Stock Preparation and Sheet Characteristics of Writing and Printing Paper

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Summary

After detailed description of Sheet Characterictics of "Writing and Printing Papers", the beating and refining procedures, replacement of beaters with refiners, the modern stock preparation system and blending of short fibred pulps with long fibred pulps have been discussed. Other factors which affect the characteristics of these papers, such as morphology of fibres, cooking and bleaching procedures, the hemicellulose content and the furnish have also been discussed.

Introduction

A very distinguished American Paper Technologist summed up the subject of quality in paper as follows :—

"There is in a word no such thing as a general basis for quality in paper, and no other possible basis for quality in case of any particular paper than its suitability for its intended use."

Good writing paper is a blotting, good newsprint is poor wrapping, good book-paper is an impossible cigarette paper and so on. The properties which confer high quality upon a paper intended for one purpose are precisely those which condemn it for another.

"Suitability for its intended use" is certainly a prime criterion of quality in any kind of paper and this should take into consideration not only the functional specifications of the end product but the working-properties of the given paper during its conversion into the finished article.

For the preparation of "Paper-Making pulp" for a particular class of paper, a paper maker has to consider the various sources of influence on which the resulting sheet of paper manufactured on paper-machine is dependent. This applies above all to the condition of the used fibre-raw material as well as to its treatment in the stock preparation process.

It is well known that the fibre bonding is defined by certain mechanical, morphological and chemical-physical qualities, while fibre-length, fibre-width, the ratio of these two characteristics, the thickness of the fibre walls, the possible swelling of the fibres, the contents of alpha-cellulose, hemicellulose, pentosans and lignin, the degree of polymerization of the cellulose play a corresponding part with regard to the sheet characteristics of paper to be produced i.e. its strength, look through, transparency, opacity, bulk, absorbency and smoothness etc.

Difference in sheet-characteristics of writing and printing papers

There is not much difference between writing and printing paper's sheet characteristics. A large quantity of "writing paper" is used for printing. The Printer uses writing papers of all kinds, some are superior printings and other he prepares as Stationery or Prints as some part of document upon them for subsequent filling or completion.

The sizing of writing is harder than that of printings and the materials are manipulated to give a firmer handle to the

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paper sheet but there is no reason why many Writing Papers should not be used as Printings in work character of booklets, magazines without illustration and a large part of jobbing work which keeps to leaflet and pamphlet sizes. The nature of "writing papers" makes them less absorbent than the 'Printing Paper' so that the ink does not sink into the paper-sheet quickly. This is a desirable characteristic in the case of Writing, but not in the case of Printings where a fair absorbency aids the rapid drying of printed papers.

Sheet-Characteristics of Writing Papers

1. Writability :

It should be hard-sized with rosin which in better qualities and account books is supplemented by animal-sizing (Tub-sizing). Even with adequately sized papers certain inks e.g. Violet ink will at the time of Writing shall not show penetration but after several years will be visible on the other side which is very objectionable in ledgers.

2. Capacity for standing erasures :

Capacity for standing erasures and subsequently writing on the same place without the ink spreading is indispensable for account-books where alterations have to be made.

3. Smoothness :

Supplied in all degrees of finish from hot-pressed to super-calendering. The cheaper the paper, the higher the glaze in order to supress the possibility of protruding fibres which would stop the pen. These papers are also supplied with mill-finish or antique-finish (though coarse but the fibres are well attached to the sheet by tub-sizing to be picked up by the pen point).

4. Opacity : (Transparency).

(a) Opacity to be high for writing on both sides.

(b) Commercial type writings are invariably used on one side only and need therefore not be opaque. In fact a fair degree of translucency is usual and a proof of quality.

Sheet Characteristics of Printing Papers

The main characteristic of a printing paper is, of course, its printability. This property is related to many properties of the paper-sheet e.g. its uniformity, compressibility, smoothness, opacity etc. and its reaction with the printing-ink e.g. its ink receptivity, ink requirement, sizing, etc. etc.

The main characteristics can be enumerated as under :—

1. **Physical strength :**

The paper should be capable of standing a certain amount of stress and strain in passing through the presses but this property is not so important for printing as for the ultimate use requirement of the finished product.

When printing in sheets the strength requirements are rather very low but when the printing is to be done in reels, the strength characteristics should be sufficient for winding at a high speed though the strength need not be very high, only for certain qualities of printing-papers e.g. book work where adequate folding resistance is necessary.

However, in practice it is not possible to have maximum strength with a uniformly close formation and smooth finish. They are incompatibles and can only be obtained by coating the base paper.

The physical strength of paper is important for binding, stitching and sewing operations e.g. a paper having very low strength may break or crack in folders and fall apart on the stitching machines.

2. **Formation :**

It is necessary that the sheet of paper should be uniform in thickness to take a uniform impression. The dark or thick spots which take maximum pressure and thus act as bearers to prevent impression on the light or thin spots with the resultant mottled printing.

Another effect of wild-formation is the mottled or uneven show through or possible 'strike through'. The resistance to ink penetration by the hard spots prevents the strike through at these points but soft or low spots permit the ink to penetrate further into the paper and this trouble is further aggravated when extra pressure in printing has to be used. Thus the soft spots being less opaque may permit a 'show through'. Sometimes heavy calendering is resorted to, to reduce wild formation but it results in burning or blackening of the sheet and so imparting it a poor dirty colour.

3. **Smoothness :**

This characteristic of paper is closely related to its formation. Thus long and strong fibres which have tendency to clump together and thus giving rise to wild formation and also not easily calendered with the resultant non-uniform surface. So until and unless they are not properly bound into the surface by sizing or mechanical treatment these long fibres may produce fuzzy finished wild formed sheet. Hence it is said that a sheet built for strength is not a good printing sheet.

The smoother the sheet, the better is the contact between the paper and the printing plate but it is the kind and quality of the printing required which determines the degree of smoothness necessary in paper.

The usual method of balancing strength, smoothness and formation is to incorporate a certain amount of short fibre with the long fibres and to add good amount of filler to close the very small lattices and interices formed and left over by the former. Thus the various factors responsible for smoothness are :—

1. The degree of beating the fibres receive in stock preparation.
2. The bulk and the loading of paper.
3. The calendering that it has undergone during its manufacture.

4. **Softness and Compressiblity :**

By softness and compressibility of paper we mean its elasticity and ability to return to its original dimension after compressing for good printing, the paper must compress and confirm to the shape of the printing surface when under pressure. This property is of particular importance in case of better press printing.

It is due to the compressibility of a very smooth uncalendered sheet that it prints better than when heavily super-calendered.

Softness in a printing paper is desirable only to that extent that it does not effect the other characteristics of paper, a soft sheet tends to be bulky has low strength and is fuzzy.

5. **Stiffness and Flatness :**

A too limpy and flimsy sheet may cause feeding and delivery problems at a printing-press. This is particularly true when the sheet size is large. So an adequate degree of stiffness is important to avoid "Tail hooking and Waffling terms" which apply to distortion of paper due to pull of tacking during offset printing.

Similar flatness of paper is very important in proper operation of press-feeder and delivery mechanism.

6. **Opacity :**

When a sheet is to be printed on both sides it is important that it should not show

through and similarly the succeeding sheet should not be showing through the first sheet. Also there should be no oil penetration around the printed areas. All these three ideas might be expressed by a single factor opacity i.e. the sheet should be quite opaque.

The following factors have a bearing on opacity: —

(i) The type of pulp :—For example ground wood pulp is the most opaque while bleached—Sulphite is the least. The use of secondary stock may increase opacity but it sometimes produces a soft and fuzzy sheet.

(ii) The hydration of pulp :—It reduces opacity.

(iii) The best manner to increase opacity is by the addition of fillers; the greater the refractive index of the filler the more opaque it is. Thus the refractive index of clay and Titanium Dioxide are 1.56 and 2.20; while their opacities are 2.56 and 3.90 respectively. That is why Titanium Dioxide produces more opaque sheet with less filler content. This factor is important when maximum strength with high opacity is desired.

The addition of filler promotes smoothness by permitting easy calendering of the sheet as also prevents the crushing and blackening produced by over calendering. The filled papers have better printing quality due to better ink receptivity. Similarly coating helps for better printing, here the pigments are on the surface rather than in the body.

(iv) A bulkier paper has more opacity than a thin one with the additional advantage of creating an illusion of greater substance and also the paper handles better.

Opacity is of prime importance in line and half tone printing as it indicates uniformity of formation and thickness.

7. **Porosity :**

The ease with which air passes through a sheet of paper, is considered by some paper makers as a measure of its oil absorption factor i.e. its ability to absorb oil. This conception seems to be erroneous as the paper has a large number of bloked capillaries into which the oil penetrates but which do not pass entirely through the sheet of paper and so not accounted for in the porosity test.

A highly filled sheet may thus have a low porosity but still may have excellent ink receptivity. Similarly, coated-papers have very little or practically no porosity yet have a very high rate of oil absorption due to pigments present on the surface of the sheet.

8. **Surface strength for pick resistance of paper :**

The paper should have sufficient cohesion of bond strength to resist the pull of ink due to the tackiness of the latter. This is usually imparted by beating and sizing to uncoated papers while coated papers should have enough coating adhesion.

Paper designed for Offset printing, letter press, gloss ink printing needs relatively high degree of pick resistance to stand the higher tack of these inks. Letter press papers for printing of half tones generally can be made with less pick resistance because of lower ink tack requirements.

Dimensional stability of paper

A good printing paper shall be in equilibrium with surrounding atmosphere such that it neither expands nor contracts. A dimensionally unstable paper may render it unfit for multicoloured printing jobs as it is liable to miss register. That is why most of the modern presses condition their

paper to a temperature of 18°C and a relative humidity of 40-65%.

The expansion of machine made paper is more in the cross than in the machine direction whereas hand made papers are immune from this defect due to the equal expansion which in turn is due to equal filling in all directions.

The following factors are of interest to make paper dimensionally stable: —

(a) Paper made from Grass is more susceptible to moisture than paper made from Chemical wood.

(b) Beating increases the tendency to respond to moisture variations.

(c) Presence of loading and absence of sizing deter moisture absorption.

Paper which is not dimensionally stable tends to curl, show wary edges or belly in the middle of the sheet.

10. **Acidity and Alkalinity:**

The pH of Paper determines not only its permanence but also affects the fountain solutions used in printing offsets and these in turn may affect the plates in press work.

11. **Static Electricity:**

When the paper and the atmosphere is unduly dry then the paper is charged with electricity. The surfaces of the sheets acquire a tendency to adhere to each other.

The Object of Stock Preparation

Stock preparation in the manufacture of paper may be defined as the work done on the fibres to develop inherent values of the fibres in order to evolve from these developed values a sheet of paper which will sum up to the customer the required specifications in the qualities of the finished products.

With this thought in mind it is realised that from the first sheet of paper made to present time the 'stock preparation process' is the most important factor in the manufacture of paper.

The selection of the stock species of fibres from which this sheet is to be made is governed by the knowledge of the inherent values which can be developed to the degree necessary to produce the desired qualities. Control of the 'stock preparation' equipment, the mechanical mediums used to develop these values is the prime factor governing quality and quantity (production rate) of the finished sheet.

Beating and Refining Procedures

The stock which consists of fibrous material is subjected to two main processes 'beating' and 'refining'. A century old saying that 'paper is made in beaters' holds true today also. Though the designs of beating equipment has changed but the principle behind it remains the same.

In stock-preparation it is normal aim to reduce the freeness a minimum amount to some point where the stock will be capable of forming sheet having desired physical qualities. In working on the fibres in order to reduce its freeness to the desired value it is important to adopt proper methods of freeness reduction otherwise quality of the sheet will suffer.

Broadly speaking the treatment should consist of as much brushing and as little cutting as will produce the desired result. In particular the stock prepared by brushing will drain more freely and allow more of water being carried on to the four drinier wire which is of great advantage in forming a sheet. Fibres which have been brushed in a unit having a relatively high intimacy will usually produce a sheet of better strength characteristics.

It is pertinent to note that for any given

freeness stock brought to that condition by brushing will provide a sheet of paper of quite a different physical characteristics to that made when the same freeness condition is brought about by cutting.

For this reason 'beaten freeness' can be different from 'refined freeness' and both are different from 'Jordauned' (where cutting is taking place). Care must be taken to avoid misunderstanding by making direct comparisons. When contemplating the methods to be adopted for the production of some particular sheet of paper.

Replacement of Beaters with Refiners

The preparation of stock for supply to the paper machine can be broken down into three functional parts.

1. Pulping or slushing of the stock.
2. Refining of the stock.
3. Cutting of the stock.

Since the middle of the eightnenth century Hollander-Beater has been used as the one instrument to accomplish all the above operations together. The original design of the Hollander-beater was basically sound, can be judged by the fact that the beaters today differ, but little from the original invention of 200 yrs. ago. Needless to say it is quite inefficient to attempt to accomplish three functions, all incompatible with each other in the same machine. Though the invention of other types of processing equipments such as jordans, and refiners has been made but still the beater has not lost its importance of being only satisfactory piece of equipment for effectively treating certain type of materials such as rags, flax and many species of grasses.

Lot of efforts have been made to perform the different functions of pulping, wet beating and cutting in the same beater but all proved failure. This led to the development of specialised refining equipment to perform each separate function. Individual units are now sold for pulping, for brushing or beating and refining. Thus the three basic functions of the beater i.e., pulping, beating and blending are done separately and much more efficiently in different pieces of equipment each specifically designed to perform its particular function. In the last decade the trend has been towards the replacement of the beater with several different units each performing an individual function.

For slushing and pulping action there is now 'hydro-pulper', for second or refining action the 'hydrofiner' and for the third or cutting action the 'Jordan Refiner'. In high production mills the 'Jordan Refiner' has almost completely replaced the beaters. The main advantage of the 'Jordan' over the beater lie in savings in space and the circulation power required.

The Modern Procedure for Stock-preparation :

The three functions of stock-preparation i.e., slushing, refining and cutting of pulp are performed separately in separate equipment. By controlling these three functions individually, a sheet of paper can be manufactured more efficiently than before having the desired characteristics in the finished paper.

a. Pulp Slushing :—

The hydrapulper is now used for the job of pulp slushing. The stock is fed into large cylindrical chamber and the violent pulping action imparted by the impeller circulates the stock in a vertical path. This action continues until the stock particles are broken down small enough to be transported to hydrafiner. Its extremely high capacity, its quick action and low power usage makes the 'hydrapulper' as the most efficient machine for pulping and slushing.

b. Stock-refining using Hydrafiner and Jordan :—

Jordan or a conical refiner consists of a conical rotor or plug equipped with metal bars along its length which revolves inside the conical shell also equipped with bars around the whole inside surface. As a general rule the Jordan is used mainly for cutting the fibres but it can be made to do considerable beating if the bars on the rotor and the shell are wide, the stock consistency high and the rotational speed high. By increasing the pressure in the 'Jordan' from 30 to 50 lbs. per sq. inch increases the amount of wet beating. Reducing the power input increases wet beating and increasing tensile strength. The consistency used in Jordan refining is usually somewhat less than in the beater and this promotes cutting action. In many mills Jordans and beaters are used in combination to provide flexible stock preparation system, the beater being used to provide basic beating and Jordan used for final control.

In the conical refiner when wider bars are used in the plug and the shell and the peripheral speed made high i.e. from 300-600 R.P.M. to 1100-1200 R.P.M. there is less cutting of the fibres and brooming and bruising but more longitudinal splitting of the fibres, it is known as hydrafiner. The Hydrafiner operates under high speed with low medium horse-power applied. One hydrafiner is equivalent to two to five beaters. The hydrafiners may be used in all types of mills from low production to high production.

These hydrafiners can be used effectively for refining pulp for the manufacture of 'writing and printing papers' having maximum tear.

As an individual machine not being used for refining action, the hydrafiner has further advantages. On short fibred and easy hydrating pulps like that of bagasse, straw and many species of grass where defibring is frowned upon, the hydrafiner due to its gentle brushing action can do extremely good job. Where both folding endurance and good opacity are needed in the paper manufactured the hydrafiner provides the former but to achieve opacity a certain amount of cutting must be done. This can take place in Jordan-refiner. A balance of refining and cutting actions have to be main aimed to obtain different characteristics desired for manufacturing all kinds of writing and printing papers.

Blending of 'Short Pulps' in Stock Preparation

(a) To meet the rising demand of writing and printing papers, the Indian Paper mills have now started to manufacture these on high speed machines, i.e., about 1000 ft./mt. There is already shortage of the conventional raw materials like bamboo and sabai grass to manufacture these papers. So, it has become all the more necessary for the Indian Paper Industry and the Government to consume more of the non-conventional fibres, e.g. Sachrum Munja (Khar-kana), Kai (Sachrum spontoneum), Bagasse and some hardwood species. But the pulps from these raw materials are mostly short fibred and so their percentage of blending with long fibred (conventional fibres) is limited and also there is at present no suitable equipment for their stock preparation.

At present 40% of such kind of pulps can be conveniently blended with bamboo or wood pulps, to run the stock on the paper machine at the speed of about 750 ft./mt. but when this percentage is made high the difficulties are encountered in the manufacture of paper. The main hurdle is the stock preparation plant. The original freeness of (C.F.) Soft wood or Bamboo pulp is 700 and that of short fibred pulps i.e., of bagasse or khar is only 300°. In order to manufacture 'Cream Laid' or 'White Printing' at the speed of 750 ft./mt., the suitable C.F. of blended refined stock

is required to be about 300. But the original C.F. of khar or bagasse is already 300. The difficulty arises at this point because if this pulp is refined to get good formation, the C.F. would come down and the machine has to be slowed. Good paper would be made but at the cost of production. On the other hand if the short-fibred pulp is not refined, the speed of paper machine 750 ft./mt. can be maintained but the paper made would not be as good in formation as when the pulp was refined.

(b) So in order to surmount this difficulty the foreign paper technicians K. Resenfeld, J. Hoffmenn and G. Mickley have designed a disk type refiner in which mechanical fibre treatment takes place without any cutting or shortening effects. The refiner operates at a fixed clearance, in order of the magnitude of average fiber lengths between their working members rotating at high relative speeds. It can be fed with high fibre consistencies above 20%. In the gap between rotary and stationary member high velocity gradients effect intensive hydrodynamic shearing forces on the pulp of high consistency. A cutting or shortening of the fibres cannot occur due to relatively wide fixed clearance. The fibre surfaces themselves will exert intensive internal frictional forces on each other due to their high consistency and subsequent intimate contact. The manufacturers claim that unusually high tear properties are obtained with simultaneous development of tensile and bursting strength in the manufactured sheet from the prepared stock.

(c) There is a big difference in beating characteristics of long fibred pulp e.g. bamboo and soft wood and short fibred pulps e.g. khar and bagasse etc. The rate of beating in case of short fibred pulps is much quicker than that of long fibred pulps. The beating characteristics of 'pine wood' and 'Bagasse' pulps can be judged from figure no. 1 and no. 2.

The most desirable method for handling mixed furnishes of long and short fibred pulps in the stock-preparation plant is to beat each pulp separately and blend fully beaten pulps in a chest. In a continuous system separate refining of mixed furnishes can be achieved by passing one pulp through the full refining system and putting the other pulp through a smaller portion of the refining system and mixing the two flows in a metering box.

On the above basis Black-Clawson International Ltd. have designed a stock-preparation system to handle mixed furnishes of hard wood and soft wood. The flow diagram of the process is given in fig. 3.

Other Factors Affecting Stock Preparation and Sheet Characteristics

(a) **Morphology of fibres:** The morphology of fibres consists of fibre-length, fibre length/diameter ratio, cell wall thickness and cell well organisation. Lot of work is being done by the foreign research workers to examine the effect of each of the above fibre characteristics on its stock preparation and on the quality of the sheet manufactured. So far the following conclusions have been made:

(i) **The length of the fibres:** It is important for tear resistance, and less important for burst and tensile strength in a sheet but these can be developed on beating. Longer fibres tend to give a more open and less uniform sheet structure.

(ii) **The thick-walled fibres:** It gives bulk, open sheet with rather rough surfaces. The thin walled fibres give dense, well formed sheets, Pulp strength properties such as burst tensile, particaularly folding endurance are adversely affected by an increase in the cell wall thickness.

(iii) **Cell diameters:** It does not much influence the paper properties and also there

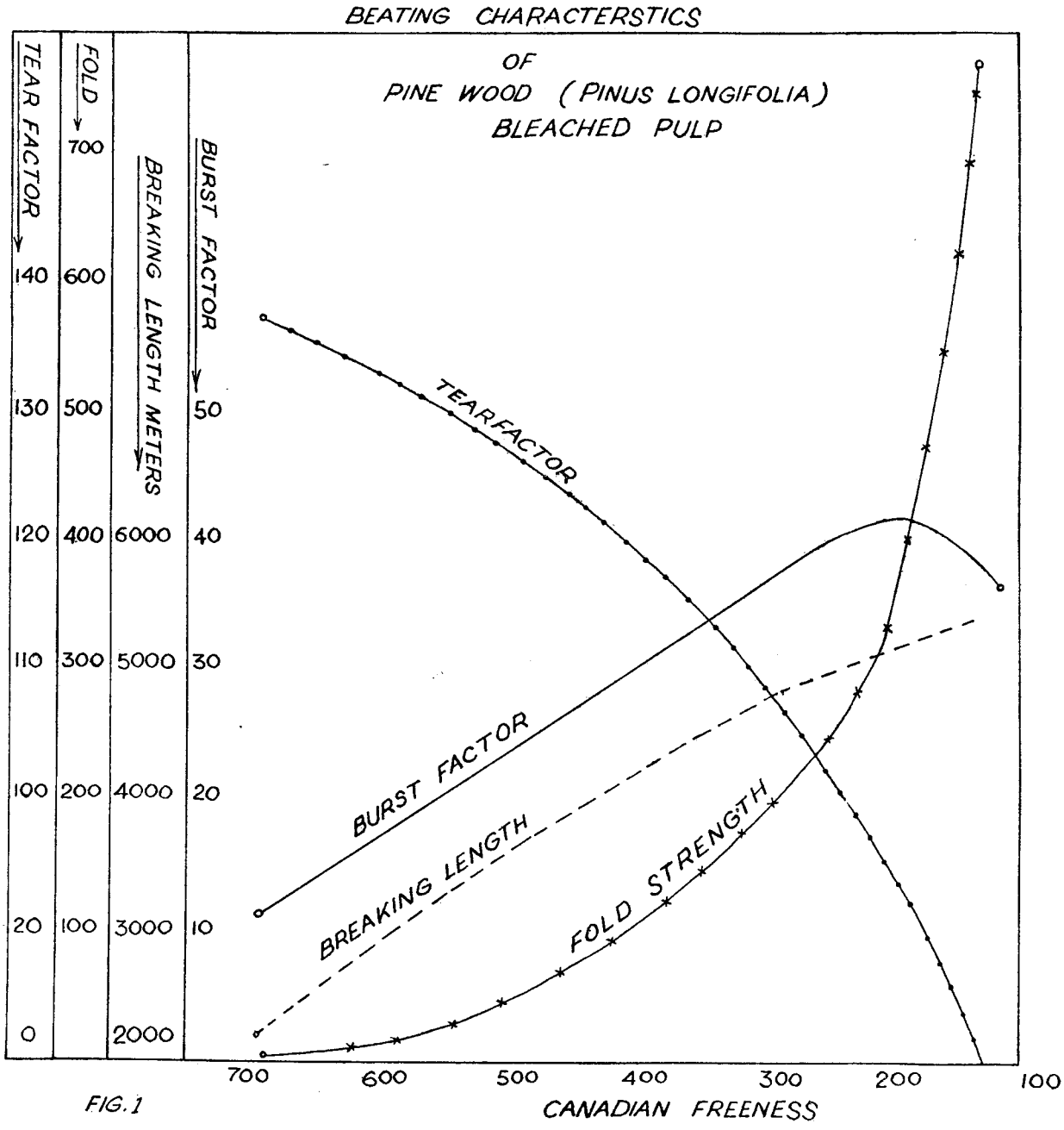

BEATING CHARACTERSTICS
OF
PINE WOOD (PINUS LONGIFOLIA)
BLEACHED PULP
TEAR FACTOR
FOLD
BREAKING LENGTH METERS
BURST FACTOR
140
130
120
110
100
20
0
700
600
500
400
300
200
100
6000
5000
4000
3000
2000
50
40
30
20
10
TEAR FACTOR
BURST FACTOR
BREAKING LENGTH
FOLD STRENGTH
700
600
500
400
300
200
100
CANADIAN FREENESS

FIG. 1

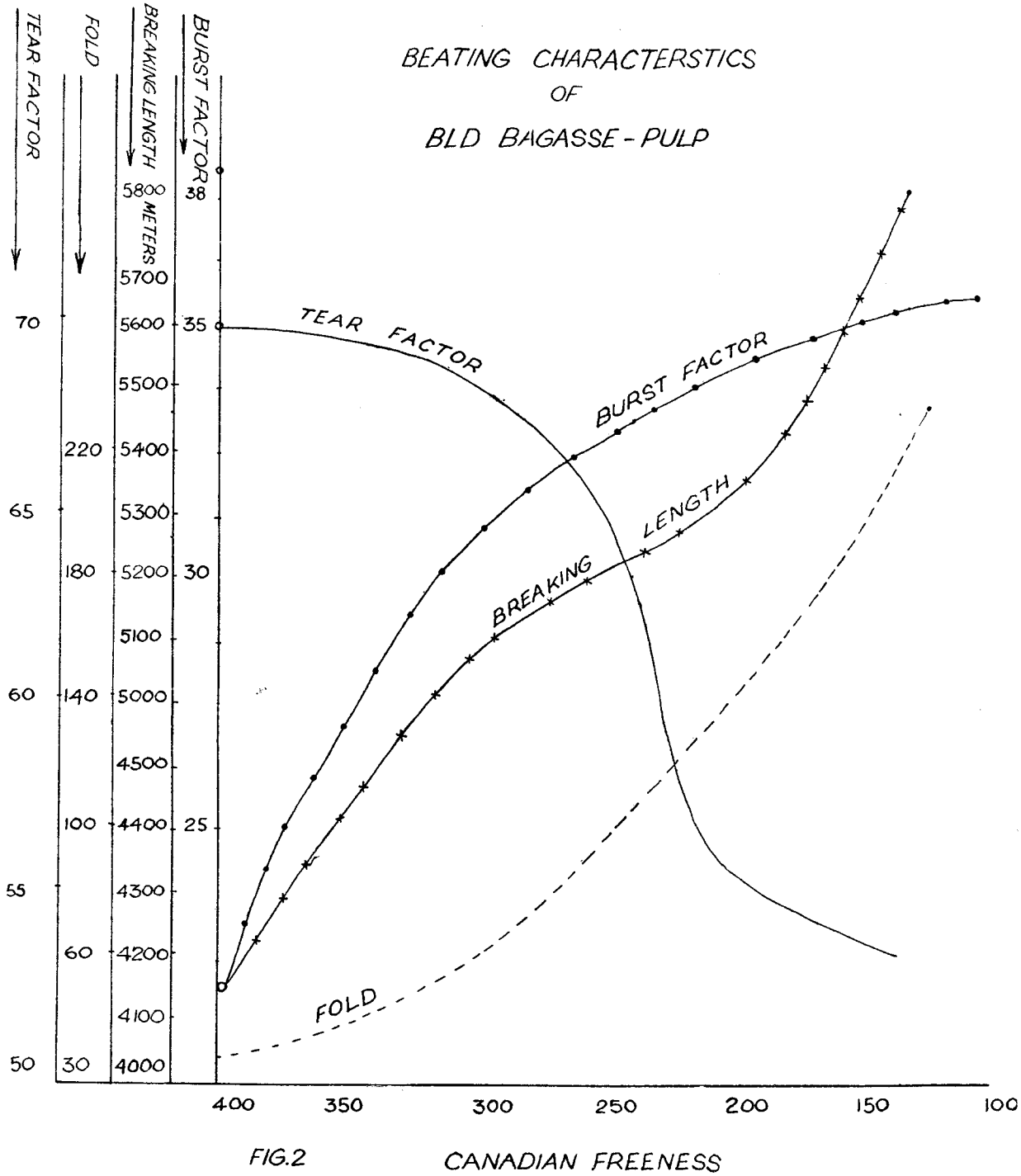
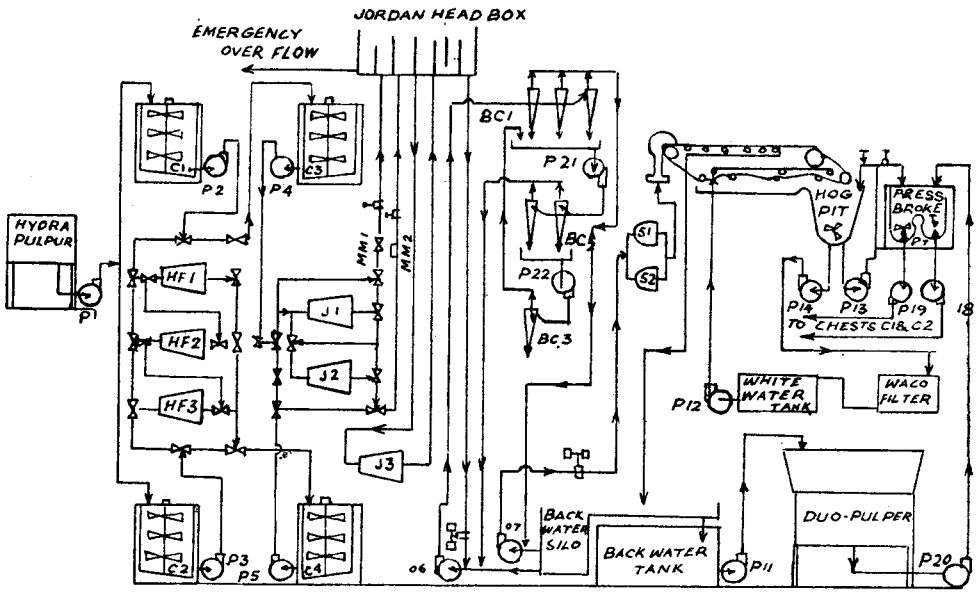

BEATING CHARACTERSTICS
OF
BLD BAGASSE - PULP
TEAR FACTOR
FOLD
BREAKING LENGTH
METERS
BURST FACTOR
TEAR FACTOR
BURST FACTOR
BREAKING LENGTH
FOLD
70
65
60
55
50
220
180
140
100
60
30
5800
5700
5600
5500
5400
5300
5200
5100
5000
4500
4400
4300
4200
4100
4000
38
35
30
25
400
350
300
250
200
150
100
CANADIAN FREENESS

FIG.2



Simplified Flow Diagram. Key: BC: Bouer Centri Cleaner; C: Chest; HF: Hydra-tiner; J: Jordan; MM: Magnetic Meter; P: Pump.

FIG. 3

is no significant effect of length/diameter ratio on strength properties.

(iv) **Parenchyma-Cells:** These are short and extremely thin walled, if present in large percentage, would adversely affect yield and printing qualities of the paper.

(b) **The Cooking and Bleaching Process applied to fibres:**

The cooking and bleaching process to which the fibres have been subjected before their coming to the stock-preparation have great influence on the development of strength characteristics in the 'beating process' of stock-preparation. When the pulp is over cooked and also subjected to drastic bleaching process, the pulp loses its strength to withstand the impact of the beating-process. Sometimes it is even difficult to run the web on the paper machine. If the pulp is given mild cooking treatment and bleaching is perfumed under controlled conditions, there is good development of strength characteristics during the 'beating process' of stock preparation.

The following are the results of strength tests of Un. bld. pulp from wood when it is cooked under mild conditions i.e. using higher liquor ratio and using optimum quantity of chemicals. These are compared with results obtained by cooking wood under drastic conditions i.e. using same amount of chemicals but using lesser liquor ratio. The digesters used were tumbling digesters.

	Mild Cooking		Drastic Cooking	
C. F.	280	280	275	250
B.F.	42.6	43.6	26.3	30.2
Brk. length (mtrs)	6762	7580	4320	4690
Fold	1485	1152	129	250

The above results show that the inherent strength of the fibres of the raw-material is quite high and which remains little affected due to milder cooking conditions maintained in the digester. Further when these fibres are subjected to bleaching process to get reasonable brightness, under proper P.H. control, the degradation effect of bleaching Chemicals on the fibres is negligible, resulting bleached pulp having maximum inherent strength which when subjected to beating-process in the stock preparation plant develops high strength properties. It has been practically observed that there is marked improvement in the strength characteristics of the sheet of paper manufactured on paper machine from thus prepared stock.

The following table shows the improvement in strength characteristics of the manufactured paper when the stock-preparation plant is switched over to above type of pulp keeping rest of the manufacturing conditions unchanged for the same quality of paper made.

White Printing 54.0 Gms.

Strength properties	From Pulp made under drastic conditions	From Pulp made under Mild conditions
1. Breaking length (meter)	1736	3752
2. Bust factor	7.1	14.9
3. Fold (d.f.).	4.5	11.0

(c) Hemicellulose Content of the Fibres

Ligning is an undesirable and hemicellulose a desirable component of paper making pulp. As a consequence the hemicellulosic material of the fibres is penetrable by water and after deligification is swells considerably forming gel inside the fibres, in the inter-fibrillar spaces and on the surfaces of the fibres and fibrills. The adhesive effect of such a swollen surface is

generally accepted by the research workers in this field.

It may be postulated that the greater the amount of hemicellulose present in the fibres at the stock preparation stage, the stronger would be the manufactured paper. The interafibrillar hemicellulosic material is supposed to play an important part in the 'beating function' of the stock preparation. It imbibes water and acts as an internal lubricant making the fibres flexible. Further more its swelling pressure contributes to the losening of the structures of the fibres and also to their fibrillation process.

In order to obtain maximum strength properties in the manufactured sheet of paper, it is desirable that the pulp prior to stock preparation stage should have maximum amount of hemicellulose. This can be achieved in the process by giving 'milder' cooking conditions to the raw material fibres and applying the bleaching process under controlled conditions, so that fibres remain safe from the degrading effects of bleaching chemicals.

(b) Furnish of the Fibres:

Writing papers: The different qualities of writing papers are as under :-

(i) Wove and laid.

(ii) Bank loan Bonds and Airmails.

(iii) Ledger and A|c. Book Papers.

(iv) Drawing or Cartridge Papers.

Every variety of writing paper may be wove or laid without alteration in quality. In fact most mills make wove and laids from the same stock by mere changing of dandy roll. All the above qualities of writing papers are made from the stock having pulps of Rag, chemical wood pulp and grass or bamboo pulp. For poor quality of writing papers different quantities of mechanical wood pulp is used. For highest quality of writing papers when permanence and strength is desired 100% Rag furnish is used. For making bank loans and bank demand and bonds strongest rags e.g. Hosiery cutting or linen stock is used. Similarly ledger paper should have high tub sized surface, opacity, moderate finish both sides alike in surface. To obtain the above qualities on all rag furnish with a fair proportion of strong-linen, prolonged beating to draw out fibers, a shake which will ensure a good felting and slow drying to allow of gradual contraction are necessary.

Printing-papers :

Printing papers are usually made from combination of furnishes to suit end products. They may be made from combination of :—

1. Chemical wood pulp, e.g. bleached sulphate, sulphite, soda and bleached semi-chemical individually or combination.
2. Chemical bamboo or grass, pulp, e.g., bleached sulphate or soda.
3. Various percentages of ground wood combinations.
4. Various percentages of rag pulps.
5. A considerable quantity of assorted high grade waste paper.

The following are the characteristics of paper obtained from different furnishes :

All Rag Paper :

It is soft to print, pleasant to handle and very durable. Splendid white shade can be obtained and when it is printed with good black ink it gives a very rich appearance.

Mixture of rag and chemical wood or bamboo pulp :

Soft type paper is formed which takes good finish.

Chemical wood and grass :

Produces a very good printing paper.

Types of wood pulp :

They are hard and transparent sulphite and soda. The harshness due to sulphite may be greatly modified by the use of soda pulp but the mixture may not be as soft as of grass pulp. Excellent results in printing can be obtained on careful beating and blending of the fibres in the stock preparation process.

Mechanical pulp :

It is used where absorbency, bulk and opacity is required but not where the permanence and strength are the chief characteristics in the manufactured sheet of paper.

CONCLUSIONS

In order to have efficient production both in quality and quantity of writing and printing papers on high speed machines, i.e., about 1,000 ft./mt., a continuous type of stock-preparation system consisting of Hydrapulper, hydrafiners and Jordans may prove very useful. Good qualities of writing and printing papers can be produced by mixing long fibred pulps with short fibred pulps. The Indian Paper Mills are facing difficulty in using short-fibred pulps of bagasse, straw and some species of grass more than 40% in their furnish due to lack of proper refining equipment available in stock preparation system.

The urgency of the situation demands that a proper type of equipment possibly a disc-type refiner, indigenously made, may be evolved in which along with fibrillation there is no further shortening of the fibres. This would remove the hurdle of using higher percentages of these pulps in their furnishes.

Further in order to obtain better strength characteristics in the manufactured sheet, it is necessary that the raw fibres are subjected to cooking and bleaching process in such a way that there is minimum degradation of cellulose of the fibres and as well as their pentosan content is kept intact as far as possible for development of strength characteristics in stock preparation process.

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