DOWNLOAD PDF STUDY OF STOCK JUMP AND VACUUM FORCE ON THE TABLE OF FOURDRINIER MACHINE

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STUDY OF STOCK JUMP AND VACUUM FORCE ON THE TABLE OF FOURIDRINIER MACHINE Department of Mechanical & Industriai Engineering University of Toronto Abstract Stock jump has ken a common problem on fourcirinier table for decades.

An Insignia Films production for American Experience. In the months that followed their faces blanketed the news, as the country waited to see who would become the first man in space. But far from the Project Mercury spotlight, deep in the New Mexico desert, the Air Force was also preparing to launch a man towards the heavens. It was the culmination of over a decade of little-known aerospace experiments, and this would be the most dangerous of them all. There were a myriad of problems with sending a person up to that altitude. Could you keep them warm? Would they be exposed to dangerous radiation? How do you give them a safe breathable atmosphere? Organs can rupture, blood vessels can rupture. The temperature is a hundred degrees below zero. There are just so many things that can wrong. Gregory Kennedy, Aerospace Historian: Though largely forgotten, balloonists would be the first to venture into the frozen vacuum on the edge of our world, exploring the very limits of human physiology and human ingenuity in this deadly realm. Flying in a balloon to the upper reaches of the atmosphere, perhaps seems odd, eccentric, even self-inflicted madness. They answered a lot of questions. They answered a lot of big questions. At , feet, higher than any human being has ever been in a balloon at this point, Joe Kittinger gets a signal from his ground crew. He stands up in the gondola, disconnects his onboard oxygen supply, says a little prayer, and steps off. In April, a young army doctor was transferred to a remote airfield miles north of Los Angeles, which would soon be named Edwards Air Force Base. John Paul Stapp was a maverick in the bourgeoning field of aviation medicine and Edwards was just the place to be. His accomplishment marked the beginning of a new era that would push the limits of man and machine. Aerospace as a concept, the idea of getting a man high up into the atmosphere and beyond, was still relatively new. And doctors were aware that the human body, although robust and neatly packaged, does have its limits. Francis French, Aerospace Historian: John Stapp was watching jets go higher and faster and realized that scientists and doctors had no idea really what would happen to the human body as it was subjected to faster forces and higher altitudes than ever before. And so Stapp decides to investigate what the human body can handle. How much speed we can handle, how much falling we can handle, how much altitude we can handle. And he starts to unpack this little by little. Stapp explored pilot ejection seats, liquid oxygen breathing systems, tested the impact of windblast, and subjected a succession of Air Force personnel to all manner of experimental contortions. But he spent the most time studying G-force limits: The military maintained that any force beyond 18Gs -- or 18 times the pull of gravity -- would be fatal. Stapp helped design a series of faster and faster rocket sleds, to challenge that assumption. Imagine a soapbox racer made of aluminum on a railroad track with rockets on the back of it. Which would be fired down the track and then slammed to a stop in just a few seconds. Stapp rode the sleds himself, each time ramping up the speed and the G-force pressing on his body. He cracked ribs, lost six fillings and broke both of his wrists. He got up to over miles an hour and pulled 38 Gs. And when he told his superiors that he had survived 38 Gs they told him to cease and desist immediately. Stapp used to say, "I always follow orders when they make sense. There were nine rocket engines on the back of that sled. And when they fired, Stapp said that he lost all orientation as he shot down this track in excess of miles per hour. At the end of the track, Stapp slammed to a full stop in 1. It was the equivalent to ejecting from an airplane at 30, feet. And he was out to prove that a pilot could do that in an ejection seat and survive. Dana Kilanowski, Aviation Historian: The most serious thing that happened was the hemorrhaging into his retinas. He got out of the rocket sled, he thought he was permanently blind. He was taken to the base hospital where gradually his vision came back. He had two black eyes, but other than that, he was fine. John Paul Stapp had set an almost inconceivable G-force record of He is an explorer in, in the sense that he never is satisfied. And when he said that, there was a lot of laughter, because space was something that

Buck Rodgers did. Pilots were not gonna go into space. So, I immediately put my hand up. He needed Captain Joseph Kittinger to help conduct a series of zero-gravity experiments, testing the reaction of the human body to weightlessness. Stapp was a visionary. He could see that we were going to keep on going higher and faster and that eventually, we would reach space. And he wanted to be sure that when we did finally cross that threshold, we would be ready. For his next experiment, Stapp wanted to study a person in space-- or at least as close as he could get. For this, he would now turn to the oldest aerial vehicle known to man. In , the first hot air balloon lifted a menagerie of farm animals several hundred feet above the palace of Versailles, amazing Louis XVI and his court of onlookers. Later that year, Frenchman Jacques Charles became one of the first humans to view the world from the air. Such an astonishing view," he recounted. No one knew what it was like up there, no one had been up there. If a balloon went into a cloud, would everybody be electrocuted? What would happen as you got nearer the sun? How high can we go? Throughout the 18th and early 19th century, bigger and better balloons lifted adventurers higher and higher into the sky, sending them to heights beyond 20, feet. They were suffering from oxygen deprivation which first of all effects your sight and then your muscular strength. They managed to descend in the nick of time. A new frontier had been discovered. Far from deterring aerial explorers, this forbidding death zone would lure them farther and farther into the clouds. Human beings had spent their entire evolution confined to the surface of the earth. And suddenly we have this three-dimensional space opening up above us. It goes up to an altitude of about 35, feet. The next layer up is the stratosphere. The stratosphere was really the new frontier. The balloonists were the first ones that went up there and exposed themselves to those conditions. In , sealed inside an innovative pressurized and oxygenated gondola, Swiss physicist Auguste Piccard rose to over 51, feet, marking the first successful foray into the stratosphere. Then in , the Soviets claimed they had exceeded 60, feet in their first high altitude balloon. And the way the score was kept was altitude records. The balloon alone weighed in at over 5, pounds. Two and a half acres of cotton fabric had to be glued together using three hundred gallons of rubber cement. The massive contraption was assembled on site in South Dakota by more than a hundred troops from a nearby Army base. Three million cubic feet of hydrogen gas, pumped through canvas tubes, was needed to lift the gondola, the three men, and over a ton of scientific equipment. One of the big issues they wanted to solve was the problem of cosmic rays. When you get above the troposphere you are exposed to very strong particles of radiation coming from outer space. They thought of them as cosmic bullets. They thought cosmic rays might make people sterile. They might go into their eyes and make them blind. They might affect their brain. There were many, many theories along those lines. On July 28, , Explorer lifted off. Americans were captivated by a live radio broadcast of the event. For the glory of the Army! They were almost within range of setting an altitude record when the balloon started to rip. The bottom fell out of the balloon and then it became kind of a hydrogen filled parachute. As the hole widened, they picked up speed. Plummeting towards earth, it was clear the men would have no choice but to bail out.

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Chapter 2 : List of English inventions and discoveries - Wikipedia

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After performing a usability test on the product we found out several major problems of the product. There is a large possibility of getting cut by the blade while doing so. On the other hand, the apple has to be attached to the tri-fork in the proper orientation in order for the peeler to operate smoothly. We also found out that the suction base has a large failure rate when operating on a rough surface. We then dissected the product, took every component apart, and studied each part. The Failure Modes and Effects Analysis shows that the springs, the vacuum base, and the channel stopper has the greatest Risk Priority Number among all the parts. It is crucial to look further into improving the performance or durability of these parts. In our Design for Manufacturing and Assembly analysis we recognized that the screws and nuts are not standardized. This problem is further amplified as most of the assembling procedure is done by human. Most of the parts are made using standard manufacturing methods such as casting, punching, thread rolling, and injection molding. Some components, however, require a second procedure such as nickel-plating to prevent rusting of the part. In our Design for Environment analysis we found out that the primary environmental concern of the product is its carbon dioxide emission. Lastly, we performed a Mechanical Analysis on the product to investigate its performance using mathematical functions and physics relations. We simulated various magnitudes of torque acting on the handle and calculated the maximum torque the suction base can withstand before it fails. Through the study we found out that the suction base is sufficient to withstand torques and forces under normal usage. Customer Needs The primary customer need in an Apple Peeler is to have the ability to easily and quickly remove the skin of an apple. This means that the user must be able to peel the apple without exerting more force or energy or spending more time than they would when peeling with a hand-held peeler. It is also expected that the device can peel the skin off various types of fruits and vegetables of similar shape and size. Since this is an everyday kitchen ware, the first and foremost requirement for this product is ease of use and safety. If must be easy enough so that the device can be operated from common sense without instruction by people of different age groups. It must be safe to be used by small children and elders, both male and female. Customers should not have to worry about possible safety hazards caused by everyday equipment. Stakeholders The following are the major stakeholders which influence the new design of an Apple Peeler. Consumers The consumers are the primary stakeholders of the product. Product must be relatively cheap to purchase since the function of the product is limited as opposed to a table knife. Safety must be considered in detail to prevent any type of injuries. Design will need to accommodate various users with different sizes and strength. Operation of the product must be intuitive to be carried out without instruction. One or two step process is preferred. Product must efficiently and quickly skin the apple. Product must be able to skin apples of all sizes and shapes. Must be easy to maintain. Easy to clean and no rusting. Easy to store, Easy to setup. Should be able to work on various surfaces and with various products. Aesthetics must be appropriate for a kitchen. Retailers Retailers are concerned with how the product presents itself at their stores. Product must be compact as possible for efficient storage. Product must be of manageable weight to be handled easily at stores. Product must be durable enough to stay intact even when handled poorly or dropped. Product should be aesthetically pleasing or should be able to be made aesthetically pleasing to attract customers. Manufacturers Manufacturers are concerned with ease manufacturing. Product should have low part count. Parts used should be easily accessible. This may mean that the parts have already been manufactured for other products. Material used in manufacturing the parts should be cheap and easily accessible. Assembly process should be simple, quick and easy to reduce production speed and labor costs. Product must be easy to handle. This may be done by reducing weight and choosing appropriate shape of the product so that when the product is boxed it is easy to handle. Product must be durable so that any external load applied during shipping does not affect the quality of the product. System Function The Apple Peeler can have the following functions: Peel an apple a. Peel, core and slice and apple a. In addition to the peeling process above, the apple is cored and sliced in a spiral. Core and slice and apple a. Same function as above but without peeling the apple. Suction cup fixes the base to the table top a. The lever activates the suction cup which applies a downward force on the product, giving the user support when peeling the apple. Operation Steps To operate the device, the following steps are followed. Place the device on a smooth surface, making sure there is no irregularity on the surface or dust which may reduce the effectiveness of the suction cup. Turn the suction cup lever to activate the suction cup. Check that the device is securely attached to the surface. Pull the handle away from the device as much as possible to allow enough space for the apple to be placed within the device. Secure the apple in the device by pushing the bottom of the apple into the tri-fork. Depending on the functions the user wish to perform, follow one of the following; a. Place the peeler blade to come in contact with the apple surface. Place the peeler blade to come in contact with the apple surface as seen in section above. Move the peeler blade away from the apple surface until the peeler handle stopper clicks into place. Make sure the channel stopper is on the groove of the grooved channel. Turn the handle away from the body until sufficient result is achieved according to the user. Remove the apple from the device. Remove the core from the tri-fork by slowly reversing the direction of the turn. Usability The following feedback was given from the user who operated the device in a typical use scenario, which are; In a kitchen. On smooth tiled kitchen top. With an apple of standard size and shapes. By an average male. Handle screw becomes loose after several runs. The user is required to reach over the device in order to activate the suction cup, which is a potential safety hazard. Strength of suction is not enough to support the peeling process. User is required to hold the base even when the suction cup is activated. Peeler Uneven apple surface causes the peeler to miss the part of the skin, leaving some areas unpeeled. The blade will wear after time, and there are no replacement blades. This means the customers are forced to buy a new product when the blade becomes dull. Slicing and coring are performed by the same part, so both functions must be performed at the same time. The user has no freedom to choose one from the other. The device would fail to operate its intended function, and may break the device. Tri-fork Apple placement requires strength. Some elders and children will require assistance when operating the device. Apple core is hard to remove after coring and causes the core to shoot off the tri-fork. The apple must be placed in the correct orientation, or it will not peel and also potentially break the product. General The peeled skin made a mess on the kitchen table and product. Troublesome to re-place the groove locker after each peel. The adjustments are done by screwing and unscrewing nuts and bolts, which is very troublesome. The nuts keep the majority of the parts intact and therefore very tight and hard to remove. There is no replacement for the nuts. User may try to remove the slicer blade and if a nut is lost during this process, the peeler is no longer functional. The peeling process must be done in one continuous run. Once stopped, the peeler may not peel some areas of the apple. The size of the peeled object cannot exceed the specification.

Chapter 3 : Apple peeler - DDL Wiki

A paper machine (or paper-making machine) is an industrial machine used in the Pulp and paper industry to create paper in large quantities at high speed. Modern paper-making machines are based on the principles of the Fourdrinier Machine, which uses a moving woven mesh to create a continuous paper web by filtering out the fibres held in a paper stock and producing a continuously moving wet mat.

This review presents a comprehensive and systematic discussion about the effects of the type of fiber and machine technology on tissue properties. Advanced technologies, such as through-air drying, produce tissue with high bulk, softness, and absorbency. Conventional technologies, where wet pressing is used to partially dewater the paper web, produces tissue with higher density, lower absorbency, and softness. Different fiber types coming from various pulping and recycling processes are used for tissue manufacturing. Softwoods are mainly used as a source of reinforcement, while hardwoods provide softness and a velvet type surface feel. Mechanical pulps having stiffer fibers result in bulkier papers. Chemical pulps have flexible fibers resulting in better bonding ability and softness. Virgin fibers are more flexible and produce stronger and softer tissue. Recycled fibers are stiffer with lower bonding ability, yielding products that are weaker and less soft. Mild mechanical refining is used to improve limitations found in recycled fibers and to develop properties in virgin fibers. At the same time that refining increases strength, it also decreases bulk and water absorbency. Overall, water absorbency, softness, strength dry or wet , and disintegration are the most important properties used to evaluate the performance of tissue products. The observed properties of commercial tissue products are basically a function of fibers, chemistry, and manufacturing technology. There is a vast number of fiber types, tissue machine technologies, and chemical additives available in market for manufacturing of tissue products. Inside this complex environment, tissue paper manufacturers have to choose the right combination of fibers, additives, and technologies to produce specific tissue products capable of achieving the desired performance while providing enough profitability to the producer. Motivated by the complexity of this task, the main objective of this review is to present a discussion about how tissue paper properties can be tuned as a function of fiber type and tissue machine technology. This review brings a comprehensive description about a tissue products, grades, and their properties, b a comparison of product performance from different tissue machine technologies, c properties of different type of fibers, and d the effect of mechanical refining on tissue properties. Even though chemical additives e. Information about the use of chemical additives in tissue manufacturing can be found elsewhere Neal ; Forbess Tissue Paper Definitions, Products, Market and Grades Based on their function, paper products can be placed in three main categories: Products in the third category, also known as tissue and hygienic papers, have a wide range of types and applications, including facial tissue, toilet tissue, napkin, kitchen towel, hand towel, and wipes. Some tissue papers are also used in the manufacturing of baby napkins and sanitary towels Hubbe ; Kilby and Crevecoeur ; FAO a. Nowadays, tissue paper, together with packaging products, are the most promising sectors in the paper industry due to the constant increase in demand. The global production of tissue paper has been in constant growth for the past ten years average annual growth rate is 2. This diverse assortment of tissue products is commercialized in two market segments: AFH products are designed and sold for non-domestic consumption. Consumers typically use those products in workplaces, catering services, and public places e. Therefore, the consumption of those products, from the final consumer perspective, comes as a secondary need. In other words, if consumers want to go out to have a nice dinner, it is more likely that they would prefer to go to a restaurant that offers their favorite food than going to a place with premium napkins. On the other hand, AH products are designed for domestic consumption and are usually found at wholesalers or retailers. The consumption of those products come as the primary need for consumers. In this case, consumers will decide about what tissue product to buy based on the desired performance and price. For example, if consumers prefer to use very soft, white, and strong bath tissue, it is more likely that they would prefer to buy a premium product than a basic bath tissue, even though they would have to spend more money to satisfy their needs. Tissue products are manufactured and sold in a variety of brands that can be divided into two major groups: NB are brands owned by the manufacturers and PLB are brands owned by wholesalers or retailers. With the commercialization of PLB products, retailers have the potential to increase their overall profits. As a result, by commercializing PLB products, retailers would have higher gross margin and higher bargaining power when compared to NB products. Manufacturers can also benefit with the production of PLB products. Additionally, PLB production will reduce the participation of competitors in the market place and will increase cooperation with retailers. However, PLB production can result in losses to manufacturers due to insufficient profit and cannibalization of their own NB products. Typically, PLB consumers are price-sensitive and value-oriented, willing to pay less in a given product category. Matrix of Fiber Types and Technology Used to Make a Range of AFH Tissue Products and Grades in the European Market adapted from Wrap As a function of fiber properties, chemistry, process conditions, and technology, tissue products can be classified in three major grades or categories: EV products are the most affordable products, capable of meeting minimum performance requirements. Those products have one or two plies and are manufactured with conventional technology, such as wet-creped and dry-creped technologies. EV products have high content of recycled and low quality fibers such as mixed office waste, old corrugated containerboard. PR products can also be manufactured with conventional technology. However, they usually have a lower content of recycled fibers when compared to EV products. UL category accounts for more expensive and high-performance products, manufactured with a minimum amount of recycled fibers. UL products are usually manufactured combining advanced technologies, such as through-air drying TAD , high content of virgin and high-quality fibers, multiple plies 2 or 3 , and chemicals softeners, debonders, wetting agents Fisher ; Zou Table 1 presents a matrix that illustrates the type of fiber and technology used to manufacture AFH products in the European market. As a result of type of fiber and technology, the final properties of tissue products improve as one goes from the left to the right side of the matrix. For example, the combination of proper virgin fibers and advanced technology would result in a high bulk and soft tissue product with good absorbency. On the other hand, the use of the high content of recycled fibers and conventional technology would result in a denser tissue paper with lower softness and lower absorbency Wrap Every tissue product is designed for a specific application and performance, which will determine their primary, essential or functional properties. For example, kitchen towels are mainly used for cleaning and absorption purposes Council of Europe When consumers use a kitchen towel, they usually expect to have a strong product, especially under wet conditions, capable of cleaning a dirty wet surface without breaking apart. Another important property for kitchen towels is absorbency. Consumers expect that kitchen towels would be capable of absorbing and holding as much water as possible when they have to dry a wet surface. Other properties, such as softness, brightness, and appearance could be considered as secondary properties because those usually do not have a significant contribution to the main purpose of kitchen towels cleaning and drying surfaces. However, it is important to highlight that the distinction between primary and secondary properties is based on the functionality of the products and it is not based on particular needs of a different group of consumers in different market segments and geographic regions. For example, softness has become an important property for the marketing of kitchen towels. According to Zou a , target properties for tissue products in the American market change among different applications. Softness and strength are desirable for bath tissue, while absorbency is also important for facial tissue. For napkins, strength and absorbency are target properties, while bulk is also important for towels. According to Novotny , softness, absorbency, and brightness are very important for bath and facial tissue, while absorbency and strength are more essential for towel and napkin. Table 2 presents the suggested primary properties of some AFH tissue products in the European market and Table 3 presents a benchmark comparison among all the national brands of kitchen towels in the USA market. The lower the value, the softer is the sample. Light Dry-Crepe Conventional technology Bulk Bulk is defined as the volume occupied by a given weight of paper. It is the inverse of apparent density and can be correlated with many other mechanical properties of paper Thorp Bulk is an important property for tissue products because paper thickness and bulk correlates well with absorbency and bulk softness Novotny Compaction of the fiber network is an unwanted effect if the target is to produce a very bulky product. A higher bulk can be achieved when tissue product is manufactured with advanced technologies e. Other process conditions, such as the use of lower pressure in the press nips, milder refining of fibers, and paper creping will also contribute to higher bulk Kullander Besides technology, fiber type also plays an important role in tissue bulk. Additionally, high yield pulps can also be used to produce a higher bulk tissue product. Recycled bleached kraft fibers, with a history of drying, tend to be stiffer and less conformable, which will result in a higher bulk paper product that is desirable for tissue production. However, many recycled fibers already have been refined extensively, tending to produce a relatively dense sheet of paper Hubbe Absorbency Absorbency is an important property for toweling and other tissue products with the purpose of wiping liquids. Absorbent tissue products should be capable of readily absorbing water absorbency rate and retaining a high level of absorptivity absorbency capacity until the end of the task Kullander The ability to absorb liquid depends on having a high capillary pressure to suck the liquid and high permeability to allow the fluid to quickly flow away from the point of insult. When paper products get in touch with water, the first phenomenon is surface wetting, followed by the penetration of water inside the paper structure. The penetration phenomenon is a very complex process because it will cause swelling of fibers as water is absorbed into fiber cell wall, resulting in changes in volume and pore structure of the paper Thorp Absorbency properties are influenced by chemical properties of fiber surface and porosity of the paper web structure Kullander Absorbent products have large amounts air-filled spaces among the fibers in the paper structure Hubbe Absorbency can be controlled by fiber type, refining, creping, plies, and additives Kullander Fibers containing high content of lignin have lower water absorbency. For example, due to its high content of lignin, mechanical pulps can absorb about 1 gram of water per gram of pulp, while bleached fibers, such as kraft fibers, can typically absorb 5 to 10 grams of water per gram of fiber. Lignin removal increases hydrophilicity, porosity, and swellability of bleached kraft fibers, resulting in improved water uptake. The extractives present in cellulosic fibers also have a hydrophobic behavior. Tissue products manufactured with curly fibers are bulkier and more absorbent Trepanier Bath tissue and towel products are made from lightly refined fibers to maintain initial relative stiff and tube-like nature of fibers that are necessary to achieve a high level of absorptivity Thorp ; Hubbe Typically, in a saturated tissue product, water is located in the spaces between plies, spaces between fibers, in the fiber lumen, and inside the cell wall. Within the cell wall, water can be located in micro, meso, and macropores. Water present in micropores is classified as non-freezing and freezing water. Non-freezing water corresponds to the first layers of water associated with the biomass surface. Freezing water corresponds to the water that has a depressed melting temperature due to the curved interfaces in micropores. The water present in macropores has similar thermodynamic properties to those of the bulk that is also present in the lumen, between fibers, and between plies Kullander Most of the absorbed water is located in the spaces between fibers, and machine technology is an important variable to create inter-fiber spaces. TAD machines produce tissue products with higher bulk and higher absorbency than conventional machines.

Chapter 4 : Yahoo Finance - Business Finance, Stock Market, Quotes, News

Fourdrinier Paper Machine table the stock is subjected to against centrifugal force until the sheet has separated from the felt.

A drainage foil element for removable attachment to a web-forming machine having a forming wire and support means for said element extending transversely of said forming wire for supporting said foil element in working relation to said forming wire, said foil element comprising in a unitary structure: A drainage foil according to claim 1 wherein each of said bearing portions has a front edge formed at an acute angle for shearing water from said forming wire. A drainage foil according to claim 1 wherein said drainage means comprises means defining a slot between said suction-creating portion and said second bearing portion, and beneath said slot, apertured means for holding said second bearing portion in a fixed position trailing said suction-creating portion. A drainage foil according to claim 1 including means to adjust the position of said second forming wire bearing portion relative to said first forming wire bearing portion. A drainage foil according to claim 3 wherein said drainage means is apertured sufficiently large so as to minimize plugging with solid material entrained in the drainage from said forming wire. This invention relates to apparatus and methods for improving and regulating the drainage of water from the forming wire part of web-forming machines, such as Fourdrinier paper machines, and in particular to improvements in drainage foils. The greater part of the water associated with the stock as discharged from the slice is drained away through the wire, leaving most of the fibres on the wire in the form of a continuous felted fibre mat or web. Such drainage occurs principally in the vicinity of certain forming wire-supporting means. In the making of paper on a Fourdrinier machine several problems are current. One of these is the problem of obtaining the necessary drainage of the water from the stock without excessive removal of the fine fibres or "fines" as they are known in the art. Another problem known as "kick-up" that was associated with the use of table rolls was to a degree brought under control with the introduction of drainage foils. With low speed machines, table rolls provide adequate drainage and sufficient disturbance to aid formation at the wet end of the table. There are two mechanisms for the disturbance. One is the upwash of water into the web at the in-going nip and the second is the acceleration imparted by the rapid changes in wire radius of curvature at the out-going nip. Increasing machine speeds leads eventually to excessive upwash with stock jump and reduced fines retention on the downstream side of the roll. Both mechanisms are important for good formation but when using tablerolls they cannot be easily controlled independently of machine speed or drainage rate. To overcome the stock-jump instability, stationary foils are used in place of some or all the rolls. They have a more gentle dewatering action and, because of the sharp front edge, do not push any significant amount of water back into the sheet. They pull the wire down under the action of the suction. The wire moves back up after running through the suction region and the resultant forming-wire curvature again causes a disturbance to the sheet. This aids formation but, at high speeds, can again lead to stock-jump. Independent control of drainage rate and disturbance level is still not possible. Foil-type drainage apparatus for paper-making machines involves one or more drainage or dewatering elements "foils" disposed one after another in the machine direction in fixed relationship to the Fourdrinier wire and extending across the machine transversely to the direction of wire travel. Depending on the width of the paper being made, the foils can be as long as 30 feet, or more. Examples of two different types of such foils are found, respectively, in U. The foils are subject to wear, and for this and other reasons it is desirable that they be exchangeable and hence removably mounted on supports. Other solutions exist, all generally incorporating supporting means extending transversely of the forming wire for supporting a foil, and means in the foil for fixing the foil to the supporting means. Owing to the force exerted on the foil in one direction by the wire passing over its leading or "sealing" section, followed by the force exerted on the foil by suction in the opposite direction in its suction-forming section, there is a tendency for a dewatering foil in use to twist around its mounting or supporting means, and this contributes to creep of the foil and to wear of both the foil and the forming wire, as well as to instability in the dewatering process. The front edge meets the oncoming forming wire with an acute angle which, with the sharp front edge, sheers off the majority of the water hanging under or otherwise protruding from the wire. If more than one foil is used, as in a set or group of foils working together, each foil is separately mounted and each has one front edge, one bearing section and one drainage section; and each is subject in use to forces tending to twist it around its supporting means. During use of the foil suction forces are located between a pair of bearing forces. The mounting means in the foil is located in a part that in use is remote from the forming wire. The forces that are effective on the foil in use, including drag and water removal force components, produce a minimum of resultant torque around the mounting, or supporting, means. The improved drainage foil of the invention has several notable features and advantages: The foil has a suction-producing surface followed a fixed distance away by a water shearing edge; a water drainage slot is located between them, so that the water drains through the slot. The wire is supported on front and rear flat "land" surfaces, the suction surface and slot being between them. The rear surface is on a section that is integrally and rigidly connected to the front portion of the foil by a series of thin webs which produce negligible blockage for water flow through the drainage slot. Superior fines retention can be achieved with this arrangement. The foil is more efficient at removing water because of the short distance between the wire supports or "land" surfaces. For best performance, prior-art existing foils must be operated with a minimum spacing of one or two foil blade widths and sometimes more. If all other quantities such as foil divergent angle, stock consistency, wire tension, machine speed, and the like, are held fixed, it is known that the drainage rate decreases with increasing distance between supports. As the distance between the forming wire bearing portions of the foil is reduced, the foil performance becomes less dependent on the wire tension and there is less wire sag between supports. In current prior-art foil installations, wire sag reduces the effective foil angle, and drainage can reduce significantly with reduced wire tension. More water will be drained. In the case when two successive foils are used, there will be two shear edges following the suction forming section of the first foil, as will be described in connection with FIG. The shearing action of the incorporated water-shearing edge immediately following the suction forming section is independent of the spacing of or distance to a following foil, unlike current foil designs which have only one water-shearing edge per foil. The enhanced ability of the incorporated shear edge immediately following the suction-forming section in the same foil to shear off more water than the shear edge at a following foil comes about because the mat being formed on the forming wire will be more compressed in the vicinity of the incorporated shear edge than it will be further away in the vicinity of the following foil. If the water under the wire is not sheared off until the wire reaches the shear edge of the following foil, the mat will have had time to expand and pull some water back through the forming wire. Because of the incorporation of an integral rear support for the forming wire, the foil can have, effectively, a zero resultant torque around its mounting means. The force due to wire drag is still present but this is a small force component. The locking device for the foil on its mount can be much less critical in design than with the prior-art foils because the forming wire geometry relative to the suction-producing section is largely fixed by the front and rear forming-wire supports. Any tendency of presently available prior-art foils to rotate on their mounts results in a reduction in the effective foil angle, and consequently a reduction in drainage. The balanced torque which is contributed by the present invention also will result in less creep in the polyethylene material used at present as the body material of many drainage foils. Because the forming-wire support loads are divided more or less evenly between the two support surfaces and because the rate of wear is roughly porportional to the pressure of the load on a surface, the rate of wear of foils of the invention will be considerably less than that of a conventional design with the same drainage rate. Because the foil is less sensitive to wire tension, it is possible to extend wire life by reducing tension provided other table factors permit this. The second or rear forming wire support section can be made adjustable in position relative to the first or front forming wire support section, enabling wire support loads to be balanced, and tension to be reduced further. The drainage foil 10 has a known mounting means 12 in the form of a mortise slot running the full length of the foil in the lower portion and opening through the bottom surface This slot can cooperate with mounting means according to U. Those skilled in the art will recognize that other forms of mounting a foil to a support are known in the art and can be used in place of the illustrated arrangement. The top part of the foil will be located in use adjacent typically, as in a Fourdrinier machine, under a forming wire 20, to which the foil normally according to the prior art provides bearing support at a first bearing surface 22 on a first forming wire bearing section 23 which extends along the foil from the leading edge 24 to the drainage surface 26 on a suction-forming section 27, the width of the bearing surface being marked "A" in FIG. The trailing portion 28, constituting a second forming wire bearing section, is fixedly held separated from the first forming wire bearing section 23 by webs 34 connecting the trailing portion to the suction-forming section A slot 36 extending the full length of the foil between the rear-most boundary of the suction-forming section 27 and the forward-most boundary of the trailing portion 28 communicates with an array of elongated holes 38, one of which is shown greatly enlarged in FIG. The width of the slot 36 is marked "C" in FIG. The holes 38 should be made sufficiently large so that they will not plug with fines drawn out of the web or mat not shown being formed on the wire. The material of which the new foil 10 is made can be any of the materials suitable for making prior art foils incorporating only the first bearing section 23 and the suction-forming section 27; polyethylene is mentioned above. The foil 10 has two leading edges 24 and 29, one at each of the forming wire bearing or support surfaces 22, 30, respectively. Each leading edge is formed by two surfaces meeting at an acute angle; being the front surface 21 with the bearing surface 22 of the first bearing portion 23; and the front surface 31 with the bearing surface 30 of the second bearing portion Water drained from the forming wire in the suction-forming section and water sheared from the forming wire at the second leading edge 29 drains away through the slot 36 and holes The two bearing sections 23 and 28 support the forming wire 20 on their front and rear support or "land" surfaces 22, 30, respectively. The forming wire 20 sags between them in the region 19 under the suction force produced by the downwardly sloping drainage surface 26, but in the present invention the amount of wire sag is restricted by the second or rear bearing section For a given forming wire tension all other relevant factors being equal the amount of wire sag is less than would occur between two successive prior art foils. This enables the forming wire to be operated with reduced tension, for a given amount of wire sag. An advantage of operating the forming wire with reduced tension is to extend its useful life. When water is drawn from a web or mat of paper-making slurry being carried on the forming wire 20, the mat will squeeze down a bit over the suction-forming section 27 as water is pulled from it by the suction. As the wire leaves the suction-forming section the mat will expand tending to pull back into itself water that is hanging under the wire. In the present invention the second edge 29 is in position immediately following the drainage slot 36, at the fixed distance C from the drainage surface 26, where it can shear water from the underside of the wire 20 before the web on top of the wire can expand and retrieve that water. One foil of the present invention is more efficient in removing water than are two successive foils according to the prior art. As is noted above, it is known in the art that for best performance, existing foils must be operated with a minimum spacing of one or two foil blade widths, and sometimes more, between successive foils. The effective foil angle between the wire and the drainage surface is thus maintained more nearly constant during use of the foil and, in turn, this assures a greater degree of stability of the dewatering function in a paper making or other web-forming process. A contributing factor to the lack of stability of the dewatering process is the tendency of prior art drainage foils to twist around their mounting means. In use, the suction produced over the sloping drainage surface 26 tends to pull the trailing edge of a prior art foil up to the wire, as well as to pull the wire down to the foil. In addition, the downward force exerted by the wire on the front support surface tends to push the foil down toward its mounting structure. Thus, referring to FIG. When that happens, the effective foil angle between the wire 20 and the drainage surface 26 is reduced, and the magnitude of the suction force is reduced, with a resultant reduction in drainage. In the present invention the rear support section 28 is subjected to a downwardly directed force represented by a downward-pointing arrow 49, creating a force tending to rotate the foil around its mounting means clockwise in FIG. The two downward forces 41 and 49 are on opposite sides of the suction force 43 and in the opposite direction to it, and this arrangement minimizes the resultant torque force around the mounting means, thereby largely removing the tendency of prior-art foils to reduce the magnitude of the suction force. In this way, the prior art defect that contributed to drainage instability can be minimized and with adequate care eliminated in some installations. During operation of the foil there are additional forces on the foil, as is illustrated in FIG. The forming wire produces a drag force on each of the support surfaces 22 and 30, as is indicated by two arrows 53, 55, respectively. The water being drained through slot 36 and holes 38 impinges on the front wall 31 of the rear support section 28, creating a water removal force directed substantially perpendicular to that surface as is represented by an arrow The force of wire drag 53, 55, tends to enhance the clockwise-twist force 51, but the force contributed by wire drag is relatively small. The force 57 contributed by draining water has a small net effect on the twisting forces 45, 51 because it can contribute to each twisting force. The foil can be designed so that in a given installation and under a given set of operating conditions the resultant torque is substantially zero. This result is not possible with prior art foils. An additional benefit of small torque around the foil mount, approaching zero in magnitude, is that the requirements placed on devices for removably locking a foil on its mounting means become much less critical. The forming wire geometry relative to the suction-producing surface 26 is largely fixed by the front and rear supports 23 and 28, and the mounting and locking mechanisms do not have to contribute to the stability of that geometry. The advantages of the invention are thus seen to contribute to each other. With a stabilized foil there is a still further advantage that, when a plastics material such as polyethylene is used to make the foil, the tendency of that material to creep is minimized. Preferably, the load forces 41 and 49 imposed by the forming wire on the support sections 23 and 28 are divided evenly between those sections.

DOWNLOAD PDF STUDY OF STOCK JUMP AND VACUUM FORCE ON THE TABLE OF FOURDRINIER MACHINE

Chapter 5 : Paper machine - Wikipedia

March April May June July August September Study of stock jump and vacuum force on the table of fourdrinier machine.

Machined Product Analysis For our product evaluation, we looked at four different types of analysis. Almost everyone owns a toaster or has access to it, meaning that it needs to be designed to allow mass production. Design for Manufacture The toaster is manufactured using several different processes. The main two process used are injection molding and stamping. Extrusion, deep draw methods, and an hydraulic press were also used. Exterior of Toaster - The case, bottom, and user interface of the toaster were all injection molded. Although injection molding is an expensive process due to its high price equipment and molds, with the toaster it is probably a good option. With the number of toasters being made and the consistency of the toaster design, the mold for a toaster is more than paid for. There are probably three different injection molds for this product: This combination of multiple parts in one mold is allowable due to the small size of the various parts and the lack of detail needed for each part. The shape of each of these parts were designed to be most efficient for injection molding. The bottom, which consists of many slots or vents, is the most complex of the shapes and is made up for this by having four locations that the plastic is injected. Exterior Metal Slots- The slots of the toaster was made through a deep draw process. This is a special type of stamping that gives radial stress to the flanges of the metal, and allows it to be stretched radially as well linearly. This gives the metal a rounder finish, making it look more complete and attractive. This process was used only for the exterior metal on the slots for the toaster. Its purpose was to make the toaster attractive. Although this process is more expensive than just stamping and bending metal, in mass quantities the cost is not unreasonable. This process in the toaster manufacturing could definitely be taken out, but it would also hinder the quality and attractiveness of the product. Interior Metal Plates and strips- The metal in the interior of the toaster was all stamped and bent. This is an easy process which uses sheet metal and then stamps out the shape of the metal needed. All unused sections of sheet metal can then be re-melted and used again. This is a very cost-effective method of manufacturing. You start of with the sheet metal, cut it in to shape by stamping it and then bend it to give it more strength and durability. This process is easy, low time, and easy to automate. Metal Rods and Wires- All of the metal rods and wires in the toaster were made through metal extrusion. Where metal is heated and then pushed through a die to its desired shape. This process is easy to do, and it is cost-efficient as while extruding the pieces can be easily cut to their desired length. This creates very little waste in material and makes the whole process extremely quick. Mica Sheets- Mica is a great insulator and hard to burn. Thus is a great choice to contact the heating wires and insulate the various circuits and wires. In order to produce mica sheets, mica is ground fine and mixed with a colloid agent and water. A single sheet of uniform thickness is formed by pouring the mixture onto a mesh screen. Vacuum means and a hydraulic press are used to complete the formation of a sheet. Mica is not inexpensive, but its special properties make it a extremely valuable material, its used in a wide variance of products from dry wall to cosmetics for this reason. If you look at the toaster as a whole, you realize that the toaster was manufactured the way it was to try to optimize time, efficiency, and cost. They made some sacrifices in the manufacture for aesthetic appeal, by deep drawing the metal plate on top of the toaster. One problem with the design for manufacture is the number of parts needed to make a toaster. Since there are so many parts, many different processes are needed to be used to make them all. You have extrusion of metal and plastic electrical wiring , stamping, press, injection molding, and all the electrical components. This gets expensive in the amount of machinery and tools needed, and how much time it takes. Even though there were so many parts, looking at all the different individual choices it is obvious that each part was made in the optimal way, looking at time and cost. Thus even though there are many parts, each was made as well as it possibly could. Design for Assembly The toaster is designed to be assembled by hand. It is made in China, where labor is cheap, and its parts were designed to allow easy and quick assembly. Each of the metal plates in the entire were connected together with a series of tabs. The plates connected together when the tabs fit into small slots and were then folded over by hand. This allowed the plates to be easily and quickly adhered together. The one problem is that is it requires a lot of tedious work for the laborer. It was easy to see that different people worked on the tabs on our toaster, as different tabs were folded dramatically different for each plate. There were also holes punched into the metal plates to allow for easy assembly of having either rods, wires, or metal pieces fit easily through a space into their correct location. This once again was optimized for hands-on assembly. As you can see from the picture below, this design was even incorporated for somewhat complex shapes and assembly to quicken the process and keep it accurate. This step, though most likely still quite challenging, has been helped a lot by this step. It allows the bread shelf to be assembled later on in the process allowing other components to be placed first while being able to reach its position easier than before. The injection molded bottom had some built in slots that the circuit boards easily slipped into, making the circuit board addition a last minute process. All that needed to be done was to slide them in, connect the two boards together, and solder the wires to the leads. The stamped metal insides were also able to be slid into place, to secure the toasting cavity to the toaster base. The hardest part of the assembly is probably trying to put in the mica sheets and wires into the stamped metal area. This requires sliding the mica sheets down while threading the wires at the same time. The toaster did a good job of organizing the assembly process so that there was little obstruction and everything was reachable. Looking at the whole assembly process, the toaster has a lot of parts to put together. Automating more of this process would be beneficial for time and getting rid of labor. This would also increase costs due to machinery and maintenance. Although the toaster is made entirely by hand, the parts were designed to limit the laborer to easy tasks, improving time and reliability of the assembly. Most failures should be found before the product leaves the factory. The major failure modes mostly involve mechanical fatiguing of parts and mechanisms accelerated by thermal loading. This testing should include average and heavy use under normal and extreme conditions. The risk may also be lowered if the properties of the metals used are already known. If the components will be able to function properly after 4 years of use, then the product will have reached an acceptable lifespan. This will cut down on reliability testing costs and keep the overall product costs low. The first nine parts on the list were analyzed at the component level while the rest were at assembly level. Since most failures for the assembly level parts had similar failures and effects, they were analyzed together. The scale used can be found in the Engineering Design textbook by Dieter and Schmidt.

Chapter 6 : Stock Quotes, Business News and Data from Stock Markets | MSN Money

On a single-wire paper machine wet end, what are the forces used to remove water from the sheet, in order? gravity, vacuum, pressing What would the correct answer be for the following ratio on a typical paper machine making copy paper?

The process sections[edit] Paper machines usually have at least five distinct operational sections: Forming section , commonly called the wet end, is a continuous rotating wire mesh which removes water from the paper by sucking it out of suspension. Press section where the wet fibre web passes between large rolls loaded under high pressure to squeeze out as much water as possible. Drying section , where the pressed sheet passes partly around, in a serpentine manner, a series of steam heated drying cylinders. Infra-red driers are also used to supplement cylinder drying where required. Calender section where the dried paper is smoothened under high loading and pressure. Only one nip where the sheet is pressed between two rolls is necessary in order to hold the sheet, which shrinks through the drying section and is held in tension between the press section or breaker stack if used and the calender. Extra nips give more smoothing but at some expense to paper strength. Reel section where paper coming out of the machine is wound onto individual spools for further processing. There can also be a coating section to modify the surface characteristics with coatings such as china clay. History[edit] Before the invention of continuous paper making, paper was made in individual sheets by stirring a container of pulp slurry and either pouring it into a fabric sieve called a sheet mould or dipping and lifting the sheet mould from the vat. While still on the fabric in the sheet mould, the wet paper is pressed to remove excess water and then the sheet is lifted off to be hung over a rope or wooden rod to air dry. Fourdrinier machine[edit] In , Louis-Nicolas Robert of Essonnes , France, was granted a patent for a continuous paper making machine. Didot thought that England was a better place to develop the machine. But during the troubled times of the French Revolution , he could not go there himself, so he sent his brother-in-law, John Gamble, an Englishman living in Paris. Through a chain of acquaintances, Gamble was introduced to the brothers Sealy and Henry Fourdrinier , stationers of London, who agreed to finance the project. Gamble was granted British patent on 20 October The Fourdrinier machine used a specially woven plastic fabric mesh conveyor belt known as a wire, as it was once woven from bronze in the forming section, where a slurry of fibre usually wood or other vegetable fibres is drained to create a continuous paper web. The original Fourdrinier forming section used a horizontal drainage area, referred to as the drainage table. With the help particularly of Bryan Donkin , a skilled and ingenious mechanic, an improved version of the Robert original was installed at Frogmore Paper Mill , Apsley, Hertfordshire , in , followed by another in The Fourdriniers also bought a mill at St Neots intending to install two machines there and the process and machines continued to develop. Thomas Gilpin is most often credited for creating the first U. S cylinder type papermaking machine at Brandywine Creek , Delaware in This machine was also developed in England, but it was a cylinder mould machine. Pulp paper The plant fibres used for pulp are composed mostly of cellulose and hemi-cellulose, which have a tendency to form molecular linkages between fibres in the presence of water. After the water evaporates the fibres remain bonded. It is not necessary to add additional binders for most paper grades, although both wet and dry strength additives may be added. Rags of cotton and linen were the major source of pulp for paper before wood pulp. Today almost all pulp is of wood fibre. Cotton fibre is used in speciality grades, usually in printing paper for such things as resumes and currency. Sources of rags often appear as waste from other manufacturing such as denim fragments or glove cuts. Fibres from clothing come from the cotton boll. Bleach and other chemicals remove the colour from the fabric in a process of cooking, usually with steam. The cloth fragments mechanically abrade into fibres, and the fibres get shortened to a length appropriate for manufacturing paper with a cutting process. Rags and water dump into a trough forming a closed loop. A cylinder with cutting edges, or knives, and a knife bed is part of the loop. The spinning cylinder pushes the contents of the trough around repeatedly. As it lowers slowly over a period of hours, it breaks the rags up into fibres, and cuts the fibres to the desired length. The cutting process terminates when the mix has passed the cylinder enough times at the programmed final clearance of the knives and bed. Another source of cotton fibre comes from the cotton ginning process. The seeds remain, surrounded by short fibres known as linters for their short length and resemblance to lint. Linters are too short for successful use in fabric. Linters removed from the cotton seeds are available as first and second cuts. The first cuts are longer. The two major classifications of pulp are chemical and mechanical. Chemical pulps formerly used a sulphite process , but the kraft process is now predominant. Kraft pulp has superior strength to sulphite and mechanical pulps. Both chemical pulps and mechanical pulps may be bleached to a high brightness. Chemical pulping dissolves the lignin that bonds fibres to one another, and binds the outer fibrils that compose individual fibres to the fibre core. Lignin, like most other substances that can separate fibres from one another, acts as a debonding agent, lowering strength. Strength also depends on maintaining long cellulose molecule chains. The kraft process, due to the alkali and sulphur compounds used, tends to minimize attack on the cellulose and the non-crystalline hemicellulose , which promotes bonding, while dissolving the lignin. Acidic pulping processes shorten the cellulose chains. Kraft pulp makes superior linerboard and excellent printing and writing papers. Groundwood, the main ingredient used in newsprint and a principal component of magazine papers coated publications , is literally ground wood produced by a grinder. Therefore, it contains a lot of lignin, which lowers its strength. The grinding produces very short fibres that drain slowly. Thermomechanical pulp TMP is a variation of groundwood where fibres are separated mechanically while at high enough temperatures to soften the lignin. Between chemical and mechanical pulps there are semi-chemical pulps that use a mild chemical treatment followed by refining. Semi-chemical pulp is often used for corrugating medium. Bales of recycled paper normally old corrugated containers for unbleached brown packaging grades may be simply pulped, screened and cleaned. Recycling to make white papers is usually done in a deinking plant, which employs screening, cleaning, washing, bleaching and flotation. Deinked pulp is used in printing and writing papers and in tissue , napkins and paper towels. It is often blended with virgin pulp. At integrated pulp and paper mills, pulp is usually stored in high density towers before being pumped to stock preparation. Non integrated mills use either dry pulp or wet lap pressed pulp, usually received in bales. The pulp bales are slushed in a [re]pulper. Stock pulp preparation[edit] Stock preparation is the area where pulp is usually refined, blended to the appropriate proportion of hardwood , softwood or recycled fibre, and diluted to as uniform and constant as possible consistency. The pH is controlled and various fillers, such as whitening agents, size and wet strength or dry strength are added if necessary. Additional fillers such as clay , calcium carbonate and titanium dioxide increase opacity so printing on reverse side of a sheet will not distract from content on the obverse side of the sheet. Fillers also improve printing quality. Historically these were made of special ceramic tile faced reinforced concrete, but mild and stainless steels are also used. Low consistency pulp slurries are kept agitated in these chests by propeller like agitators near the pump suction at the chest bottom. In the following process, different types of pulp, if used, are normally treated in separate but similar process lines until combined at a blend chest: From the unrefined stock chest stock is again pumped, with consistency control, through a refiner. The discs have raised bars on their faces and pass each other with narrow clearance. This action unravels the outer layer of the fibres, causing the fibrils of the fibres to partially detach and bloom outward, increasing the surface area to promoting bonding. Refining thus increases tensile strength. For example, tissue paper is relatively unrefined whereas packaging paper is more highly refined. Refined stock from the refiner then goes to a refined stock chest, or blend chest, if used as such. Refining can cause the softwood fibre tube to collapse resulting in undesirable properties in the sheet. From the refined stock, or blend chest, stock is again consistency controlled as it is being pumped to a machine chest. It may be refined or additives may be added en route to the machine chest. The machine chest is basically a consistency levelling chest having about 15 minutes retention. This is enough retention time to allow any variations in consistency entering the chest to be levelled out by the action of the basis weight valve receiving feedback from the on line basis weight measuring scanner. Many paper machines mistakenly control consistency coming out of the machine chest, interfering with basis weight control. The forming section makes the pulp into the basis of for sheets along the wire. The press section, which removes much of the remaining water via a system of nips formed by rolls pressing against each other aided by press felts that support the sheet and absorb the pressed water. The dryer section of the paper machine, as its name suggests, dries the paper by way of a series of internally steam -heated cylinders that evaporate the moisture. Calenders are used to make the paper surface extra smooth and glossy. In practice calender rolls are normally placed vertically in a stack. Diagram showing the sections of the Fourdrinier machine Forming section or wet end[edit] A worker inspecting wet, bleached wood pulp on an old-fashioned Hollander pulper or "beater". From the machine chest stock is pumped to a head tank, commonly called a "head tank" or stuff box, whose purpose is to maintain a constant head pressure on the fiber slurry or stock as it feeds the basis weight valve. The stuff box also provides a means allowing air bubbles to escape. Flow from the stuff box is by gravity and is controlled by the basis weight valve on its way to the fan pump suction where it injected into main flow of water to the fan pump. The main flow of water pumped by the fan pump is from a whitewater chest or tank that collects all the water drained from the forming section of the paper machine. Before the fiber stream from the stuff box is introduced, the whitewater is very low in fiber content. The whitewater is constantly recirculated by the fan pump through the headbox and recollected from the wire pit and various other tanks and chests that receive drainage from the forming wire and vacuum assisted drainage from suction boxes and wet fiber web handling rolls. On the way to the head box the pulp slurry may pass through centrifugal cleaners, which remove heavy contaminants like sand, and screens, which break up fibre clumps and remove over-sized debris.

DOWNLOAD PDF STUDY OF STOCK JUMP AND VACUUM FORCE ON THE TABLE OF FOURDRINIER MACHINE

Chapter 7 : Drainage foil element having two wire bearing portions - Thermo Electron Corporation

A typical headbox, or inlet, and Fourdrinier section of a book-paper or newsprint machine is shown in Fig. 1 in its simplest form. The widths of modern book-paper machines run to about 20 feet, of newsprint machines Pressurized Slurry jet headboxâ€". 1/2 inch thick Paper web (18% solids) to press section <â€" r<ecircuiarea __2 Filtrate Fig. 1.

It is important to keep in mind that a certain degree of fiber flocculation can be expected, regardless of chemical conditions in a papermaking furnish. The flocculation occurs because a typical papermaking fibers have length-to-thickness ratios between about 50 and That means that the fibers tend to collide with each other and become somewhat entangled. At the same time, hydrodynamic shear also tends to break down the fiber flocs, and the degree of flocculation can be understood as a dynamic equilibrium between these two tendencies. Papermakers employ the following kinds of strategies to try to minimize the level of fiber flocculation in the paper: Paper machine adjustments that affect the small-scale uniformity of the product can include the angle of impingement of the jet onto the forming fabric velocity forming vs. These approaches generally lie beyond the scope of this website, except that it may be pointless to consider approaches involving chemical additives if no attention is being paid to the paper machine equipment settings. In principle, the simplest way to reduce the tendency for fibers to flocculate in a stirred suspension is to decrease the consistency dry mass of filterable solids per unit of volume. Studies have shown that the degree of flocculation tends to be related to the product of the consistency and the square of the length-to-thickness ratio of the fibers. In practice, papermakers are able to reduce the consistency only up to the point where a there is adequate fan pump capacity, b the headbox flow is not so high as to create undesirable wake effects, or c the furnish still drains easily enough so that the paper reaches a solids level suitable for wet-pressing by the time it leaves the forming section of the machine. Excessive flow through a headbox, relative to its rated capacity, can cause alignment of fibers at an angle to the machine direction. Some ways to modify a papermaking furnish to reduce the flocculation tendency include refining to make the fibers more flexible , or the substitution of a higher level of hardwood fibers in place of softwood fibers. Chemical strategies to reduce fiber flocculation in a sheet of manufactured paper tend to be somewhat counter-intuitive. One would like to think that the best solution would be to add a chemical to help the fibers slide past each other. Such an effect is employed during the production of wet-lay nonwoven fabrics by the addition of high levels of very-high-mass anionic or nonionic water-soluble polymers. The use of such "formation aids" can work during formation of thin sheets of synthetic fibers, since the resistance to dewatering tends to be low. However, when producing paper or paperboard from typical wood-based fibers, as used in most papermaking grades, a similar chemical approach would tend to inhibit dewatering and require a decrease in the speed of the paper machine. The most important chemical strategies for avoiding poor formation uniformity of paper can involve avoiding excessive effects of chemical flocculants, i. This can be done in either of two ways. The first involves adding the lowest practical amount of retention aid, consistent with what is needed to keep the paper machine system clean, to minimize the decomposition of sizing agents , and to avoid a strongly two-sided composition of paper if made on a Fourdrinier former. The second approach involves adding the flocculant before a unit operation such as a pressure screen , where fibers are subjected to high levels of hydrodynamic shear. It has been shown that such hydrodynamic forces tend to redisperse fibers that have been flocculated by high-mass polymers. However, a high proportion of chemically-induced attachments between very fine particles and fibers tend to survive the high-shear exposure. Some of the most notable recent progress in achieving more uniform paper has involved the use of chemical programs that promote easier release of water during the formation process. Such chemical systems were described earlier , and it is worth noting that treatment programs involving microparticle additives are often associated with efforts to achieve more uniform formation. However, the drainage-promoting chemical strategies can be effective only in cases where they make it possible to make other changes, such as lowering the headbox consistency, reducing the average fiber length, or increasing the level of refining. If so, the streaks have to be corrected by mechanical changes, rather than chemical adjustments. For instance, it may be necessary to reset the slice adjustments so that the opening is more even across the entire width of the machine. This is much harder to do that one might imagine, since it is usual for counter-rotating vortices to form just after the slice, and interactions between such vortices can result in the streaks. More serious effects can result from deposits on the slice. Efforts to correct such streaks by adjusting the slice opening at different points sometimes make matters worse. Sometimes streaks can be related to the speed of rotation of a perforated roll in an air-padded headbox. Other possibilities include partially plugged suction boxes and various kinds of misalignments or ridges in the fabrics. Chemical strategies can be important, relative to streaks, if the problem is related to deposited materials , either at the slice lip , on the forming fabric, or in the wet-press felt s. See the comments regarding deposits and scale if the streaks seem to be possibly related to the headbox slice. See comments regarding barrier chemical treatment if the streaks seem to be related to a partly-occluded forming fabric. See comments regarding felt filling if the streaks seem to be related to wet-pressing. In some paper machine systems it is possible to obtain streaky formation due to poorly mixed retention aid , assuming that the polymer is added very late to the system. This is especially a concern if the retention aid is added on one side of a main stock line in the approach to the headbox. Cross-machine streaks or "barring" is most often due to unsteady flow or unsteady pressure at the headbox. A specialist should look at the system and find out whether the stock valve is opening and closing excessively, of whether there are other conditions leading to pulsating flow. The information in this Guide is provided as a public service by Dr. Users of the information contained on these pages assume complete responsibility to make sure that their practices are safe and do not infringe upon an existing patent. There has been no attempt here to give full safety instructions or to make note of all relevant patents governing the use of additives. Please send corrections if you find errors or points that need better clarification. Go to top of this page.

Chapter 8 : Patio Furniture & Accessories : www.nxgvision.com

Different from the dry creped machine, the TAD machine does not have a press section, and this helps to preserve the three-dimensional structure of the paper web. Dewatering before the drying section is achieved with vacuum on suction boxes to a consistency of about 20% to 25%.

See Article History Papermaking, formation of a matted or felted sheet, usually of cellulose fibres, from water suspension on a wire screen. Paper is the basic material used for written communication and the dissemination of information. In addition, paper and paperboard provide materials for hundreds of other uses, such as wrapping, packaging, toweling, insulating, and photography. The word paper is derived from the name of the reedy plant papyrus , which grows abundantly along the Nile River in Egypt. In ancient times, the fibrous layers within the stem of this plant were removed, placed side by side, and crossed at right angles with another set of layers similarly arranged. The sheet so formed was dampened and pressed. Upon drying, the gluelike sap of the plant, acting as an adhesive, cemented the layers together. Complete defibring, an indispensable element in modern papermaking, did not occur in the preparation of papyrus sheets. Papyrus was the most widely used writing material in ancient times, and many papyrus records still survive. By the 14th century a number of paper mills existed in Europe, particularly in Spain, Italy, France, and Germany. The invention of printing in the s brought a vastly increased demand for paper. Through the 18th century the papermaking process remained essentially unchanged, with linen and cotton rags furnishing the basic raw materials. Paper mills were increasingly plagued by shortages; in the 18th century they even advertised and solicited publicly for rags. It was evident that a process for utilizing a more abundant material was needed. Improvements in materials and processes In a book was published that launched development of practical methods for manufacturing paper from wood pulp and other vegetable pulps. Several major pulping processes were gradually developed that relieved the paper industry of dependency upon cotton and linen rags and made modern large-scale production possible. These developments followed two distinct pathways. In one, fibres and fibre fragments were separated from the wood structure by mechanical means; and in the other, the wood was exposed to chemical solutions that dissolved and removed lignin and other wood components, leaving cellulose fibre behind. Made by mechanical methods, groundwood pulp contains all the components of wood and thus is not suitable for papers in which high whiteness and permanence are required. Chemical wood pulps such as soda and sulfite pulp described below are used when high brightness, strength, and permanence are required. Groundwood pulp was first made in Germany in , but the process did not come into extensive use until about Soda pulp was first manufactured from wood in in England, and in a patent was issued in the United States for the sulfite pulping process. Hence, water-based inks and other aqueous liquids will penetrate and spread in it. Impregnation of the paper with various substances that retard such wetting and penetration is called sizing. Before , paper sheets were sized by impregnation with animal glue or vegetable gums, an expensive and tedious process. In Moritz Friedrich Illig in Germany discovered that paper could be sized in vats with rosin and alum. Although Illig published his discovery in , the method did not come into wide use for about 25 years. Discovery of the element chlorine in led to its use for bleaching paper stock. Lack of chemical knowledge at the time, however, resulted in production of inferior paper by the method, discrediting it for some years. Chlorine bleaching is a common papermaking technique today. Introduction of machinery Prior to the invention of the paper machine, paper was made one sheet at a time by dipping a frame or mold with a screened bottom into a vat of stock. Lifting the mold allowed the water to drain, leaving the sheet on the screen. The sheet was then pressed and dried. The size of a single sheet was limited to the size of frame and mold that a man could lift from a vat of stock. In Nicolas-Louis Robert in France constructed a moving screen belt that would receive a continuous flow of stock and deliver an unbroken sheet of wet paper to a pair of squeeze rolls. The Fourdrinier brothers obtained a patent also. Two years later a cylinder paper machine described below was devised by John Dickinson , an English papermaker. From these crude beginnings, modern papermaking machines evolved. By paper coated by machinery was being made for use in the printing of halftones by the new photoengraving process, and in Carl F. Dahl invented sulfate kraft pulp in Danzig, Germany. Although the paper machine symbolizes the mechanization of the paper industry, every step of production, from the felling of trees to the shipment of the finished product, has also seen a dramatic increase in mechanization, thus reducing hand labour. As papermaking operations require the repeated movement of large amounts of material, the design and mechanization of materials-handling equipment has been and continues to be an important aspect of industry development. Although modern inventions and engineering have transformed an ancient craft into a highly technical industry, the basic operations in papermaking remain the same to this day. The steps in the process are as follows: The differences among various grades and types of paper are determined by: Fibre sources The cell walls of all plants contain fibres of cellulose , an organic material known to chemists as a linear polysaccharide. It constitutes about one-third of the structural material of annual plants and about one-half that of perennial plants. Cellulose fibres have high strength and durability. They are readily wetted by water, exhibiting considerable swelling when saturated, and are hygroscopicâ€”i. Even in the wet state, natural cellulose fibres show no loss in strength. It is the combination of these qualities with strength and flexibility that makes cellulose of unique value for paper manufacture. Most plant materials also contain nonfibrous elements or cells, and these also are found in pulp and paper. The nonfibrous cells are less desirable for papermaking than fibres but, mixed with fibre, are of value in filling in the sheet. It is probably true that paper of a sort can be produced from any natural plant. The requirements of paper quality and economic considerations, however, limit the sources of supply. Wood Pulped forest tree trunks boles are by far the predominant source of papermaking fibre. The bole of a tree consists essentially of fibres with a minimum of nonfibrous elements, such as pith and parenchyma cells. Forests of the world contain a great number of species, which may be divided into two groups: Softwood cellulose fibres measure from about 2 to 4 millimetres 0. The greater length of softwood fibres contributes strength to paper; the shorter hardwood fibres fill in the sheet and give it opacity and a smooth surface. When the sulfite process see below was the chief method of pulping in the early days of the pulp industry, spruce and fir were the preferred species. Since that time, advances in technology , particularly the introduction of the kraft process described below , have permitted the use of practically all species of wood, greatly expanding the potential supply. Because of the enormous and rapidly growing consumption of wood for pulp, concern regarding the depletion of forest resources has been expressed, even though yearly growth often exceeds the annual harvest. In , for example, though new growth exceeded the harvest by a considerable margin, much of it was inferior in quality and less accessible than the harvested trees. Moreover, wood is now being harvested at a more rapid pace. Approximately 40 percent of the harvest is going into pulp, and that figure is expected to increase. There is also a rising public demand for withdrawal of forestland from timber production for recreational use and to prevent disturbance to the ecology of certain areas. On the other hand, application of new techniques in fertilization and genetics has brought about enormous increases in the productivity of forestlands in some areas. Two significant trends in pulpwood utilization deserve mention. Until recently, lumbering and other wood-using industries were operated quite independently of the pulp industry. Since World War II , however, the waste from the wood-using industries, such as sawdust, has increasingly been used for pulp. In addition, more abundant and less desirable hardwoods have been used as a source of pulp. The woodyard of a pulp mill formerly stored pulpwood in the form of roundwood logs, but recently there has been a trend toward storing in the form of chips. Rags Cotton and linen fibres, derived from textile and garment mill cuttings; cotton linters the short fibres recovered from the processing of cottonseed after the separation of the staple fibre ; flax fibres; and clean, sorted rags are still used for those grades of paper in which maximum strength, durability, and permanence, as well as fine formation, colour, texture, and feel, are required. These properties are attributed to the greater fineness, length, and purity of rag fibre as compared with most wood pulp. Rag papers are used extensively for bank note and security certificates; life insurance policies and legal documents, for which permanence is of prime importance; technical papers, such as tracing paper, vellums, and reproduction papers;

high-grade bond letterheads, which must be impressive in appearance and texture; lightweight specialties such as cigarette, carbon, and Bible papers; and high-grade stationery, in which beauty, softness, and fine texture are desired. Rags are received at the paper mill in bales weighing from to kilograms to 1, pounds. After mechanical threshing, the rags are sorted by hand to remove such foreign materials as rubber, metal, and paper and to eliminate those rags containing synthetic fibres and coatings that are difficult to remove. Following sorting, the rags are cut up, then dusted to remove small particles of foreign materials, and passed over magnetic rolls to remove iron. The cut and cleaned rags are cooked to remove natural waxes, fillers, oils, and grease in large cylindrical or spherical boilers of about five-ton capacity. About three parts of cooking liquor, a dilute alkaline solution of lime and soda ash or caustic soda combined with wetting agents or detergents, are used with each part of rags. Steam is admitted to the boiler under pressure, and the contents are cooked for three to ten hours. Once cooked, the rags are washed, then mechanically beaten. The beating shortens the fibre, increases the swelling action of water to produce a softened and plastic fibre, and fibrillates or frays the fibre to increase its surface area. All of these actions contribute to better formation of the paper sheet, closer contact between fibres, and the formation of interfibre bonding that gives the paper strength and coherence. Wastepaper and paperboard By using greater quantities of wastepaper stock, the need for virgin fibre is reduced, and the problem of solid waste disposal is minimized. The expansion of this source is a highly complex problem, however, because of the difficulties in gathering wastepaper from scattered sources, sorting mixed papers, and recovering the fibre from many types of coated and treated papers. Wastepaper may be classified into four main categories: High-grade and corrugated stocks originate mainly in mercantile and industrial establishments. White paper wastes accumulate in envelope and printing plants, while tabulating cards are supplied by large offices. Much magazine stock comes from newsstand returns, but some comes from homes. Corrugated waste is supplied by manufacturing plants and retail stores. Printed news is derived from newsstand returns and home collections. Mixed paper comes from wastebaskets of office buildings and similar sources. In recent years there has been considerable interest in wastepaper recycling in the interest of ecology. Converters of paper and paperboard have also turned to new materials combined with paper and paperboard to give their products special characteristics. Although these new materials have broadened the market for paper, their presence has posed new problems in reusing paper stock. The most common new ingredients are asphalt, synthetic adhesives, metal foils, plastic and cellulose-derivative films and coatings, and some printing inks. Some objectionable materials can be sorted from wastepaper, and packers generally try to remove them completely.

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table elements by manipulating other laboratory process variables, (e.g. the consistency), if the these process operations de-water the stock without the development of a mat.