A cash prize of $10 is given every month for the best essay contributed to this Department on a subject selected by the editor. The essay considered as the best in each month will be published, and $10 forwarded within ten days to the author. The conditions on which these prizes are offered are as follows:—1. Competitors must be paid-up subscribers to the Dominion Mechanical and Milling News. 2. All articles sent in to become the property of the publisher of this journal. 3. Articles must reach this office not later than the 20th day of the month next preceding the date of issue. 4. Every article must be accompanied by the bona fide name and address of the author, not, however, for publication unless desired. 5. Articles to be written on one side of the paper only, and not to exceed 2,500 words. The merits of all articles written for this Department will be decided by three thoroughly competent and impartial judges selected by the editor, and competitors may depend upon being fairly treated in all cases.

Subject for next competition: "What Constitutes Good Management in a Manufacturing Establishment?"

"HOW POWER IS LOST AND MAY BE SAVED."

BY "SINE."

WHETHER the "power" mentioned as the theme refers to losses in production, or in consumption (transmission), the writer does not know. Yet, as power, applied either theoretically or through the metamorphosis of the pocket book, begins the moment the fire is built under the boiler furnace, or the water applied to the wheel, it will not be out of place to follow an increment of it from its inception to the point of consumption in the machine to which it may be applied.

The production of power with water motors, of whatever kind, involves interesting conditions; yet as they pertain to the province of dynamical mechanics, mostly beyond the control of an operator, they will be passed by. With steam, however, it is different; the intelligence of the operator is quickly manifest in great increase of work, as the want of it is as quickly perceptible in failure to perform the wonted task. The application of power means, in the first place, the most perfect combustion of fuel obtainable, and its application to the work to be done by the most perfect appliances, so that the least percentage of loss shall occur during transmission.

Very simple, and, to the careless attendant, trivial things, greatly affect the production of power in the steam boiler. A lamp will "smoke" either if the draft from beneath or above the chimney be obstructed, if the oil (the fuel) be low, or if the wick fails to deliver it evenly or in quantity. The production of too much smoke in a boiler furnace is a certain indication of imperfect combustion—either imperfect draft or so much fuel that the air cannot supply sufficient oxygen for complete combustion. Smoke is carbon in a state of fine subdivision, capable of producing great heat if it be raised to a sufficiently high temperature for oxygen to unite with it. This temperature cannot be raised if fuel be added too rapidly or in great quantity. The energy of the fire is taken to raise the fresh fuel to the temperature of combustion, and but little is left for other work.

Nothing will take the place of brains in producing steam economically. Two furnaces apparently similar, will give very different results through some trivial and perhaps unnoticed defect in the setting, that the intelligent operator will easily remedy. Two similar furnaces with similar settings will develop enormous differences when operated by an intelligent or an ignorant or careless man. One will keep his flues clean, will see that a minimum of scale is deposited on his boiler sheets, that his chimneys are open, and that his hearth is clear, and especially will feed his fuel little at a time, spread it well over the fire, and exhibit vigilant watchfulness over all the details of his work. The other will neglect all these, fill his furnace full, and read novels between fires. Between the accumulation of ashes on the grate, and the mass of cold fuel on the top, oxygen has precious little chance for work. The glowing bed of incandescence that the successful fireman will aim always to have under his water, is had only occasionally, and then in such a way as to endanger the boiler.

The engine is the next place where the resultant effect of the power in fuel may be conserved to advantage, or wasted, as may be; but as much of this is dependent upon the engine builder, it will only be necessary to mention the necessity of cleanliness, the reduction of friction, keeping ports and valves clear, and the arrangement of "cut off" so that the greatest amount of power will be developed by using steam expansively, with a minimum of actual boiler pressure, consistent with the load, or power to be developed. Much has been written on this subject, and considerable difference of opinion yet exists as to the best practice. But various engines vary curiously in their effect in this relation, and similar engines of the same make behave differently, so that experiment only may determine the best point. Such experiments, however, should only be made by accomplished engineers. The casual mechanic, or the tyro who is usually in charge of engines now-a-days, should leave the valves alone, as it is a fair presumption that the builders have already determined the best arrangement, and interference by all but the most accomplished, will usually result in making matters worse. Much loss of power in many mills and shops may be traced to the impertinent curiosity of those in charge, whose first impulse, when there is a day or two of "shut down," is to take everything to pieces, and see how it is made; and there be few who do not imagine they can improve upon the maker's work, and are surprised, when the change has been made, to "see how that engine eats up steam" to carry a three-quarters load. The maker is blamed, and his machine condemned, for the result of the ignorant curiosity of the person in charge. The writer lays stress upon these points from a memoir of his own early experience.

A great loss of power results in cases where the heat from the exhaust steam is not utilized in heating the water before it enters the boiler. This lack, of course, is due to no fault of the engineer or fireman. It is a drain upon a treasury, however, that no prudent manager will permit, as the most casual will perceive the folly of burning coal to heat water, and then pouring in cold water. It is unnecessary to more than refer to the advantage of providing measures for prevention of scale, both for the preservation of the boiler and an economical use of fuel. It will suffice to state that a scale one-half an inch thick will require fifty per cent. more fuel to raise a given quantity of steam.

But leaving boiler and engine, and proceeding to where the force is utilized, it will be found the rule, not the exception, that badly aligned shafting, gummy and often gritty journals, and above all, slovenly, loose and uneven belting, absorbs fully one half of the force imparted from the engine. The more machinery that is in use, and the greater subdivision there is in the transmitted power, the more pronounced and destructive is the loss of it. And when, to great subdivision of the power, there is added to each piece moved a belt hanging by one corner, and sagging so loosely that it slips over the pulley fully one half of its revolution, the waste of power is so enormous that where there is much machinery to be moved, it becomes a matter for wonder how such concerns keep out of the bankrupt courts—that is, if they do. The worst of this is that these cases are not rare, but rather the rule. With many it would seem that the driving belt is the only one deserving attention. Yet it should be clear, as the driving belt is but a convenient intermediary between the motive power and the working machine, that if it should transmit the force substantially as received, the most of it will be lost if the main and lateral shafts, pulleys and belting, are not in proper running order; or, given the main-driving and the main and lateral belts in proper "trim," the power may still be lost by careless attachment to the machine where the objective resistance lies, and where the work is to be performed. It will simplify the problem if the mechanic who has charge of a mill or factory will consider the two extremes—the one the motive force, and its economical production; the other the resistance, and the power required to overcome it. If the motive force could be applied directly to the machine where the resistance is met, as, for instance, by a positive transmitter, as gearing, it is clear that the motive force will be transformed into work, less only the loss by friction in the parts of the motor, the parts of the gearing, and the parts of the machine doing the work. As with ordinary machinery this loss by friction would, say, represent a loss of 15 per cent., it is clear that the remainder would be applied directly to the production of useful work. But separate these two elements by an endless chain of transmission devices, and on every journal there is a new element of friction. But these elements are not of high value, unless the shafting "binds" in the journals. But the spider's web of belting at best represents considerable lost power, and when carelessly hung, absorbs it in great quantities. If a belt is so loose as not to affect materially a driving pulley, it will affect a driven pulley just as little, and but little work can be done with a machine driven by it—the power will run to waste. This trouble will diminish exactly as the belt responds to the movement of the pulley; and, within certain limits, this responsiveness will increase exactly as the belt is tightened and other properties of the belt increased so that slipping shall not occur. The limits referred to are in stress on shaft gearings, and weakening of the belts through strain.

It being true that the nearer the motive power is brought to the work the less loss there will result through the friction of multiplied parts, very much of the effective power of a mill will depend upon how it is planned, and it follows that the location of machinery with reference to the motive power should be such, that the power may be applied to the work with the fewest changes in the matter of transmission. A great many mills grow by a process of evolution, and machines are perforce placed wherever they will go, and not where they should go. With these, the only cure is a new building; yet very many new mills have a needless and wasteful application of shafting, counter shafts, quarter twists and the like, that absorb power and perform no commensurate office.

Where, among a hundred and more belts, such as would be required by an average shop or mill, not half a dozen will be found running either properly tight or true on the face of the pulley, whether used as transmitters or as parts of a machine itself, the waste is due to carelessness, for one can hardly assume that ignorance of such patent facts could be so general as to include a whole working force. A slack foreman, or a parsimonious and penny-wise proprietor, is the probable cause of the insidious, continuous waste that enters the boiler furnace as good money and dissipates into thin air before it reaches its work. The principal remedy is vigilance, and sufficient time to immediately repair any slackness observed. A parsimonious proprietor will begrudge oil to keep his belting pliable and capable of taking firm and full pulley contact. He will likely forbid a stoppage to take up a slack belt, especially if it be one of the mains, or pay a man some extra to do it out of time, although the fault will affect every machine connected with it. He may, as some I have known, even refuse proper lacing, and compel his men to use such scraps as they can find. The man, seeing his superiors do not care, sees no reason why he should feel solicitude, and so the trouble grows worse, and gradually extends throughout the mill. Probably he will insist that a ragged, twisted old belt, pieced until there is a great hump of lace leather every yard, shall continue to be used, although a piece of link belting would do nearly as well.

Effective transmission requires pulleys true and smooth of face, well balanced, tightly keyed onto straight shafts, that must run true and level in line. If good material be bought, the question of oversight is one of keeping truth in the shafting, good belt contact, flexibility in movement of belts, even lacing and proper tension. Journals must be kept free from dirt and well supplied with lubricant, and every element of friction reduced to the utmost limit.

I have not the space in this paper to outline the details of lacing, lining shafting, or the tricks of firing and engineering. Vigilance, industry and good keen sense, are the principal requisites. I have endeavored, however, to impress a few first principles, which, if held in mind, will simplify details, which, in fact, will occur to any mind intent upon success.

WANTED—THE MILL FURNISHER.

THERE is a chance for Canadian mill furnishers to capture a share of the New South Wales trade. Judging from the following remarks of a N. S. Wales miller in the New York *Millers' Journal*, there is a golden harvest out there awaiting the mill-furnisher's sickle. Hear him:—"In New South Wales there is not a store where the best milling machinery is kept in stock, and this is a great drawback to millers, as we have no choice at hand, only what we read of, and then get someone to import. We, therefore, generally do the best we can without. It is a wonder that some of your American makers do not send their machines to some good business firm in Sydney—not to Victoria or Melbourne, which is 500 miles away. If next season is a good one our millers must spend thousands of pounds on their mills to bring them up to the mark. The machinery required is, we think, packers, wheat cleaners, centrifugal mixers and such as are always in use in little mills for labor-saving, &c. The want of these and the great price charged here for them and fitting them up make us continue in the ways of our forefathers. We trust you will do your best in furnishing us with the matter required and get here, or send to reliable agent in New South Wales, so that we can do business with less expense."

The Millers' *Gazette*, London, Eng., says: In the High Court of Justice on Monday last, in the case of the Germ Milling Co. v. Robinson, an appeal was made by the Germ Milling Co. for a new trial in this case, on the ground that the plaintiff had made certain mistakes in his evidence at the recent trial before Mr. Justice Sterling. Sir Charles Russell, Q. C., Mr. Aston, Q. C., and Mr. Chadwyck Healey appeared for the plaintiff, and the Attorney-General, Mr. Romer, Q. C., and Mr. Carpmael for the defendant. In consequence of the absence of Lord Justice Cotton, Lord Justice Bowen and Lord Justice Fry declined to hear the case, and it now stands postponed to a day to be agreed upon, when a full Court will be sitting.