in default of any better means, to close the windows and turn

on the steam in the heating coils so as to dry things out, but this is not so severe on the workers as it would seem, for, the air being dryer, there is more evaporation from the surface of the body, and, as this is a cooling process, it tends to equalize matters.

Many hot days are also very dry, and it would then require a great deal of moisture to put the air in a satisfactory condition.

If means for cooling the air were provided, it could be much more easily got into a properly moist state.

The greatest trouble is, however, occasioned by the dry days, and it is for the purpose of obviating this trouble that humidifyers have been introduced.

Humidifyers and Their Attributes.

A humidifyer is an apparatus for keeping the air in a room in a properly moist condition, and, to be satisfactory, should fulfill the following conditions:

Rapid and perfect distribution of moisture in the form of the finest vapor; a minimum amount of water to be used for the quantity vaporized; the power required for operating to be small; the apparatus to be simple and not liable to get out of order, and to be easily understood and taken care of; adjustment and regulation to be accurate and easy; easy to open up and keep clean, and free from any liability to clog up; a minimum of space to be occupied; low cost of upkeep; the smallest possible amount of machinery; and a reasonably low first cost. It should also be possible to keep the system in proper order if looked after by the ordinary mill help, and it should be so simple as to make it unnecessary ever to call in expert advice in connection with it.

There are a number of meritorious humidifying systems on the market, and it is not the purpose of this article to recommend one or other of their methods.

Apparatus Required.

The apparatus used, according to the system, consists generally of such features as pumps, fans, air-pressure tanks, humidifyer heads, atomizer nozzles, revolving discs, strainers, water and steam piping, motors, etc., etc., some of which features give more or less trouble after having been run for a while.

It is a considerable advantage to have a style of humidifyer, where the cost of installing an individual head is not much greater than what the unit cost would be where a number are put in together, as there are often particular places remote from one another, where air moistening might be useful and where one head would suffice.

Amount of Water Vaporized, and Power Required.

The percentage of the water passing through the apparatus, that can be vaporized, will probably run between the limits of 3 per cent. and 25 per cent., so some styles of humidifyers will obviously take care of a greater area than others.

There is a style of humidifyer, also, which simply atomizes all of the water supplied to it, just as an ordinary atomizer would do.

There is much difference, too, in the power required for operation, and when power is expensive this point should be carefully considered.

Where only a small percentage of water is vaporized, and when water has to be paid for, the waste water can be pumped back into the system, but at the expense of some extra power.

When hot dry days occur, the power used in connection with the moistening is considerable, as a large amount of moisture must be supplied. Those systems which also keep the temperature down to a comfortable point, will use much less power at such times, as the cooler air requires less moisture.

The cost of power, in any event, cannot weigh with the benefits to be attained.

The vaporization of the water should be so complete that it cannot fall like dew or rain on the goods or on the machinery, doing damage and creating rust.

Use of Steam, and Other Methods of Air Moistening.

Many manufacturers have put into use moistening devices of their own contriving, as by allowing exhaust steam to enter the air ducts, when mills are heated by hot air, and so distributing the moisture through the buildings, or by blowing steam directly into the rooms.

This direct use of steam is carried at times to such an extent that I have seen in the spinning rooms of linen mills in Belfast, where fine yarns such as 200-1 were being spun, the atmosphere thick with steam and everything warm and dripping wet. The operatives wore clothes at their work different from those they went home in, and were barefooted, and the floors were made of large, smooth tiles.

This use of steam has been much condemned in many quarters, and claims have been made that such conditions were unhealthful, but this does not seem at all to have been proved. Anyway, there are better methods.

The keeping of the floors wet with water has ever been a common and not ineffective device, and for the storage and "conditioning" of yarn, special floors have been arranged, grooved with many channels, or miniature canals, all filled with water, and which made the atmosphere sufficiently moist for the purpose.

Value of Humidification Immediately Apparent.

Let humidifyers once be introduced in a mill and their value at once becomes apparent. When a dry day comes, and there is trouble all along the line, everything will be running as smoothly as ever within a few minutes after the humidifyers have been turned on, and, if they are shut off, under such circumstances, the trouble promptly reappears.

Again, if a poor lot of silk or other yarn is passing through the ma-

chinery, which may be deficient in strength or elasticity, or "twitty," much improvement can be made, even on a day of normal humidity, by moistening the air to an extra degree.

Whether the system be introduced in the weave room, in the throwing mill, or for the preparatory work, the good effects are alike apparent, and a marked increase in both quantity and quality of product is soon noticeable.

It is safe to say that no one who has installed a good moistening system has ever discontinued its use, and a constantly extending use is the rule.

Reduction of Wastage.

As increase of product means decrease of waste, it follows that a great saving of waste is one of the advantages of humidification.

Serious waste is often encountered in weaving cop yarns, when, owing to the drying out of the yarn on the tubes, the cops become loose and are knocked off their tubes while weaving, and the same is true of tram that has been standing for some time, when wound on quills.

This can be avoided by having humidifyers in the stock rooms and store rooms, by the use of which the yarn is prevented from drying out, and the air should be kept moistened wherever the silk on quills is stored.

It is in these directions that systems in which single heads can be operated separately, have a marked advantage.

In cold weather, the moistening of the air not only improves the work, but makes the operatives feel warmer and more comfortable, for, owing to the diminished evaporation from the skin, a person will feel warmer in a moist air of 70 degrees than in a very dry air of 80 degrees.

Hygrometers and Humidity.

To know what the moisture present in the air is, hygrometers should be placed in the various rooms and it is well to have plenty of them, as, even in the same room, the humidity will vary from place to place.

These hygrometers should be of the best character if good results are to be had, and many cheap hygrometers are worse than useless, for they are apt to be seriously misleading.

The standard of humidity to be set will vary according to the nature of the work in the department, the material that is being used, and the experience gained by the management in practice.

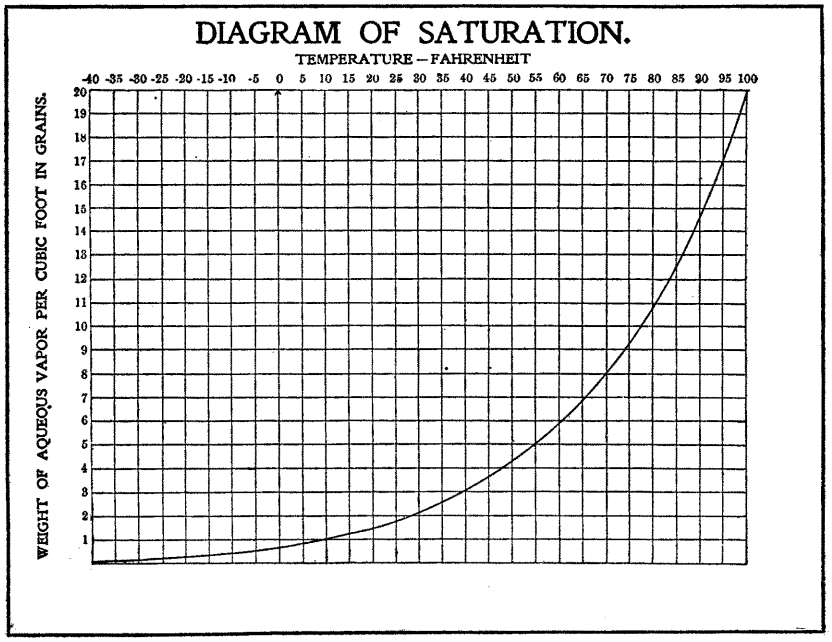
Temperature and humidity are closely related. In a very hot atmosphere, the moisture that can be taken up by the air is very great, and the saturation point is high. On a very cold, frosty day, the reverse will be the case.

It is stated that in 1,000 grains of atmospheric air the moisture will range from a minimum of 4 to a maximum of 16 grains. (Chambers' Encyclopædia.)

The weight of a cubic foot of atmospheric air at 32° F., and under a tension of 1 atmosphere, is 527 grains.

Diagram of Saturation.

A "Diagram of Saturation" is here presented, the curve which has been plotted showing the maximum moisture, in grains, which the air will absorb at temperatures from 40° to 100° F.



Maintaining the Proper Humidity.

A fair normal average of heat and moisture conditions might be stated as a temperature of 70° F., and a humidity of 70 per cent. This may afford a good basis to work on, though, as it is well to keep on the safe side of the moisture, the writer would suggest 75 per cent. as a good standard.

Before starting time in the morning, the person to whose care this matter is committed should visit each room, observe the hygrometers, and put the humidifyers into action where necessary. In the winter time, this person can also regulate the heating if desired.

During the day, the foreman in charge of the floor should see that the proper moisture is maintained at those times when artificial humidification has to be resorted to. It may be well to set limits such as to

turn on moisture at 72° hygrometer readings, and shut it off at 77°.

It is needless to say that at such times the windows should be kept closed, as it is no part of the scheme to try to moisten all out of doors.

In systems having automatic regulation all this trouble is avoided.

Other Advantages to be Gained.

This ability to constantly maintain certain standards of humidity also assists in other ways, as there is then no undue stretching of belting or strapping, no shuttles too loose in their boxes, no excessively dried-out Jacquard cards, or harnesses, to break or wear out speedily, etc., etc.

A careful consideration of the foregoing should convince any manufacturer that here is a matter of real importance, and, if he be not already using humidifyers, he should take early steps to equip himself in this direction with, at least, an experimental installation.

It is not too much to hope that the total annual output of many mills might be increased from 5 to 10 per cent. by the regular and intelligent use of these facilities, and such a prospective gain as this would warrant installations of a far more expensive character than any humidifyer system.

Those who have yarns for sale, and who are often subject to much loss of weight while it is lying in stock, can thus protect themselves against loss.

Unscrupulous persons also can, and no doubt do, use this means to unduly moisten their goods, and thus make their customers pay for water instead of yarn. By the use of the facilities offered by the conditioning houses for ascertaining the moisture in textiles, these abuses, however, can be readily kept in check.

XIII

THE TESTING, OR CONDITIONING, OF SILK AND OTHER FIBRES.

Much has been written and spoken about silk conditioning, and the subject is a very old one. It might be supposed that no silk manufacturer could fail to be thoroughly informed on this important matter, but quite the reverse is the case. Surprisingly few of the men who are constantly paying out large sums of money for silk seem to take much interest in the question, and while many manufacturers talk glibly about conditioning, as if they knew all about it, one does not have to go much below the surface to find how little they do know.

Ignorance Regarding Conditioning.

This ignorance is due to a lack of appreciation of the importance to them, in money, of this testing. The subject is a technical one, and there are many manufacturers who pride themselves on being "practical," and sneer at anything that may be termed theoretical, and conditioning with them comes under this head. Others will not take the trouble to inform themselves, and others, again, appear to be mentally unable to grasp the facts when laid before them. However, just let them once thoroughly understand that a failure to make use of the testing facilities within their reach is costing every mother's son of them hard cash, and a lot of it, every year, and they will waken up to the fact that they have not been so "practical" as they supposed, and will probably then take a lively interest in the subject. There are, of course, many manufacturers who are exceptions, but they are in the great minority.

Opportunities of Loss.

A purchaser of a lot of silk at $4.00 a pound will be very careful to see that he is not charged $4.05 or $4.10 a pound for it; and, if he were,

the bill would promptly go back for correction. He would not even consent to a charge of one-tenth of one per cent. more than he has agreed to pay. At the same time, he complacently accepts, in many cases, a less quantity of silk than he should get for his $4.00, and the fact that he may only be getting $3.90 worth, more or less, seems to have entirely escaped him.

What would be thought of the business sanity of a butcher, or a grocer, who would habitually and cheerfully accept one or two pounds short weight on every hundred that he bought? And yet this is what lots of manufacturers of silk are doing, simply because, owing to the peculiar nature of silk, the loss is not apparent, and what they cannot see they do not believe. Is it not as important to verify the weight as it is to check the price?

Again, if a manufacturer buys a certain size of silk for his goods, it is most important that he should be sure that it is within the commercial limits of that size. If heavier, he will be getting too much silk into his goods, and, once thrown, it cannot be returned to the silk merchant and has got to be swallowed. Proper determinations, made in advance by the Conditioning House, will give him a close approximation of the size; and, if finer or coarser than contracted for, he can demand a substitution of the proper size.

Meaning of "Conditioning."

It is unfortunate that the word "conditioning" has been used in this country to describe the operations we are referring to. Few people understand just what it means, and the terms "Conditioning House" and "conditioned weight" are too often meaningless names, while names like "Testing House" or "certified weight" would be understood.

Anyway, conditioning is simply the making of carefully devised tests for ascertaining the actual weight, under accepted conditions, of the substance tested. In silk, tests are made for weight, for size, and for boil-off, and, less frequently, for tenacity (breaking strength), and for elasticity. Twist is also determined and length of skeins measured.

Tests that may Profitably be Made.

It is equally important in the woolen and worsted industries that proper tests should be made, but in this country such testing, except in a few rare instances, is almost unknown. On the Continent and in England, however, free use is made by these trades of testing facilities.

Cotton and cotton yarn, absorbing moisture from the air less freely, and being of lower cost, have not invited such careful checking off; but, none the less, if all sales were based on conditioned weight, many abuses would be corrected.

A testing house may also have a laboratory equipped to make chemical and physical tests of all sorts of substances. Such a commodity as soap is largely used by silk mills. Good and very dry white olive oil

soap showed, in various tests made by the writer, a moisture averaging 14½%, the different tests coming very near to each other. A sample case of soap from another maker, being tested, showed a loss of 25%, and yet it was not unduly damp. Soap is not silk, yet a difference of 10½%, where it is largely used, is important.

Oils may be tested to determine the amount of fatty acids or other undesirable constituents in them, or to see if they contain admixtures of foreign matter which would make them undesirable for use, and also to find out the percentage of fatty matter, or olein, contained in the oil, for, of course, the richer it is the less of it will need to be used.

Other determinations that might be useful would be tests on paper for moisture, thickness and strength; on coal to show its calorific value; on harness twine for strength and other properties; on leather and leather belting, and on many other things.

Very important, too, for dyers and printers, is the determining of the purity of chemicals and the strength of dye-stuffs and coloring matters, a branch of investigation that does not receive anything like the attention that its importance demands. Tests to show character and purity of water are also of importance.

The number of directions in which the aid of the chemical and physical facilities of a well-equipped testing house may be of great money value to any manufacturer is obvious. At any rate, no textile mill can afford to neglect the conditioning of its raw materials, be they cotton yarns, raw-silk, wool or what not; and as most excellent testing facilities for textiles in the shape of an admirably equipped Conditioning and Testing House, have been furnished in New York by public-spirited gentlemen, it would seem to be the duty, as well as the interest, of all silk manufacturers to make free use of such services.

The neglect of these opportunities in the past has been doubtless due to the ignorance of manufacturers, who, unable to visibly see that their weights were incorrect, did not believe that they might be. On the other hand, they visibly did see that they were parting with real money for getting tests made, and so they concluded that this was an unnecessary expense, and they cut it out, and, when short-weight silk, but moister than it should be, was delivered to them, they paid for it without a thought of loss. The penny was so near to their eye that they were unable to see the dollar just beyond.

Experiences as to the Profit of Conditioning.

The writer's experience in the testing of silk, purchasing only good grades and from the best houses, is that errors in the weights of Asiatic silks were sufficiently numerous that the reclamations that could properly be made on the sellers paid for the conditioning charges twice over, and this on a basis of testing one bale out of every three. On poor-grade silks, and with houses that were not very careful, the amount to be claimed would certainly not be less.

On the Continent of Europe, business people do not make expenditures that add to the expenses of their business as freely as do Americans. In fact, we take pride in our liberal expenditures, and rather look down upon the parsimonious methods of other peoples. Having in view this national trait, one would expect to find in the United States, if anywhere, the freest expenditure for every legitimate object, and surely the ascertaining of the correct weight of the silk one is called on to pay for is a legitimate object. But what are the facts?

The economical Europeans find that they can afford to pay for the conditioning of nearly 55,000,000 pounds of raw and thrown silk in a single year (1907). The manufacturers of the United States, using about two-thirds as much silk as Europe, with all their boasted liberality can only point to the pitiful total of about 400,000 pounds tested in the same period.

(It is pleasant to note here that the campaign of education on the subject of Conditioning has been so successful that, by the year 1912, the weight conditioned had risen to 2,678,037 pounds, placing New York fourth among the conditioning houses of the world in the amount of testing done.)

The fact is that in Europe they have learned by experience that the only safe and satisfactory way, for both the buyer and the seller, is to have the weight of the silk checked off every time it changes hands, and that it is money in their pockets to pay for and have made the necessary tests. The sooner that we on this side of the water take the same lesson to heart, the better.

Conditions under which Tests are Made.

There is no need here to go into a description of the exact methods employed in the conditioning houses, or the bases upon which they make their tests. Suffice it to say that entire secrecy is observed, inside as well as outside, as to the ownership of the various lots; that the best-built and most accurate machinery and apparatus that can be devised are employed in the work; that great care is taken to insure, as far as possible, that the samples selected for testing shall fairly represent the average of the lots; and that the gentlemen in charge of such establishments are selected with special reference to their expert knowledge, as well as for their character and ability. To this it may be added that many able and experienced silk manufacturers, of large technical knowledge, are constantly giving much time and thought to the problems involved in the various kinds of tests, and from time to time improved methods have been, and in the future will be, evolved.

Any one interested in learning the nature of the tests upon which the conditioning houses base their conclusions, can procure from them printed matter on the subject, in which the methods employed are fully set forth.

A manufacturer, when giving instructions to a raw-silk merchant

as to the shipping of his silk, may order two bales out of each five, or, better still, all of them, sent to the Conditioning House for tests. The testing may take two or three days, and then they follow along to the throwster after the others. The tests made are principally for weight, size, and boil-off. From these tests the percentage of loss or gain in weight over the invoice weight is arrived at for the whole of the shipment.

Terms and Conditions of Raw-silk Trading.

The manufacturer should familiarize himself with the terms and conditions on which raw-silk is sold on the New York market, so as to know exactly what he is entitled to, and the tests he has made will then prove to him whether he is getting all that he is paying for, or not.

Certain "Rules and Regulations to govern transactions in the Silk Trade of the United States" have been approved by the Silk Association of America, and these Rules, as amended August 9th, 1911, I have here transcribed, as much of the matter contained therein has a close connection with the subject in hand.

The first section of these Rules applies to dealings in raw-silk, and the second section deals with transactions in the throwing of silk.

A list of classification names for raw-silks is also appended.

RAW SILK RULES AND REGULATIONS

To Govern Transactions Between Buyers and Sellers in

THE UNITED STATES OF AMERICA

Approved by the Board of Managers of the Silk Association of America, May 22, 1908, and amended August 9, 1911.

RULES

NOTE.—It is understood that nothing in the following rules shall be construed as waiving the right in individual transactions to make any special or distinct contrary agreement, but that the rules shall govern only in cases where no special or specific contract exists.

SALES OF SPECIFIED OR IDENTIFIABLE LOTS OF SILK from stock, or to arrive, for prompt, or future delivery (as for instance, of a lot giving marks and numbers, or a specified lot of a specified chop or grade, or in any other manner identifiable and distinct from other silks), are cancelled (unless contract calls for replacement) by destruction of such silks by fire, flood, marine disaster, or other unavoidable casualty prior to delivery dates as called for by contract; or by the insolvency of reeler, or by damage to, or destruction of, the producing factory prior to delivery by the reeler.

NOTE.—The Buyer can protect himself by taking out additional marine and/or fire insurance.

SALES OF AN UNSPECIFIED LOT OF A GIVEN QUALITY, GRADE, CLASS AND SIZE OF SILK (as for instance, a sale of 100 bales Japan Filatures No. 1 at a given price and delivery), cannot be voided except by mutual consent of Buyer and Seller. Delay in actual transit, damage, or destruction of an unspecified lot of silk, where a similar lot is not obtainable on the New York market, gives the Seller a reasonable period (to be determined by arbitration in case of dispute) in which to replace.

DELIVERIES. Sales for delivery on a given date, demand delivery or readiness for delivery on the date specified.

Sales for delivery on arrival on or about a given date, give Seller the right of delivery 15 days earlier or later than the date specified.

Sales for delivery within a given period, give Seller the right of delivery at any time within the period specified, unless the contract calls for specific deliveries during said period.

Where more than one month is named without other specification, delivery is understood as approximately equal portions during each month.

Seller should notify Buyer of readiness to deliver in accordance with contract terms of delivery, and Buyer is under equal obligation to call for silk when due him, but inadvertent failure of either party to tender or call for delivery, shall not void contract where readiness to deliver can be proved.

Delivery by Seller to common carrier, or agent of Buyer in compliance with oral or written instructions of Buyer, or party ordering shipment, is at the risk of said Buyer, or party ordering shipment.

SHIPMENTS FROM ABROAD. Sales for shipment on or before a given date, demand shipment on or before the date specified.

Sales for shipment on or about a given date, give Seller the right of shipment 15 days earlier or later than the date specified.

Sales for shipment within a given period, give Seller the right of shipment at any time within the period specified, unless the contract calls for specific shipments during said period.

Date of bill of lading shall be construed as giving date of shipment.

DEFERRED DELIVERIES (except by request of Seller), if billed but not shipped, or not billed because of Buyer's request, are at the risk of Buyer, who shall pay interest, storage and fire insurance. Seller shall exercise due care and diligence in the storing, handling and insuring of such silk, shall insure it at market value as property sold but not delivered, but shall not be liable for any other matter or thing occurring during the period of the deferred delivery. Total or partial loss by fire shall constitute a good delivery of such silks, destoyed or damaged, and the amount owing Seller shall thereupon become due and payable in accordance with terms of contract, but Seller shall credit or refund Buyer with whatever amount may be received from the underwriters on silk so destroyed or damaged. It shall be the duty of the Seller to diligently enforce the collection of any claim covered by the policies of fire insurance, and expenses incurred in so doing shall be deducted from the amount recovered.

WEIGHTS—Actual Weight and Tare is weight as taken at the time of delivery, or billing date (if delivery is deferred), less actual tare of bags, papers and strings.

Invoice Weight is net weight as invoiced by Seller or Seller's agent at point from which originally shipped.

Conditioned Weight of silk is the absolute dry weight plus 11 per cent.

To ascertain conditioned weight of a lot of Asiatic silks sold conditioned weight, at least two bales out of every five bales (or less) of a lot shall be tested at Conditioning House in New York. The average of all tests must be accepted as the basis for the