lers' Day, 1950

Feb. 13—Founders' Day, celebrated in the Mem- at 8.30 p. m.

owing were the high- the programme. The Day Address by the dis- Principal and Vice- of Queen's University, Wallace; the payment of nt of one penny to the rnor of New Brunswick, . L. McLaren, P..C., who or to the university on His Majesty, the King; an's remarks by the f the university, Dr. A. an; and a one act play of Hahalaba" by Lord which it is understood of three professors and t.

NOTICE

the graduate write-ups 0 year book have been However for those who mplied with our request their write-ups to either ted class collctors or to ook committee, we are the deadline to the end y.

this deadline is definite uation photos will be in at this time. **Only those ich have an accompany- up will be used in the Book.**

0 Year Book Committee

EAD OF NIGHT

F NIGHT, produced by GLE-LION, is the fore- the famous Somerset film QUARTET, in that of a series of stories only by the psychology lved. One of the stars gnificent film is Michal who plays the part of a st who is obsessed by hat his dummy is a real that he himself is only

ture is an adventure in f the type that has made famous. It will be en- ll who see it.

ENGINEERING - AS APPLIED TO THE MANUFACTURE OF NEWSPRINT

by Jack Flowers

Editors Note—Although this is not the winning paper of the annual Technical Report Contest held each year by the Engineering Society, it is among the better ones. It has been printed due to its wider scope of interest.

The 131 pulp and paper mills now in operation in Canada constitute an industry that stands first in employment, in wages paid, in value of production, in capital investment, and as a buyer of goods and services. The industry makes Canada the largets exporter of pulp and paper in the globe, and produces three of every five newspaper pages in the world. It accounts for the fifth of all exports—the largest item in Canada's foreign trade—and for more than a third of all exports to the United States. It uses half the electric power generated for all Canadian industry. It's the largest user of transportation services, and accounts for more than one of every ten freight cars loaded in Canada. The pulp and paper industry is the largest contributor to national wealth, and generates, at a minimum, ten percent of the total annual value of all Canadian goods and services. It manages and conserves its forests, and uses less than one fifth of the annual wood consumption of canada. In view of current national interest in the sale abroad of goods manufactured from Canadian pulpwood, this paper will deal with one particular phase of the industry—the manufacture of newsprint.

Newsprint Paper, as manufactured at Dalhousie, New Brunswick, is made from spruce and balsam wood. The wood is delivered to the mill by water, with the bark still on it, in four-foot lengths. These are made up into booms, and logs from the booms are fed to a hydraulic pack-ladder, and dropped on to a conveyor.

The conveyor carries the logs to a set of barking drums. These measure twelve feet in diameter, are forty-five feet long, and revolve about in a horizonlal axis at four-and-a-half revolutions a minute. The logs enter at one end of the barking drums, and tumble and rub against each other until all the bark is removed. By this time they have reached the other end of the drum, and as they tumble out, they pass through a water shower, which washes them clean of bark and dirt. These logs are now ready for use, either in the mill, or for storage in the yard, to be used throughout the winter months when water is frozen.

The bark from the logs is dried, and burned in a special bark-burning plant, which produces from this waste material one-tenth of the total steam used throughout the plant.

The cleaned wood, to be used right away, is then divided: 20% goes to the sulphite pulp mill, and 80% to the groundwood pulp mill. We will now follow the path of the wood through the two mills, and describe the different treatment given to each percentage.

The manufacture of groundwood pulp is exactly what the name implies. It's a mechanical separation of the fibres, one from the other, by abrasion. There are several kinds of machines used for this work, but they all operate on the same principle. The type of machine used in Dalhousie is a magazine loading grinder, made by Waterous Ltd. of Brantford, Ontario. The grinding-wheel used is artificial, and is composed of blocks of carborandum grit of different sizes; these blocks are bound and cemented on a metal frame, to form a cylinder 64 inches in diameter and 54 inches long. Two of these grinding wheels are mounted on one 10 inch shaft, one on each side of a motor: thus, it's possible to run two grinders from the one motor. The motors used are 2400 and 3600 horsepower, and run at 225 revolutions per minute. The rough surface, so essential for the grinding wheels is maintained by a hydraulically operated sharpening device, on which is mounted steel burrs: these move constantly across the face of the grinding stone.

Above the grinding wheels, supplying them with a constant flow of logs, in the magazine—a metal box measuring 51 inches by 45 inches. As the wood is fed into the magazine, it passes through to the bottom, to be mechanically placed against the grinding stones below —the axis of the log lying in the same line as the axis of the stone; fresh wood is then piled into the magazine to ensure it is constantly charged and full of logs.

Meantime, a large metal shoe, operated by a hydraulic ram, forces the wood against the rough surface of the grinding stone. There are two hydraulic rams for each grinder, mounted on either side of the grinding stone; by grinding logs on both sides of the stone, full use is made of the grinding surface.

Under each grindstone are water showers, which wash the pulp fidre from the stone into a shallow pit, in which the stone is submerged three or four inches; the temperature of the water is regulated at 180 degrees Fahrenheit, to ensure efficient absorption of heat generated into the wood by friction against the stone.

After the pulp fibre is washed from the grinding stone, it flows through canals to coarse screens, called Bull screens. These screens are rotating cylinders with 3/16ths of an inch perforated plates mounted on the outside surface. The stock enters the cylider at one end, and rejected stock is passed through to the other end: this rejected stock is further refined, and used to make coarse wrapper paper. The accepted stock passes through the fine screens. Here it goes through perforated plates, is washed off, collected in tanks, and pumped to yet another process of elimination . . . accepted stock is separated from rejected stock by centrifugal screens. The perforations in these screens are .065 inches, and only stock which comes through these plates is used to make newsprint paper; the rejected stock is, once again, passed on to the wrapper mill.

The accepted stock is run over filters, or deckers, which remove some of the water, and thus increase the consistency of the stock. The stock thus thickened, is then stored in large tanks, with propellor agitators to keep it constantly in motion, until it is needed on the paper machines.

The logs that were sent to the sulphite mill are treated chemically. They are prepared for this process by feeding them into a machine called a clipper, which is a heavy revolving disc equipped with four or more long heavy knives. These knives slice off the ends of the logs so quickly that a stick is reduced to chips within three seconds. The chips are pieces of wood about one inch long, and an eighth of an inch thick. It is necessary that the wood be in this form for the chemical treatment, so that the cooking liquor can penetrate the wood easily and digest, or dissolve, the sugars, and lignin or binding material between the wood fibres, without trouble or subsequent waste.

After passing through the chipper, the chips are screened; all the large pieces are removed, crushed and rescreened, and the sawdust and other dirt is removed as waste. This sawdust waste goes to the bark-burning plant mentioned previously, where it is burned. The good wood or chips are then elevated to large bins located under the roof of the digester building, and stored there until dumped into the cooking boilers or digesters with the cooking acid. The cooking acid is produced in the mill by a chemical process involving sulphur in the form of brimstone, and limestone. The digestors are large steel boilers lined with brick into which the chips are dropped until the digestor is full: the spaces between the individual chips are filled with cooking acid. The digestor is then closed, and steam is forced in at the bottom. The temperature rises, and a pressure of steam and sulphur dioxide is built up. This pressure is relieved at the top of the digestor—the excess gas being expelled through special pipes.

After 7½ hours of steaming or cooking, the wood in the digestor has been reduced to a pulp by the acid dissolving the lignin or binding material between the wood fibres: the end of the cooking process is noted by testing some of the liquor in the digestor. This liquor contains anly .3% of total S02 gas, and is a waste. It contains sugars, lignins and resins amounting to almost half the weight of the dry chips. Some mills use this waste for the manufacture of yeast, and others for alcohol while still others make a paste or glue with it. The digestor containing the finished cooked wood is blown by pressure being released through a ten-inch valve and pipe line at the bottom. When the digestor is empty, all of the pulped wood is in this blow-pit. Now clean, fresh water is run in, until the top of the pulp is completely covered. The liquor drains out of the perforated bottom, and the water filters through the pulp, washing practically all traces of this lipuor away.

The stock thus left is unscreened sulphite pulp. This material is then sluiced into a chest, and pumped to coarse screens or knotters, where the large chunks of wood are removed; then it flows to centrifugal screens, where the sulphite fibres are screened again through thousands of 1/16th inch diameter holes, perforated through copper plates. These machines are called fine screens. The slivers and small uncooked chips are removed here, and are a waste. The total waste from screening amounts to about 4½% of the pulp made, and is used in the wrapper paper mill. The good stock from these fine screens contains a lot of water, which is removed by filters; the thickened pulp drops into chests for temporary storage, where it is treated with a solution of alum dissolved in water . . . this eliminates the pitch, or any stickiness of the pulp resulting from improper removal of the liquor when the pit was washed. The alum also hardens and prepares the pulp, so that it will flow onto the paper machines without any trouble.

All the logs have now been turned into groundwood pulp, and sulphite pulp, ready for the paper machines.

The fibres of the sulphite pulp are long and slender—almost a quarter of an inch long, and very fine. This long length ensures strength to a sheet of paper, as these fibres mat together in a criss-cross manner, forming a screen on which the shorter groundwood fibres are caught and lie, closing up the sheet of paper when it is formed on the paper machines. The sulphite pulp, and the groundwood pulp, are pumped to a measuring machine, where the exact amounts of both pulps are allowed to pass, after which they mix together with broke paper: broke paper it the name given to paper which was not properly made—it's mixed with water, and returned to be made over again. Some colouring dye is also added to colour the finished paper any colour desired, and the whole lot is mixed with water, resulting in liquid paper.

This liquid paper is allowed to flow through a box, so that there are no eddies or surging, and then through a wide nozzle, which extends the full width of the machine —in the Dalhousie Mill this measures 223 inches, or slightly more than eighteen and one half feet. This nozzle is open about half an inch, so that we have a rectangular opening half an inch high, and and eighteen and one feet long. The liquid paper flows through this opening out to a continuous wire screen, known as Fourdriner wire. The excess water drains through the wire, and the fibres form a criss-cross screen on the wire. The short ground-wood fibres give the paper bulk, while the long sulphite fibres bind the mass together, and give it strength.

Since it costs a lot of money to evaporate the water, as much water as possible is removed before stock goes to the dryers, so vaccuum boxes, placed under the wire are decigned to draw off excess moisture. The web of paper is then pressed between rolls in a manner similar to a large clothes' wringer. A continuous woolen blanket felt carries the wet web of paper betwee the nip of these rolls, and protects the paper from damage, while helping to remove even more of the water. After passing through two sets of rolls like this, the wet web of paper still has 66% of water in it, and then runs into the dryer section of the machine. This section is made up of fifty drying cylinders five feet in diameter, and nineteen feet wide. These revolve on horizontial axes, in roller bearings, and can attain a peripheral speed of fifteen hundred feet per minute. Steam is injected into these drying cylinders, which are placed in two rows, one above the other, in such a manner that the cylinders in the top row come between the cylinders in the bottom row. The paper runs round a top drying cylinder, then down to a bottom drying cylinder, and so on, to the end of the rows. Long, continuous canvas dryer felts follow the progress of the paper, over these dryers: their function is to hold the web of paper against the dryer, to help in the quick drying process, and stop any possibility of bulging.

In the Dalhousie mill the paper machines have operated at speeds slightly over 1400 feet per minute, which is among the highest rates of speed which paper is being made. In order to carry the wet web of paper through the dryers

(continued on page seven)