# The Dandy Roll

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#### SUMMARY

This paper describes the design features of Dandy Rolls, Brackets and accessories used on various paper machines to produce different grades of paper. It also describes various operational problems with Dandy Rolls and remedial measures/changes required to overcome these problems in a general form.

## INTRODUCTION

The history of dandy roll can be traced back to the early 19th Century. Earlier the dandy rolls were used only in the manufacture of deluxe papers but now their use has gradually become more wide spread and their designs have been modified to confirm to the advancement in working conditions.

## FUNCTIONS OF DANDY ROLL

Dandy Rolls are required on the wet end of Fourdrinier paper making machines for re-orientation of the fibres in the wet web of papers by exerting pressure upon the sheet in process of formation. A Dandy Roll equalies the upper surface of paper, climinales variations in density of the papers, improves the strength by better bonding and sheet formation and imparts Watermarks on paper sheets. In brief, the functional condition of the Dandy Roll for the quality of paper and the production in troubles with the wet web to smoothly pass through the presses and there after the dryer nests, is very considerable.



## FIG.I. REPRESENTATION OF DANDY ACTION

## **REPRESENTATION OF DANDY ROLL**

A Dandy Roll when handled properly will improve the formation of the sheet to a very considerable extent. Even comparatively well formed sheets can be further improved by its judicious use. The Dandy reorients the fibres locally, rearranging them during the period while the fibre mat still retains sufficient fluidity. The action of Dandy Roll is illustrated diagrammatically in the FIG. I.

The Dandy is so adjusted before the start up of the machine, that it is just clear of the wire. When the sheet is on the wire, however, the roll is supported by the sheet, thus exerting pressure on the fibre mat. The woven dandy cover allows the passage of water through it and thus as the mat is compressed, the water removed passes into the dandy and out again on the down stream side. This results in a big difference in appearance between the sheet on the two sides of the dandy, the film of water on the outgoing side conveying the impression that the dandy has put water in. At this point the consistency of the stock on the wire varies, but is usually of the order of 6 percent, depending on the furnish wetness and desired dandy effect, which is adjustable.

## **OPERATION**

As the fibre mat first touches the dandy it is of fairly uniform consistency though flocculated to some extent, and with a rough and uneven surface. The gentle compression of the mat rolls and regets the fibres into a level sheet, the thicker lumps being spread out sideways to fill up the trough-like spaces and being at the same time deflocculated.

A small wave of water is formed just infront of the dandy and this overcomes the surface tension forces and the water passes through the cover, the fibres

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which are deposited on the cover being better pressed back onto the main mat. The water passing through the cover is carried round to the outgoing side, where it is instrumental in pushing the sheet off the dandy roll as it is carried up a little way inside the roll by its revolution. The faster the machine is running, the higher up this water is carried.

If the mat is sufficiently fluid there is little or no separation of water, and the mat passes under the roll, unchanged. When too much vaccum is used on the flat boxes before the dandy, these remains a water film between mat and wire, but none between dandy and mat and the sticking of the sheet to the dandy is therefore possible. It is to prevent this problem, that the wire cloth of a dandy is always coarser than the paper machine wire on which it is running, by which it gets the advantage of the web tending to stick to the wire side because of greater contact area as compared to the coarser Dandy Cover Cloth with less area of contact.

Should the sheet approaching the dandy be too wet, the dandy sits deeper into the mat and the water squeezed from the sheet cannot get into the dandy fast enough, and thus the size of the wave is increased to a point where the pulp mat is flocculated by the dandy completely disturbing the sheet and increasing its width. The heavier the dandy, the higher the consistency at which disturbance will become evident.

A large dandy is more effective at the same speed than a small one because the action on the sheet is over a longer period due to larger arc to cover the area of contact. The wet beaten stock being more fibred stock is more difficult to close up than a short fibred stock by the action of a dandy. Short fibred stock is, however, disturbed at a lower consistency than long fibred stock, thus a nonshortened wet beaten kraft will 'swim' under the dandy even at a considerable dilution with no other result than improved formation. A heavily loaded sheet is more difficult to work with a dandy, partly due to interference of the loading to fibre movement and partly to impedence of flow of water through the dandy covers, and also due to the accentuated clogging of the Dandy Cover Cloth.

Sometime water is added to the top of the dandy or from the inside of the dandy by a spray pipe, and is used to regulate the fludity of the fibrous mat, serving also to keep the dandy clean. This is especially used when a clear laid mark is repaired.

## CONSTRUCTION OF DANDY ROLL

A dandy roll is made essentially in the form of hollow structure and have varying constructional and design features suiting individual Mills requirements. Some are provided with shafts and others are without Shafts with Axle Ends or End rings. These are constructed from Stainless Steel Wires or non-ferrous copper base alloy sheets, strips, bronze cast flanges, rods, hollow bars, round and shaped wires etc. All the points where two or more than two sections corsa,

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the joint is secured by welding or soldering resulting in a rigid structure with a firm cylindrical surface which forms the base for cover.

## DIMENSIONS OF DANDY ROLL

The length of the cylinder of a dandy should be from 50 to 60 mm larger than the width of the wire, in order that the latter may not get cut lengthwise by the edge of the rims at the end of the roll. The determination of the diameter is very important. The surface of contact between the roll and the stock being proportional to the diameter of the dandy, the maximum possible diameter is subject to certain limiting factors and (its working speed.

The minimum diameter depends on the speed of the machine. A too rapid rotation causes the water to splash forward and the splashing leaves marks on the sheet.

For rolls with friction drive (running due to friction with fourdrinier wire) a speed of rotation of 100 revolutions per minute is advised as a general rule.

The larger diameter rolls, having drive arrangements, this speed may be increased upto 150 r.p.m.

#### **TYPES OF DANDY ROLLS**

The following types of Dandy Rolls are more commonly used by the paper Mills.

- (1) Wove Dandy Rolls—with or without Watermarks.
- (2) Laid Dandy Rolls—(Chain Type)—with or without Watermarks.
- (3) Laid Dandy Rolls (perforated Plate Type) with or without Watermarks.

All these types of Dandy Rolls are now being made in India by Shalimar Wires & Industies Ltd. Calcutta.

## WOVE DANDY ROLLS

Wove Dandy Rolls may be used for improving sheet formation and also for Water marks.

When a roll is used only to improve the sheet of paper without marking it, it is termed as Plain Wove Roll. The papers thus manufactured are also Wove Papers.

## PARALLEL LAID DANDY ROLLS (CHAIN TYPE)

In such Dandy Rolls the jacket is made of laid wires running parallel to the axis of the dandy and these are kept in position by twisting two wires in chain form at regular intervals to form an uniform jacket. The laid wires and the wires forming chains, mark their impressin on paper.

## CIRCULAR LAID DANDY ROLLS

This type of roll is used when for reasons of size, it is desired to mark the sheet of paper in opposite direction. It is made with or without supporting wire.

(a) Circular Laid Dandy Rolls Witbout Supporting Wires -The simplest arrangement consists of utilising the spiral wire strand covering the frame as a laid wire. The pitch of the winding of the spiral wire is decided according to the separation of the laid wires.

The 'slice' wires consist of fine soldered rods parallel to the axis of the roll.

(b) Circular Laid Dandy Rolls with Supporting Wires—In this case the frame work of the roll, on which is wound the spiral wire, is fitted with a wove wire jacket, the mesh of which is determined by the spacing of the laid wires. A spiral wire is then wound on, following the grooves formed by the warp strands of the wire. It is thus firmly held in place.

The 'slice' wires are soldered as in the previous case.

## LAID DANDY ROLLS (PERFORATED PLATE TYPE)

In this type of dandy rolls, the rings which make up the frame of the roll serve as slice wires. The rings are perforated, at a few hundreths of a millimeter from their edges, with regularly spaced fine holes through which are threaded from one end of the roll to the other, the laid wires. These wires form an uniform covering and no extra jacket is required. This type of roll imparts a very clear and uniform mark. It is particularly recommended for thin papers such as Cigarette paper.

## WATERLINE ROLLS

Certain papers must carry a continuous distinguishing mark. This mark usually consists of clear parallel lines, regularly spaced known as Waterlines. It is obtained by fitting circular projecting wire strands to the jacket of the dandy roll. These strands may be either welded to the wire or woven. The former method results in clearer lines and is generally preferred.

#### WATERMARKS

Watermarks originated in Italy nearly 700 years ago, so it is an art that is even older than letter press printing. Used by paper makers for their own benefit or at the behest of their customers, watermarks come in several forms—letters, symbols, words, patterns and motifs.

To mention Watermarks is to conjure up visions of quality writing paper, bank notes, cheque papers and postage stamps, but in fact, the technique has extended to lavish trade marks for prestige purposes and to all kinds of security applications.

Trading stamps and gift coupons feature among the more prosaic uses, while other developments have included Watermarks for secret papers and even for wrapping paper and labels for wines and medicines etc. to prevent fraudulent passing off these commodities by unscrupulous back street vendors and to prevent adulteration.

The production of a watermark is more than a process—it is a highly specialised art which calls for

highest dedication of applied skills through out every stage. The water mark manufacturer needs to know where the paper is to be made, at what and its grammage. Even the actual type of machine has to be indentified so that the final design provides for its known characteristies.

Pre-distortion is carefully built into the watermark. Tight corners must be avoided, since these could entrap pulp on the papermaking machine. There must be no sharp edges which could tear the paper. The design must be such that it can be made robust enough to withstand the speed of modern machinery, bearing in mind the weight of paper being considered.

There are two types of Watermarks :

(a) Clear Watermarks.

(b) Shaded Watermarks.

## **CLEAR WATER MARKS**

Clear Watermarks, which are the most common, are those which appear on the paper. They are produced by thin metal strands soldered or sewn onto the surface of the jacket of the roll.

The form of these strands, their width and projection vary according to the weight of the paper and the composit ion of the stock.

#### SHADED WATERMARKS

Shaded watermarks are those which appear on the paper as a dark tint, which may be accompanied by intermediate or clear tints.

They are obtained by means of reliefs and hollows on the dandy cover. The most varied designs may be obtained, postraits, inscriptions etc.

## POSITION OF THE DANDY ROLL ON THE MACHINE

The roll is set up on the table between the suction boxes in a position which experience has shown to give the best results.

If the roll acts on the stock when the latter is too wet, the fibres do not rest in the position given to them by the roll, and the look-through of the sheet, instead of being improved, is sometimes marked with longitudinal lines due to the carrying along of excess water.



## POSITION OF DANDY ROLL ON MACHINE WIRE

If on the other hand, the roll acts on the sheet when the distribution and setting are already well under way, its effect is greatly reduced.

The Dandy Roll causes the wire to bend down words by the pressure it exerts. In order to avoid

friction of the wire on the edges of the suction boxes, it is recommended to place under the wire two table rolls, one on each side of the line along which the dandy roll presses down, as shown in the figure.

## **RUNNING DIFFICULTIES**

Any slight flaw in the cover will cause fibre to stick at this point, and a gradual accumulation of fibres at the one place will ultimately pick a hole out of thesheet and the subsequent drop off will cause a break at the couch press.

A wiper, consisting of a piece of felt trailing on the dandy and dampened by a slight spray, is often used to overcome such defects.

A dandy will often break up froth bubbles; these may, however, be so persistant that the roll rotation with bubbles covering the surface. This results in 'Dandy worms'—thin places in the sheet where a bubble has pushed the pulp aside on the ingoing side of the roll. Whereas a wiper, as described above, may be sufficient to deal with bubbles, it is usually necessary to use a steam shower which is placed inside the roll if the construction permits. A disadvantage of the steam shower is that the resulting fog obscures the machineman's appreciation of conditions in the locality of the dandy.

Sometimes on poorly operated machines froth bubbles are allowed to form and travel round with the wire. These can accumulate in front of the Dandy and will lift and stretch the fibre mat.

Any slackness in the cover, usually a result of fair wear and tear, can give trouble at high speeds by stuff between the cover and its backing wires. These accumulations occur in large spots and make a thin place in the sheet of every revolution.

Laid dandies are generally easier to run than plain wove dandies, since the mesh is coarser. It can generally be said that the biggest trouble is liable to occur with a dandy when the stuff is too fine, because of its tendency to filling the spaces and stick to the Dandy. The properly beaten stock without excessive wetness would not pose this problem.

Wove Watermarking dandies are extremely sensitive. The more water present under the dandy the clearer will the watermark be, thus the conditions that are best for watermarking are worst for the sheet generally.

Thus a balance has to be found by the stock preparation department and the machineman to enable the sheet to be run at the beating degree permitting a fibre to water ratio at the dandy that will both close the sheet, and give good watermark.

As the sheet passes from couch to press section and through the press section and dryers, it shrinks in width, the final width at the reel being considerable narrower than on the wire. The amount of shrinkage is dependent on the wetness, type of stock and extent of draw used, the latter being dependent on the speed. The watermark, however, is put in on the wider sheet on the wire and thus the insignin on the dandy are spaced to allow for the shrinkage.

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When running watermarked papers to register it is important that the conditions are such as to maintain the proper spacing of the watermark.

## PRECAUTIONS TO BE TAKEN WHEN THE ROLL IS PUT INTO SERVICE

- a) Attention must be paid to.
- good mechanical condition of the supports.
- their perfect alignment.
- absence of any cause of friction, permanent or temporary, which may reduce the speed of rotation. In order to allow for expansion of the roll, the lateral stops, which are preferably of the roller type, should be so placed as to leave a play of 2 mm per metre length of the roll.
- b) Before putting the roll into operation, a linear speed approximating to that of the machine should be imparted to it. This setting in motion of small rolls and rolls with axle ends in general, is done by hand. It is sometimes necessary to set large-diameter

rolls in motion mechanically, on account of their inertin.

c) Once in motion, the roll should be carefullyput into contact with the wire. If the speeds of the roll and the wire are not approximately equal at the moment of contact, the jacket will suddently acquire the speed of the wire and conseequently will slip on the body of the roll and may even become torn. In the modern arrangements, for running the dandy on high speed machines, the controls are provided to overcome this problem.

## PRECAUTIONS TO BE TAKEN DURING RUNNING

All supports must be provided with some arrangement for adjusting the height, which is necessary in order to assure running at a suitable pressure and without slipping. The correct adjustment is arrived at after examining the surface of the stock after it has passed under the roll and also the dry sheet.

Rolls with end rings allow the introduction of a steam pipe. This pipe is supposed to prevent the formation of froth and must be placed as close as possible to the part of the roll in contact with stock.

# ACCIDENTS WHICH MIGHT HAPPEN TO THE ROLL

## (1) Rolls with Axle Ends.

The most common mishap ist he development of a 'wobble'. It may result from a bending of the body of the roll, but is more usually due to a deformation of one of the two ends of the shaft.

It is easy to eheck by rotation if the roll has a wobble and it may sometimes be repaired on the premises. This defect occurs most often to rolls whose axle ends are too weak or handled wrongly. A diameter of the axle between 20 mm and 25 mm is recomonded.

## **ROLLS WITH ENDRINGS (OPEN ENDED)**

These rolls are generally heavier than rolls with shafts. The rest on one or more rollers attached to the supports. When any of these rollers do not turn freely, the roll is braked and jacket is subject to a considerable strain which quickly causes it to become deformed.

The seam of the jacket in this case is pushed forward in the centre relative to the ends. Sometimes the strain is so great that not only is the jacket deformed, but also the interior framework of the roll it self.

The same mishap may occur when one of the rollers on the supports becomes accidentially jammed or when one of the ends of the roll rubs against the craddle. This may so happen due to (1) Misalignment of Brackets and (2) some of the trunnion wheels not moving free due to various reasons of mechanical nature (bearings etc.)

It may also occur when a roll of large dimensions (and consequently of large inertia) is not act in motion before being put in contact with the moving wire. In this case, it is subjected to a senere strain along the entire surface of contact.

All these accidents are due either to an unsatisfactory condition of the supports, or to an imperfection in their design.

#### MAINTENANCE OF ROLLS

After use, rolls must be cleared of accumulated fibres in the framework and of stock clogging the meshes of the wire, by washing a jet of water immediately after the machine stops. We do not recommend to use a steam jet, which sometimes, causes deformation of the body of the roll.

If this cleaning is not carried out promptly, and meticulously, the accumulated matter dries and becomes very difficult to remove. To affect general cleaning, immerse the roll in a tank, allowing it to rest on its bearings if it is a roll with shaft, or on rollers if it is a roll with rim.

A water distributor may be arranged along the length of the cylinder so that the pressure of the jet causes it to turn, and blockages are removed. The cleaning tank should have an outflow pipe half way down so that the lower part of the roll remains in the water, which loosens the clogging material and thus facillitates its removal.

When this treatment is insufficient, a scouring bath is necessary. To destroy accumulations of stock or of resin, it is better to use caustic soda at a strength of 3 to 6 gram of NAOH per litre, heated to 90°C. If there is board caking, the best solvent is hydrochloric acid, very dilute.

Sulphuric acid is often used. To avoid corrosion of the frame and of the wire, it in recommended to limit the concentration to  $6^{\circ}$  or  $8^{\circ}$  Baume and adding to the solution 10% of its weight of 40% commercial formaldehyde. Various other immersion must be reduced to the strict minimum necessary, and a thorough rinsing with water must follow immediately.

## HANDLING AND STORING

Rolls are delicate object and must be handled with care. The slightest shock io the surface damages the jacket and often the supporting framework also.

The axle ends must not be placed roughly in their supports. If the frame of the jacket is put out of true, the roll acquires a wobble which renders it unserviceable. Light rolls may be stocked vertically. For the storage of heavy rolls, it is better to use craddles incorporating a cloth which supports the roll along its entire length.

When it becomes necessary to send away a roll for repair and rejacketing it should be placed on a bed of straw or fibre and packed at its sides and ends to prevent any displacement, Rolls with axle ends must never be suspended by their axle ends.

The supports play as important part in the efficient working of a Dandy Roll. Their alignment must be exactly perpendicular to the axis of the machine. If the supporting bracket is not of the required standard, it is likely that the dandy roll will jump and cause wear on the machinewire, giving poor equality paper or a crushed paper web caused by the heavy duty roll being inadequately supported.

For good performance of the Dandy Roll, the brackets must offer rigidity and strength (especially for large diameters), reliability, long life, precise control of the Dandy Roll immersion and an efficient driving and cleaning systems.

## TYPES OF BRACKETS

(a) For dandy roll with axle ends.

- (b) For open ended dandy rolls.
- (i) Trunnion type or runner wheel, type (with without helper drive).
  - -for machine speeds ranging from 100 to 600 meters/minute.
- (ii) Journal type (with helper drive)—
  - -for machine speeds above 500 meters/ minute.

Dandy Rolls are maintained in motion by the movement of the wire of the machine, through the inter Mediary of the stock carried by the Wire. In order to obtain a good surface on the sheet or a good water-mark, it is very important to avoid any slipping of the stock relative to the roll.

Such slipping may occure as a result of too much or too little pressure of the roll.

- 1) When the pressure is insufficient, the linear speed of the roll is less than that of the wire and the roll, in skating over the slock, picks up fibres from the surface of the sheet.
- 2) When the supports exert a considerable resistance to rolling, it may be necessary to increase the pressure of the roll in order to facilitate its rotation.

This pressure in conjunction with the rotation of the roll, tends to drive the stock forward on the machine. Tearing of the sheet may then result. To avoid either of these troubles attempts have been made to control the rotation of the roll by arrange-

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ments independent of the wire, by providing helper drive to syncronise the speed of dandy with machine wire. The results of these attempts have shown that.

- -the adjustment and perfecting of the processes of -manufacture are quicker and easier.
- -the speed of machine may be increased.
- -the pressure of the roll on the sheet may be reduced.
- -the roll becomes clogged lese quickly.
- -the jacket of the roll lasts longer
- --accidents involving deformation of the wire and of the frame of the roll are greatly reduced.

# CONTINUOUS ON MACHINE CLEANING SYSTEM

Efficient, continuous, on-machine cleaning is possibly the most important benefit offered "to a paper mill in a complete dandy roll system. The ideal cleaning system for the dandy roll consists of:

- (a) An internal oscillating water shower with needle jet.
- (b) An external splash-guard
- (c) An internal save-all pan
- (d) An internal steem pipe.

## (A) INTERNAL OSCILATING WATER SHOWER

It is recommended that an oscilating water shower is placed inside a dandy in the 12 to 2 O' Clock position. The shower should be needle jet type. Water shower should have the following features.

a) Efficient cleaning of Dandy

- b) Low Water consumption
- c) Easy installation and removal when replacing dandy
- d) Low maintenance cost.

For efficient cleaning with low water consumption and to cover entire surface of dandy, showers are made oscillating. Depending upon the various circumstances, water showers can be made stationery, or oscillating and may be installed outside or inside the dandy. Internal showers have more cleaning.

## (B) EXTERNAL SPLASH GUARD

The function of the external splash guard is to catch all shower water passing through the mesh cover of the dandy roll and to take this off the machine by way of outlet pipes in the base. In additional, excess water running around the roll surface must be removed.

This is mostly done approximately one third of the way up from the base of the Splash-Guard by one or more flexible Neoprene (rubber) deflector blades, which are adjustable and positioned just short of the dandy roll surface. Any remaining water is directed into the separate steam heated drip tray slung underneath the main port of the splash-guard. This tray catches all condensation drips and should beheated by steam at approx. 30 psi.

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#### (C) STEAM PIPE

The steam pipe should be placed inside the roll, close to its construction and at a slight angle to the line of contact between the roll and paper web at the out going nip. This positioning will prevent excess stock lift and the formation of water and airbubbles at high making speeds. The steam shower also assits in keeping the roll cover clean and help to atomiz the larger water droplets on the roll construction.

Alternatively or in addition, a steam pipe may be positioned out-side the roll at out-going nip. This basically achieves the some effect but will also assist in atomising any water throw from the roll surface.

## (D) INTERNAL SAVE ALL PAN

The save-all pan is sometimes necessary to collect water from the high pressure shower deflected from the inside of the dandy roll construction. If an internal save all pan is used, this should be housed immediatlly beneath the shower, so that the shower pipe sits an near the centre of the tray as possible. The thicker end of the wedge shaped tray should be some 60 mm from the side of the roll construction. The reason for this is that the condensation or drips run to the wedge base and fall down inside the roll where it is not directly over the stock-flow. The problem may be overcome if the internal catch pan and the drops of water from the shower can be allowed to fall into the roll construction at will without affecting paper quality.

#### **DRIVES & CONTROLS**

It is extremely important to keep the Dandy Roll speed in line with the machine speed especially in water-making applications and an efficient drive will always improve the quality of paper, protect the machine wire and prevent damage to the dandy such as twisting of covers.

Undriven, a dandy can lag behind the machine wire by upto 5% depending upon its size, the quality of the fibre web and the type of bearing used. Only marginal improvements can be obtained by increasing the pressure of the roll on the web, and by doing this sheet formation may suffer.

Normally, plain wove dandy rolls do not need to be driven under 250 mtrs per minute (700 r. p.m.). However, if cigarette papers or photographic copy papers are to be manufactured to a very high quality standard, then a drive of  $\pm 0.25\%$  or  $\pm 1.0\%$  accuracy will be necessary.

With some applications, it is important to drive the roll faster than the machine wire to obtain a smoother sheet with reduced picking—and this can only be done with a precisely controlled independent dandy Roll Drive.

For water marked papers, a drive is always vital asset Control of the draw of paper can give much clear watermark than if a drive is not being used.

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For many different diametres of roll (for various water marked paper sizes) a size compensating potentiometer linked to the drive system is necessary.

## SPEACIAL FEATURE OF SHALIMAR DANDY **ROLLS AND BRACKETS** a) DANDY ROLLS

SHALIMAR Dandy Rolls are the out come of years of research and experience of world famous Rai-Tillieres.

SHALIMAR DANDY ROLLS-

- 1) have very rigid construction by way of using sectional wires and stripa.
- 2) are made of quality materials to withstand fatigue and corrosion.
- 3) are very light in weight and slippages if any are minimum. This increases Dandy Roll life and wire life and gives better quality paper.
- 4) have the maximum open construction to facilitate drainage and subsequent cleaning.
- 5) are such that the water throw is minimum.
- 6) are properly balanced.
- 7) are accurately ground for extreme accuracy.
- 8) have flat or circular wires fitted in milled grooves which prevents shifting of this from position. Thus the life of dandy is much increases. Further, flat wires impart the better scope for repairability by regrinding.

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## **b) DANDY BRACKETS**

The economic benefits of using a dandy roll can not be achieved successfully unless the correct equipment for its supporting and care is not used simu-

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ltaneously. Over the years we have built up a vast store of practical experience with the dandy rolls and today we are in a position to supply the most optimum supporting brackets and showers etc.

Our Design Staff ensure that the right equipment is supplied to suit each paper machine and paper making condition. Our manufacturing staff ensure that standard of engineering be of the highest order. Some of the feature worth a special mentioning are:-

- 1) The brackets etc. are designed after careful study of the each machine. They are all custom built.
- 2) The Brackets are sturdy in design.
- 3) The materials of construction are very properly chosen.
- Their installation and dismantling take least 4) down time.
- 5) Special control features such as pneumatic quick lift etc. are provided.
- 6) Showers can be provided with osciallting type.
- 7) Splash Guards are made of stainless steel or Mild Steel with antirust paint. They can be provided with pneumatic control and steam heating.

## c) CONTROL SYSTEMS

- All Brackets are provided with a control box for-
  - 1) lifting and lowering of dandy roll pneumatically.
  - 2) controlling of oscillating shower speedpneumatically.

Dandy Brackets which have a driven dandy roll are provided with additional control as follows:-

- 1) Dandy Roll Drive-start & stop.
- 2) Speed setting potentiometer.
- 3) Machine speed indicator.
- 4) Differential speed indicator.
- 5) Dandy Roll creep.
- 6) Interlock for dandy lifting automatically in case of failure of prime mover.

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