GRINDING WHEAT BY ELECTRICITY.

THE *Electrical World* has published an illustrated description of a flouring mill at Laramie, Wyoming Territory, operated by Sprague electric motors. The capacity of the mill was 100 barrels daily. It is built of stone, three stories and basement high, and is equipped with steam heat and electric lights. The motors are used exclusively for power to run the mill, which has been in successful operation for two months. The system of milling is the "gradual reduction" process, and the yield and quality are equal to any in the States. The power is divided into units of 25 horse-power each. One motor drives all the purifying machinery, the wheat-cleaners and all the elevators and conveyors. The other motor runs the seven double sets of rolls and the flour packers. From the experience gained, Mr. Jones, the manager, states that he would advise mill-builders who use electric motors to subdivide their power into three units, by taking all wheat cleaning and scouring machinery and all elevators and conveyors running directly in their interest from the purifier line, and to apply a motor of proper capacity directly to them by means of a counter-shaft. He suggests this, owing to intermittent use of these machines. All the power is on the roller floor, one motor being belted up through one floor to the purifier line. He finds he has a lower percentage of loss of indicated power by having his engine in the mills instead of in a separate building, which would necessitate long shafting and belts. The substitution of three units for two would also afford another reduction in friction, as the cleaning machines could then remain idle much of the time, and less shafting and belting would be required. The motors are run at constant speed and are subject to little change, and that a slight and gradual increase in speed from time of starting until the day's run is complete. The increase is due to the variation in the temperature of the armature and is in about three proportions: At starting the roller line-shaft makes 210 revolutions per minute; at night the speed has increased to 224 revolutions. The motors are wound for 220 volts, but are run at 226 volts, and it requires in current an average of 150 amperes to drive the mill to its full capacity. A variation of pressure on these machines will vary the speed in about the same proportion as steam pressure will vary the speed of a steam-engine. A variation of one volt will produce the same effect on the motor as one pound of steam. It is easy to control the pressure to within one or two volts.

OVER-SPEEDED PLANING MACHINES.

THE strain upon the cylinder bolts, and the liability of the knives flying off in over-speeded planing machines, is not the only element of danger, says one of our American contemporaries. Over-speeded pulleys are just as liable to fly to pieces and do damage to the machine, as well as the operator. It is not practical to use pulleys on the cylinder shaft of less diameter than four and a half inches, as smaller ones soon destroy the belts.

Neither is it practical, as planing machines are constructed, to use pulleys on the back shaft of a greater diameter than twenty inches. Otherwise the back shaft would be too high to allow the matcher belts to run in their proper place. Now suppose the pulleys on the back shaft are twenty inches diameter, and four and a half inch face, which would be the right proportion for this purpose, with a rim averaging three-eighths of an inch thick. This pulley, in order to drive the cylinder 5,000 revolutions per minute, would require a speed of 1,125 revolutions per minute. Allowing the weight of the rim to be thirty pounds, which is about the average for pulleys of this size, the centrifugal strain by rules already given, would be as follows: The circumference in feet (5,2375), multiplied by the speed (1,125 revolutions), and divided by sixty, equals 98,202, the speed in feet per minute. The square of this number multiplied by the weight, and divided by thirty-two times the radius in feet, equals the centrifugal strain in pounds. The square of 98 292 = 8643,632. This multiplied by thirty and the product divided by 26.66, or thirty-two times the weight of the rim, gives 10851.79 pounds.

The rim of this pulley contains a sectional area of about one square inch, and the tensile strength of the best samples of cast iron, as determined by Major Wade, of the United States Ordinance department, is from 15,000 to 16,000 pounds to the square inch. It will be remembered, however, that those tests were made upon the basis of cast iron one inch square, and of different lengths, and from the best samples, perfectly sound and free from dirt or air holes, and it is a question whether the average castings obtained from the foundry from day to day will come anywhere near to this standard of strength.

Suppose every pulley was perfect and the iron up to the standard of strength, there is then only a margin of safety of 3810.40 pounds which is far below the standard of safety; for no piece of machinery in constant use and submitted to the same constant strain from day to day should be taken over its ultimate strength. Again, the shape of the material and the manner in which the strain is applied, has much to do with it. If the pulley rim instead of being a flat piece four and a half inches wide, and three-eighths of an inch thick, were put in the shape of a square bar, which would be about one inch square, it is reasonable to suppose that it would stand a much greater strain than in its present form, and in the manner in which the strain is applied. The same rule may be applied to this which is applied to beams and girders and it is necessary to state what every one knows that a cast iron beam four and a half inches wide and three-eighths of an inch thick will sustain more than four times the load when placed edgewise than it would if placed flatwise and there is but one conclusion that we can arrive at and that is that pulleys of the dimension given are not safe at such high speed. Aside from the question of safety there is also a question of economy involved that is worth consideration.

POINTS TO REMEMBER.

A GALLON of fresh water contains 231 cubic inches, and weighs 8¼ pounds (U. S. Standard.)

A cubic foot of water contains 7½ gallons, or 1,728 inches, and weighs 62½ pounds.

The friction of water in pipes is as the square of the velocity. Doubling the diameter of a pipe increases its capacity four times.

To find the pressure in pounds per square inch of a column of water, multiply the height of the column in feet by 0.433. Approximately we generally call every foot elevation equal to ½ pound pressure per inch; this allows for ordinary friction.

In calculating horse-power of steam boilers, consider for:

Tubular boilers, 15 square feet of heating surface, equivalent to one horse-power, fine boilers, 12 square feet, equivalent to one horse-power; cylinder boilers, 10 square feet of heating surface, equivalent to one horse-power.

Each nominal horse-power of boilers requires 1 cubic foot of feed water per hour.

Consumption of fuel averages 7½ pounds of coal, or 15 pounds of dry pine wood, for every cubic foot of water evaporated.

Ordinary speed to run steam pumps, when the duty is not heavy, is 100 feet of piston travel per minute.

To find the quantity of water elevated in one minute, running at 100 feet of piston travel per minute. Square the diameter of water cylinders in inches and multiply by four. Example: Capacity of a 5-inch pump is desired. The square of the diameter (5 inches) is 25, which, multiplied by 4, gives 100, which is gallons per minute (approximately.)

To find the diameter of a pump cylinder to move a given quantity of water per minute (100 feet of piston travel being the speed), divide the number of gallons by 4, then extract the square root, and the product will be the diameter in inches.

To find the capacity of a cylinder in gallons. Multiplying the area in inches by the length of stroke in inches; divide this amount by 231 (which is the cubical contents of a gallon in inches), and product is the capacity in gallons.

The area of the steam piston, multiplied by the steam pressure, gives the total amount of pressure that can be exerted. The area of the water piston, multiplied by the pressure of water per square inch, gives the resistance. A margin must be made between the power and the resistance to move the pistons at the required speed —say 50 per cent.

GIVE THEM LIGHT.

WITH the return of warm weather, says the *Roller Mill*, come the perennial complaints about bugs in the bolting chests, coupled with anxious inquiries after some effective way to get rid of the little pests. The usual prescription is any good insect powder, preferably one not poisonous to human beings, to be run into the infested reels, or sprinkled upon the cloth when the mill is not running, repeating the dose until the bugs have all been killed or driven out of the machine. The objections to such a remedy are that it renders a considerable quantity of stock unfit for flour, and that it is not permanent but must be resorted to at more or less frequent intervals in every mill in which the "demd bugs" have effected a lodging. In other words, insect powder is local, not radical, in its operation.

In view of this discouraging truth, it gives us pleasure to recommend, on the authority of an experienced miller a simple and inexpensive method, said to be prompt and lasting in its effects. It is based on the ascertained fact that bolting cloth bugs—like evil-doers of a certain two-legged race—are accustomed to operate in the dark, and will at once quit work and "light out" when anybody lets the light in upon them. Here it is: Cut out the panels on the side, or, better, both sides, of the chest, and fasten tightly across the openings pieces of canvas thin enough to allow the passage of a pretty strong light. This cure our informant says he first tried in a bug-bothered mill of which he had just taken charge, with the result that in a few days the reels throughout the mill were entirely and permanently depopulated.

USEFUL INFORMATION

Domier has discovered that bronze is rendered malleable by adding to it from one-half to two per cent. of mercury.

A workman in the Carson mint has discovered that drill points, heated to a cherry red and tempered by being driven into a bar of lead, will bore through the hardest steel or plate-glass without perceptibly blunting.

TO DRILL GLASS.—In drilling glass, stick a piece of stiff clay or putty on the part where you wish to make the hole. Make a hole in the putty the size you want the hole, reaching to the glass, of course. Into this hole pour a little molten lead, when, unless it is very thick glass, the piece will immediately drop out.

MUSTARD OIL IN LUBRICATION.—M. Thier, an engineer of *Erfurt, Germany, after experimenting for* months to find a lubricator which would prevent a welding together of iron surfaces upon which much and rapid friction is exercised, such as turbine wheels, has found the ordinary oil of mustard, mixed with small quantities of petroleum, fish oil or other similar fatty substances, answers the purpose in every respect and overcomes all the difficulties heretofore experienced with machinery where excessive friction disturbes the physical quality of the metal used.

DEVICES FOR STRETCHING EMERY CLOTH.—An ingenious device for stretching emery cloth for use in the workshop consists of a couple of strips of wood about fourteen inches long, hinged longitudinally, and of round, half round, triangular or any other shape in cross section. On the inside faces of the wood strips are pointed studs taking into holes on the opposite sides. The strip of emery cloth is laid on to one set in the studs, and the "file," as it is called, closed, which fixes the strips on one side. It is then similarly fixed on the other side, and thus constitutes what is called an "emery file," and which is a handy and convenient arrangement for workshop use.

The frequency of conflagration caused by electric light wires induced the Electric Club of Philadelphia to inquire into the means of preventing them. At a recent meeting the various automatic cut-outs proposed by different inventors were considered, some utilizing the heating of a wire, some the action of a spring pulling against an armature of a magnet. The old arrangement of a fusible alloy cut-off was pronounced objectionable on account of interruption produced when it melted, but this was obviated by an arrangement for throwing other fusible pieces into the circuit one after the other. Thus a momentary increase of current would only cause a momentary stoppage. It was evident that there is a good field for inventors here, in devising an efficient safeguard against too strong currents that may accidently be thrown upon a wire unable to carry them without heating.—*Scientific American.*

Following is a brief summary of the tests for the cast iron devised and practiced successfully by W. J. Keep, of Detroit, Mich.: When the tests are carried out in their entirety 15 pounds of metal are melted in a plumbago crucible in a firebrick furnace drvien by a blast at a prassure of 1.5 ounces per square inch. Three sets of test bars are run from each melting. One bar is .5 inch square and is cast with the ends against a chill exactly 12.125 inches apart. Another bar is cast with this and is run from the same gate. It is one inch wide and .1 inch thick and is run against chills in the same way as the square bar. When the bars have been trimmed and both bars and chills have attained the same temperature, the sinkage is measured by inserting a graduated wedge between the end of each bar and its chill. A third bar is called the fluid strip. The pattern of this is one inch wide, 12 inches long and .05 inch in thickness. This is run from the end and is poured first. The strip rarely runs full, and its length in inches is taken as a measure of the fluidity of the metal. The fourth bar is called the crook strip. It is 12 inches long, 1 inch wide and .086 inch in thickness. On the centre of one side there is a rib .412 inch high, .2 inch wide at the base and .1 inch wide at the top. The unequal shrinkage of the thin flat strip and of the taper rib causes a slight curve in the test piece. This when measured affords valuable information as to the properties of the iron and is called the "crook." The first and second bars are tested for transverse strength and resistance to impact. The first test is made by a gradually applied weight, the deflection being measured at the same time. The resistance test is made by subjecting the bars to a series of blows from a 25-pound weight until it breaks, the fall being at first .5 inch and increasing .125 inch at a time. An Arbitrary scale has been constructed giving a value in pounds avoirdupois on an assured valve for a foot-pound. After these tests have been made the depth of chill is determined, and the grain of the fracture is observed by means of a pair of lenses. The hardness of the metal is finally tested by means of Turner's machine, in which a polished surface is set under a diamond of a standard cut, and the diamond is weighted until it produces a scratch similar to a standard scratch.