Pages Missing

THE "DODGE" PATENT SYSTEM OF TRANSMISSION OF POWER BY MANILLA ROPE.

A FEW SPECIMEN LETTERS FROM PROMINENT POWER USERS:

Office of Waterloo Woollen Mfg. Co., Ltd.,
WATERLOO, ONT., March 12, 1890.

DODGE WOOD SPLIT PULLEY CO., Toronto.

GENTLEMEN, In reply to your letter of 20th Feb., we beg to say that we have used your transmission of power for some time, and are very much pleased with it.

Yours respectfully,
(Signed) GEO. DAVIDSON, Sec.

Dartmouth Ropeworks,
HALIFAX, N. S., Feb. 25, 1890.

MESSRS. THE DODGE WOOD SPLIT PULLEY CO., Toronto.

DEAR SIRS: We are pleased to be able to advise you that your system of rope transmission is very satisfactory, and strongly recommend it to all users of power.

Yours truly,
THE DARTMOUTH ROPEWORKS CO.,
JOHN F. STAIRS.

MESSRS. DODGE WOOD SPLIT PULLEY CO., Toronto. 467 ST. PAUL STREET, MONTREAL, March 1, 1890.

GENTLEMEN,—In reply to enquiry of 20th ult., would say that we are running two of your rope drives, one of these being in our saw mill, and of course under cover, and transmitting quite often 40 to 50 h. p. The other drive is in the open and operates a block conveyor. Although the quantity of power transmitted by this drive is not great, yet we find the drive a very easy way out of a mechanical difficulty, from the fact of the very awkward relative positions of the power and the conveyor.

Both of these drives have never given us any trouble other than that incidental to the wear of the ropes, which is not very considerable, and we are glad now to express our satisfaction.

Yours respectfully, LAURENTIDE PULP CO., LTD.,
JOHN FORMAM, Secretary.

THE DODGE WOOD SPLIT PULLEY CO., Toronto. TORONTO, June 21st, 1887.

GENTLEMEN,—I have much pleasure in stating that the Rope Transmission put in my factory one year ago to transmit power from the engine to the line shaft has proved very satisfactory, and has run since then without a fault. The Rope Transmission with which I supply power to the large factory of Messrs. Keith & Fitzsimmons, and which you put in about two months ago, is also giving excellent service. This transmission, which runs across the street 150 feet, with the shafts running at right angles and in opposite directions, is considered by experts to be the most wonderful piece of rope transmission in the Dominion. The third transmission, which is conveying power from the lower flat to the upper one, is also giving satisfaction. Comparing the way in which we were annoyed with breakages of the belt, which runs at right angles, and the great strain on the shaft through the tightness of the belt, with the ease with which the shafting is now run by the rope transmission, calls forth my highest praise of that system of transmitting power.

You are at liberty at any time to send parties to my factory to examine same. Yours truly, W. H. BANFIELD.

DODGE WOOD SPLIT PULLEY CO., Toronto. BERLIN, ONT., March 1, 1890.

GENTLEMEN,—Replying to your favor of the 20th ultimo, we take pleasure in saying that we are very much pleased with your system of rope transmission placed in our works. The first we placed in was to drive a shaft at right angles with the main shaft and on another floor. This we attempted to do with a belt, but it gave very poor results and was almost a failure. We then applied one of your rope drives with four one-half inch ropes, and have been running it now for over one year without one hour's loss of time. The second drive was placed in our Woodstock mills to drive a countershaft 400 revolutions per minute from a driven shaft at 170 revolutions per minute. We had been working this shaft with a heavy ten-inch rubber belt, but owing to the short distance between shafts and the extra tension required, gave us considerable trouble and loss of time in keeping belt in order, and in spite of all we had poor results and uneven speed, until we adopted your system again with perfect satisfaction and with considerable less draft on engine.

Yours truly, *ATLANTIC GLUE WORKS,*
J. S. HUBER & Co.

DESERONTO, ONT., March 1, 1890.

THE DODGE WOOD SPLIT PULLEY CO., Toronto.

DEAR SIRS:—The manilla rope power transmitter you put in for our car works is giving us excellent satisfaction.

We see no reason why it should not continue effective and reliable, and with little probability of getting out of order. Our experience thus far warrants our recommendation.

Yours truly,
THE RATHBUN CO.

TORONTO, ONT., June 22nd, 1887.

DODGE WOOD SPLIT PULLEY CO'Y.

GENTLEMEN,—We have had one of your Rope Transmissions for transmitting the power from our (50) fifty H. P. engine to line shaft, in use six months, and find it very satisfactory in every respect, and we consider it superior to any other way of transmitting power. Wishing you every success.

Yours truly,
A. R. CLARKE & CO.

Send for our Illustrated Treatise and Catalogue on Rope Driving, mailed free on application.

DODGE WOOD SPLIT PULLEY CO.

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70 KING STREET EAST, - TORONTO.

Electrical Mechanical and Milling News

VOL. XV.—No. 11. TORONTO AND MONTREAL, CANADA, NOVEMBER, 1890. Price, 10 Cents. $1.00 PER YEAR.

ELECTRICAL,

Mechanical and Milling News,

PUBLISHED ON THE FIRST OF EACH MONTH BY

CHAS. H. MORTIMER,

Office, 14 King Street West;

TORONTO, - - CANADA.

Temple Building, Montreal.

THIS is positively the last time we shall refer to the young genius of Hartford, Ct., whose discovery how to make electricity direct from heat without a dynamo has retired for the time being from public view; and we only do so to emphasize the distinction between the earnest worker in the field of science, who has really added to the world's knowledge, and the charlatan who has re-vamped some extinct schoolboy experiment as a means of fooling the individual who happens to rejoice in the possession of considerably more cash than brains.

MR. HUGH McCULLOCH, of the well-known manufacturing firm of Goldie & McCulloch, of Galt, Ont., has lately returned from a somewhat extended visit to Great Britain. He was astonished, not to use a stronger term, to observe the prevailing lack of information and indifference concerning Canada as distinct from the United States. We regret to be told that even at this day Canadian affairs receive but little attention in the columns of the newspapers of Great Britain, and that all the interests on this side of the Atlantic continue to be placed under the general classification "American." Let us hope that one of the effects of the McKinley Bill will be to bring Canada and her products prominently before the attention of the British public.

THAT a considerable proportion of the wheat harvested in the Northwest this season is very inferior in quality, is no longer a matter of doubt. By what means this inferior grain may be disposed of to the greatest advantage is a question of no small importance to those who are unfortunate enough to be the owners of it. The suggestion has been made that perhaps the wisest course that could be adopted, would be to manufacture this wheat into flour, and reduce the price of the latter sufficiently to allow of its being exported to London, and sold to supply the demand which always exists in that city for a cheap grade flour. If any of our readers can suggest a better method of disposal than this, they will earn the gratitude of holders of this class of wheat by making it public at the earliest opportunity.

THE opinion prevails in well-informed circles that the outlook for the millers of Canada and the United States is better than for some years past. The list published in this paper of mills at present undergoing, or which have recently undergone improvements at the hands of the mill furnishers, is by no means an inconsiderable one, and may be taken as one of the indications of prevailing hopefulness on the part of the millers. A member of a well-known milling firm remarked the other day that the remodelling and improvement of mills, instead of shortly coming to an end as some have imagined would be the case, would continue indefinitely. In support of this opinion he pointed to the fact that his firm had recently thrown out the machinery in a mill that in point of equipment was undoubtedly one of the best in the country, and had put in an entirely new outfit. This course he thought would have to be adopted from time to time by all millers who were determined to produce the highest quality of flour at the minimum cost.

THERE is every indication that the present rise in the price of copper will be a permanent one. Unlike the attempt of the French syndicate to corner the market, which was the cause of the last increase, it is the legitimate demand for business purposes that is now sending the price away up. The enormous consumption which is a direct result of the phenomenal extension of electric street railway systems, is rapidly diminishing the visible supply, and unless production is stimulated to a proportionate extent, a further advance may be expected. Another peculiar result of the rapid strides made in electrical construction is the scarcity, now commencing to be appreciably felt, in the supply of the metal platinum. This metal is universally used in the manufacture of incandescent lamps, and is the only one so far discovered of which the leading-in wires can be constructed. The reason for this is that it has exactly the same ratio of expansion by heat as the glass itself, so that whatever the temperature of the lamp the seal is not disturbed by any unusual expansion between the wires and the glass. Unless a substance or combination of metals is discovered which has the same expansive rate under various temperatures as that of glass, the cost of incandescent lamps must inevitably increase or their usefulness be largely curtailed. The necessities of the case may provide a substitute, as it does not appear to be a problem altogether impossible of solution.

IN all its chequered history electricity never scored a more notable triumph over its old-time rival, gas, than in the case of the city lighting of Toronto, the contract for which has been awarded to the electric light company. The desperate nature of the gas meter's case may be judged by the many and various obsolete arguments that were made to do duty in its defence. But about the most antique and mediæval of the lot was the one that the lamplighters would lose their employment. We remember as a fact that the old-time stage drivers kicked because the locomotive was introduced, and complained that the railroad would ruin their business. We think that there are more horses now employed in hauling than ever before. Though not quite within our memory, it is still a matter of record that our friends the printers raised a terrible fuss about the first steam press, but we think there are a few more pressmen now employed, notwithstanding its introduction, and so on in all mechanical arts. Toronto will now be lighted almost exclusively by electric light, and at a lower cost than by the old style method. We have pointed out in recent issues that gas is by no means played out, if the sponsors will but accept the situation and keep their eye on the signs of the times. As a confirmation of our opinion as to the position it will assume in the future, we point to an advertisement of a Toronto hardware firm which has appeared the last day or two in the city papers. The legend reads this way: "GAS FIRES."

THE Dominion Millers' Association has no reason to be ashamed of its record. It has accomplished great things in the brief period of its existence, and is destined we believe to accomplish even greater things in the future for the promotion of the interests of its members. Notwithstanding, we could wish that in the direction of a large membership and revenue, it had nearer attained to the position of the National Association of French Millers. The history of that organization extends back only four years, but it has a membership to-day above 3,000, and the numbers are still being rapidly augmented. The London Miller informs us that its conventions are attended by Cabinet Ministers, who respectfully listen to any suggestions that are made respecting the removal of grievances or for the enactment of measures which the association may deem likely to be beneficial. It must be confessed that the French miller appears to have good reason for ranging himself under the banners of a powerful association, for he really seems to have plenty of thorns in his path. In the first place he is very heavily taxed. He has to pay smartly for a license for the exercise of his calling, and this license appears to be based partly on his plant and partly on his trade. He finds fire premiums heavier than is even the case with us, and as soon as he has got his mill insured the Government swoops down and makes him disburse a heavy duty on the amount of his premiums, so that if he pays a premium of £600 he has to pay a Government duty of £60. Then the relations of the milling trade with those indispensable but irritating beings—railway directors—are by no means all that could be desired. On most of the points mentioned, business-like suggestions were registered at the recent Paris convention, which also made a strong recommendation in favor of the complete abolition of the assize of bread—a relic of the troubled revolutionary days of 1791.

IT is no wonder that so many electricians are devoting their time and means to the development of the storage battery. The immense advantages that would accrue in every department of electrical enterprise if a practical, cheap and efficient storage battery could be constructed, would be simply beyond calculation. In central station incandescent work alone the saving in machinery, fuel and labor by being able to utilize a plant to its full capacity during the whole twenty-four hours of each day, would at least reduce the cost of the light to the consumer by one half. For long-distance lighting it would undoubtedly displace the cumbrous and expensive machinery of the alternating plant, by taking in a current at high tension and giving it out at as low a pressure as required for safe and economical use. The storage battery, however, has not arrived at such a pitch of perfection as to accomplish a realization of these desirable conditions. The most successful specimens so far have been expensive to construct, more expensive to maintain, on account of their rapid deterioration, and most expensive to charge, inasmuch as the return from the current invested in them is subject to a heavy rate of discount. Inventors appear, however, to have abundant faith in a coming harvest, for the amount of time and energy applied to the solution of the problem is probably as great as is brought to bear on any other department of electrical engineering. There is no doubt a fortune ahead for the lucky inventor, but those most interested in the work will excuse us for saying that we doubt if success will be attained along the present lines. There must be a radical departure from the practice of to-day, and the well-thumbed discoveries of Faure and Plante must be abandoned in favor of something new. The use of a metal framework with the active substance plastered on it must give place to both anode and cathode of solid material, and the sloppy and indiscriminate use of sulphuric acid and water must be dispensed with in favor of some more portable and less objectionable medium. Of course we are not prepared to say what this material and its electrolyte is to be, but it must be admitted that the storage battery on the present lines, while a vast improvement over its original prototype, is not exactly what might be termed a commercial success. Central station managers still seem to think that a spare dynamo and a spare engine are the most efficient storage batteries yet introduced, and that while as a laboratory experiment it may be considered a success, it does not quite fill the bill from a commercial standpoint. The commercial aspect, after all, is the only point of view from which to estimate its true value. There are certain limited uses to which the storage battery may at present be successfully applied, but they only serve to emphasize the advantages that would follow its universal use if its practicability could only be completely assured.

OUR excellent contemporary, the Montreal Gazette, recently said: "St. John, N. B., sends the latest account of a successful exhibition. Such reports have been coming thick of late, but they do not appear to make Montreal jealous or emulous. Montreal's genius does not run to fairs." In the same issue in which the above appeared, was printed the proceedings of a meeting of the City Council, at which the mayor said he considered it would be beneficial, not only to Montreal, but to the province, to have an exhibition. He was ashamed of Montreal with such a population, seeing how Toronto was profiting by having such fine exhibitions. Following the mayor's remarks it was decided to vote $10,000 towards an exhibition next year. From which it would appear that Montreal's genius *does* run to exhibitions, and that the Gazette can no longer claim to reflect public opinion.

THE United States having at last put in operation their high protective measure known as the McKinley Bill, it remains to be seen what the effect upon Canada will be. No doubt in some respects Canadians will lose by its operation, but we believe the fears expressed by some newspapers are utterly groundless. So far as flour milling is concerned, the Americans so framed their tariff a quarter of a century ago that no Canadian flour can find its way into the United States, therefore the present increase in duties does not injuriously affect the industry. On the contrary, is there not strong reason to believe that on account of it gain will come to Canadian millers, inasmuch as the farmer whose market for barley has been interfered with, will now turn his attention more to the cultivation of wheat. Already reports come from some of our winter wheat counties that the increase in acreage of fall wheat sown is more than 50 per cent. above last year. The Dominion Millers' Association was certainly wise in appointing a committee to inquire into the varities of wheat, both fall and spring, best suited to our wheat lands, in order to afford farmers all obtainable information on this point. There is another side to this many-sided Bill. The fear engendered in the minds of farmers last year by the threatened passage of such a measure, induced many of them to sow a much smaller area of barley than usual last spring. As a consequence they received on the large shipments to the United States prior to the coming into operation of the Bill, fully ten cents per bushel more than they would have got had the usual acreage been sown. To-day even, notwithstanding the American duty of 30 cents per bushel, Americans are paying more for barley on cars in Ontario than they did a year ago when the duty was only ten cents per bushel, and the balance of the land which our farmers formerly devoted to the cultivation of barley, has produced an abundant crop of peas, which have sold at a good price for export to Great Britain. If our farmers will pursue the same plan next year, the American brewer's necessity will compel him to pay the usual price for Canadian barley and the additional duty besides.

A YEAR or two ago a sort of mania seemed to seize the average citizen on the question of overhead wires. Not only the larger cities, but pretty nearly every cross-roads hamlet in the country, passed its by-law to bury the wires. The A. C. must have thought that the wires would in some mysterious way worm themselves underground and quietly stay there. It does not appear to have entered into his philosophy that to get the wires underground the streets would have to be torn up, and that to keep them there in working order said streets would have to be torn up again and again, but so it is. It is a lamentable fact that there is considerably more kicking about the wires going underground now than there ever was about the nuisance occasioned by their presence overhead. It is not a pleasant idea to contemplate that the busiest streets in our busiest cities are liable at all times to be in a chronic state of upheaval, and that no sooner is the pavement down and the street cleaned at considerable expense, than it is torn up again and mud scattered broadcast over everything, to say nothing of the interruption to traffic caused by this constant state of disarrangement. But how can this be avoided? There is but one way, and that is to build a tunnel under the street with passages to the sidewalk at intervals. The cost of this, however, is prohibitive. If electric light, telegraph and telephone companies had to pay interest on the cost of such a subway, they would have to go out of business. Customers would not pay the price demanded for electrical conveniences. It therefore amounts to this: Either the people must forego the luxury of electric service, such as light, telephone, etc., or choose between the overhead and underground systems as at present organized. It would seem that an overhead service—if properly constructed with due regard to the convenience of the firemen and with an eye to symmetry—where the wires would be out of everybody's way, would be infinitely preferable to having the streets underfoot in an eternal state of chaos. The more so would this seem to be the proper solution as the advent in our cities of the electric street railway will compel the retention of poles along the streets. The electric railway seems to be a universal favorite, but up to the present no way has been devised to run it so successfully as by overhead wire. It is therefore about as much, or even more so, a matter of Hobson's choice, as in the case of its older sisters the light and telephone—that is to say, no poles, no railroad. If instead of a blind effort to place everything underground a compromise were arrived at, and overhead construction recognized as a permanent institution, it would lead to a more ornamental, symmetrical and solid construction, and if sanctioned by law and public opinion, an overhead system for electric light and street railway could easily be devised that for appearance, safety and convenience could not be excelled by any other method, and that in the mind of the A. C. would rob the deadly wire of more than nine-tenths of its terrors.

NICOLA ROLLER FLOUR MILL.

A CORRESPONDENT sends the Inland Sentinel, of Kamloops, B. C., the following description of the new mill at Nicola, B. C.:

On the 22nd inst., I had the pleasure of being shown over the roller flour mill lately erected by Mr. A. E. Howse, at the foot of Nicola Lake. The building is 30 x 36 feet and 46 feet high; is two stories, exclusive of basement, rests on a solid foundation of stone and mortar mason work, 6 feet high, 3 feet in width. The frame of the mill is good. This part of the contract was executed by Mr. Leeson, of Ashcroft, and Mr. Wm. Higginbotham (the latter remains as joiner to the millwrights). Mr. Howse says better men or better work than that done by the Ashcroft men would be hard to find. One hundred thousand feet of dressed and rough lumber was used up in the building and flume.

The machinery was placed in position by Mr. J. S. Mackay, Boissevain, Manitoba, who represented the makers, the Geo. T. Smith Co., of Stratford, Ontario. Mr. Mackay was ably assisted by Mr. Kenney, who, I informed, helped to place the machinery in the Enderby mill.

To briefly describe the mill I will quote from remarks made by Mr. Mackay, who said as we entered the basement floor: "Here is the main driving shaft connected with the water wheel, which propels what is known amongst millers and practical men as 'the Geo. T. Smith Co.'s short system of roller flour mills,' the benefits of which we claim to be, first, a complete belt driven mill, almost noiseless when in motion, owing to the absence of vertical shafting. Secondly, the whole business is worked by three lines of horizontal shafting, which renders power easily applied to anything requiring motion. Third, the mill is simple, complete, perfect. All the stock is conveyed from one place to another by spouting, thus lessening motive power by driving conveyors, etc." On this basement floor you will find a No. 1 horizontal wheat brushing machine. Elevators are also placed on this floor, storage for wheat, etc. The next storey is called the first or roller floor. On this floor you will observe a beautifully finished set of Burrow, Stewart & Milne receiving scales, and as the eye gathers in the contents it is arrested by seeing poised in a conspicuous position one of N. P. Beeshers' motion indicators, a most useful little contrivance. When speed gets too high or too low, a clear sounding gong rings out the note of warning. You will also see placed in line three double 9 x 18 Geo. T. Smith noiseless belt driving rolls. The shafting on this floor is all fitted with adjustable hangers and self-oiling boxes. To the uninitiated the spouting seems curious and complex, but one thing which wakes the admiration of all visitors, is the beautiful finish that all and every part of the machinery has got, which found a fitting receptacle within walls finished with dressed lumber in as good style as any wooden dwelling. The flour packing is also done on this first or main floor.

The second storey is called the purifying and bolting floor. On this are three No. 3 scalpers, three No. 3 Inter elevator bolts, one No. 3 centrifugal, one double No. 1 purifier, one No. 1 horizontal smutter, one No. 1 bran duster, also "Cyclone" dust collector connected with middlings purifier, wheat hopper for receiving stock after being cleaned, etc. The wheat on its passage to the rolls passes through powerful magnets, which catch everything of a metallic character.

The grinding capacity of the mill is 50 barrels per day. Power is supplied by a 26½ inch Leffel turbine of 28 horse power. Water is carried in a flume 560 feet long by 6 feet square and has an 18 foot head.

The mill manufactures, if required, four grades of flour: Patent or Hungarian, straight roller, strong bakers, and a coarse quality humorously called in the Northwest the "Warrior Brand," only used by Indians.

On taking leave of Mr. MacKay, he quietly remarked, "Well, I have now set up a good many mills in America and Canada for the Geo. T. Smith Co., including a large one for myself in Manitoba, and I have yet to find the first mistake in their machinery. Everything is sent that is wanted, consequently it goes together as complete and perfect as a first-class watch. This mill is the smallest that the Geo. T. Smith Go. guarantee to give satisfaction, and with good wheat will make the best grades of flour."

The mill is now running every day, in charge of Mr. Harry Richardson, lately of Guelph, Ont., turning out flour equal to any hitherto imported. This year not more than 500,000 lbs. of wheat will be ground, but next year a large increase is looked for.

The few people here that subscribed the $1,500 bonus may congratulate themselves on this boon to the valley. A market has been made for wheat at a remunerative price, and every acre of cultivable land has increased in value. Mr. Howse has excelled himself in the spirited way in which he has completed his part of the contract. He only bargained for a mill of 30 barrels per day grinding capacity, has supplied one of 50 at an extra expenditure of over $2,000 on first estimated outlay, and finished one month sooner than the date mentioned in agreement. We sincerely wish him a big run of prosperity. Any man deserves that who is plucky enough to engage in such an enterprise, spending his money where he has made it.

TRIPLE EXPANSION ENGINES FOR FLOUR MILLS.

EXTENSIVE new mills erected in Aberdeen, for Messrs. Milne Bros., (Limited), from the designs of Messrs. Jenkins & Maw, architects, will shortly be put into full operation. The buildings are almost entirely fire-proof, the floors being of concrete and iron, supported by iron beams and columns; while the roof trusses are also of iron, slated. Milling machinery of modern design has also been introduced, a special feature being the driving engines, which are of the triple-expansion surface-condensing horizontal type, having grooved fly-wheels for rope driving. The Engineer informs us that this is one of the first applications of triple-expansion engines for milling purposes in Scotland. The engines are capable of indicating over 300 horse-power and have three cylinders placed side by side, the high pressure being fitted with Corliss valves and the "Spence" trip gear connected to the governor to render the expansion automatic; the intermediate and low pressure cylinders are fitted with "Meyer" variable expansion valves adjustable by hand. All three cylinders are efficiently jacketed both in body and ends. The engines drive by ropes to one line of shafting, running the entire length of the mill. The engines were constructed by Messrs. J. Copeland & Co., Glasgow, from the designs of Messrs. Russell & Spence, consulting engineers, Glasgow, and the design and workmanship reflect credit on all concerned. Steam for these engines at 160 lbs. per square inch is supplied by a "Sinclair" boiler, constructed by Mr. James Sinclair, Leith. The feed water is heated on its way to the boiler by a Green's economizer. A preliminary trial of the engines took place recently with satisfactory results.

The total attendance at the recent St. John, N. B., exhibition was 52,000, or within about ten or twelve thousand of that of the Toronto Industrial. This is a very creditable showing for our Maritime province neighbors.

Our Western Letter.

AT the time I closed my last letter, the situation in Manitoba and the adjoining territory to the west was critical in the extreme. The country had experienced a month or more of the most unfavorable weather, right in the midst of harvest. These conditions were described in my last letter, but about that time the weather changed, and the prolonged wet spell was followed by between two and three weeks of beautiful weather. Farmers went to work with a will and rushed their stacking, completing it in good condition. The weather, however, again set in wet during the week ended October 4th, and during the week ended October 11th there was almost a continuous rain, mixed with snow on some days. The wet spell again entirely stopped all work in the country. Threshing was completely suspended for ten days in one stretch. This work was just becoming general throughout the country, and the result of the wet is that at the time of writing the amount of threshing done is comparatively trifling. In some districts considerable threshing has been done, but in other districts hardly anything has been done yet. This is serious, as it will delay threshing into the very cold weather. There are not enough machines in some sections, and with the heavy crops this year the work of threshing will be slow. When the weather becomes very cold, the machinery cannot be worked to advantage, and if the cold weather comes in early this year, a good deal of threshing will have to be left until the temperature moderates toward spring.

Another effect of the present wet spell is to stop deliveries of grain. Very little grain has been marketed yet, and the markets were only commencing to open up when the wet weather stopped deliveries. At a few points where farmers are better supplied with help and machinery, considerable grain has been marketed, but the proportion marketed to the total crop is next to nothing. For instance, though the crop of oats is large, the quantity marketed has not much more than been equal to local requirements. At some points where it is estimated about half a million bushels of wheat will be received from this crop, the quantity marketed to date is only 25,000 to 50,000 bushels, and sometimes less. This shows how the situation stands now.

The result of the continued wet weather will be that practically nothing will be done in shipping out grain before the close of navigation. Grain will therefore have to be held over until spring, subject to elevator rates, or shipped out by the more expensive all-rail routes. Even should the weather turn favorable at once and remain so, it is not likely that any considerable grain movement would set in. Country roads are in very bad shape, and it will be some time before they will be fit for loads, though prairie roads usually dry up very very quickly. It is now so late in the season that farmers will be obliged to push their fall plowing for all it is worth, and they will not take time to market wheat until it freezes up. Fall plowing is a necessity in this country, and just at the present time it is far more urgent than the marketing of grain.

The most important feature of late in the grain trade was the fixing of standards at Winnipeg for grading this year's wheat crop. A large number of samples were collected from all parts of the wheat region, and these samples would afford the first clear idea of the quality of the crop. They more than bear out any former statements as to the damage done our wheat crop this year from unfavorable weather. To say that the samples were poor would be expressing it mildly. They were very poor. The most noticeable feature is the bleaching, the bulk of the samples being badly bleached. A bright sample of wheat will be something hard to find. Another defective feature is the large admixture of green kernels. A great many samples are affected in this way. The cause of this is partly due to the cold, wet weather during harvest, which caused uneven ripening. A second growth was started by the rain, and this green stuff is mixed up with the wheat. Another reason for the unusual mixture of green and unsound kernels is owing to the fact that some farmers became alarmed about frost and cut their wheat before it had properly matured. Some very inferior samples of wheat are the result of premature cutting. Quite a sprinkling of frosted samples were also on hand, some only showing a trace of frost, while others were badly frosted.

As may be expected, with such poor samples to examine, the standards were not fixed very high. In fact the standards for grading this year's crop are very low and are likely to cause considerable dissatisfaction. For instance, No. 2 hard shows a trace of frost and has some green and defective kernels, and is badly bleached. The Act only calls for two grades of hard, namely No. 1 and No. 2 hard (aside from the ornamental grade of extra Manitoba hard). It was evident that unless a lower grade of hard wheat was established this year, the bulk of the crop would go ungraded, consequently to meet the peculiarities of the crop the examiners established a grade of No. 3 hard. This grade is not recognized by law, but it will no doubt be recognized as an established grade just the same. No. 3 hard as fixed is a black looking sample, showing frosted, green and shrunken kernels. It is a peculiarity of the crop this year that nothing to grade No. 1 Northern has yet been seen. The wheat is nearly all hard. On account of the frost, two grades of No. 1 and No. 2 frosted were fixed, to allow of the grading of frosted wheat by itself, as a badly frosted sample could not be admitted in the regular grades.

The figures of grain inspected at Winnipeg show further the quality of the crop. Up to date about 200 cars of wheat have been inspected at Winnipeg since new wheat began to move. Of these, only one car was good enough to grade No. 1 hard, or equal to one-half of one per cent. There were only six or eight cars graded frosted, but this would not include all the frosted wheat—only the more seriously frosted lots, as slightly frosted samples are allowed in with the regular grades of No. 2 hard and under. The balance of the total wheat inspected was distributed fairly evenly between the grades of No. 2. hard, No. 3 hard, No. 2 northern and rejected, the last two showing up the most. This shows conclusively that the Manitoba wheat crop is of unusually poor quality, and this poor quality is due mainly to the long-continued spell of wet weather during harvest. This is the only wet harvest experienced in this country for the past ten or fifteen years, with the exception of 1884, the latter part of which was wet. Wet harvests are therefore very rare here, but this one has proved a most remarkable exception to the rule. Some farmers who were unaccustomed to wet harvests, stacked their wheat while it was damp, and considerable loss has resulted on this account. The present wet spell will also do further damage, as it is feared that there is a good deal of badly stacked grain which would not be impervious to the moisture. Some grain is also still in stook. When the fine weather set in, some farmers left their grain in stook, intending to leave it until the thresher came around, as they thought the dry weather had come to stay, and they would be saved the trouble of stacking. In the meantime they went on with their plowing. This grain left standing will not be any the better of the soaking. The last wet spell will therefore further decrease the quality of the crop, where grain has been carelessly left standing in stook, or badly stacked. The crop is a large one in bulk, and with the prospect of higher prices this year than usual, the inferior quality will be compensated for to some extent. Still it is not satisfactory to Manitoba to send out a crop of wheat of such quality as this one. As to the wisdom of reducing the quality of the grades on account of the low average of the crop, there is some difference of opinion. Ontario has a large crop of good wheat this year, and will not require much Manitoba wheat for milling. Our surplus will therefore have to be exported. Manitoba wheat is as yet almost unknown in British markets. When they receive our wheats from this crop they will certainly not form a very high opinion of our grades, and it may take some years to live down the possible prejudice which may be formed by the reduction of the quality of the different grades this year. If we are to export wheat regularly year after year, it is evident that an effort should be made to keep the different grades up to a uniform standard as nearly as possible, one year with another.

If the weather continues unfavorable and winter sets in early, the effect of the prolonged delay in harvesting and threshing the crop will be felt seriously next year, in curtailing the wheat area for 1891. The season is short here, and for wheat plowing must be done in the fall to render success reasonably certain. The delay to the harvest is therefore a serious matter for next year's crop, on account of the backward state of fall plowing. A long, open fall would remedy this disadvantage.

COMBINATION CENTRAL STATION PLANTS.

IN our last issue, in reviewing the history of electric lighting and power in this country, says the Electrical Engineer, we took occasion to point out that experience afforded good grounds for the assumption that the future central electric station, in smaller towns at least, would be a plant combining with itself all the elements necessary for a general distribution of current-power for any and all purposes to which heavy currents are applied. That we are nearer to the realization of such a development than might perhaps have been imagined will be realized upon the perusal of the description given on another page, of the Salem-Winston combined arc light, incandescent light and railway power plant. Recognizing the economy of operating the various branches of work under one head, the promoters of the enterprise wisely acquired the rights of an existing company and with this as a nucleus have built up a business which after only a few months shows a balance on the credit side. The course here pursued was evidently in marked contrast to a practice which has obtained in our smaller towns, of working electric light and railway plants entirely independent of each other, in the face of the fact that the cost of attendance in small plants is the largest item in maintenance, and that this item remains fixed over a considerable range of size of the plant. But without waiting for this increased economy to be realized by companies to be yet organized it is evident that the same benefits can easily be secured by existing concerns by mutual arrangement. The Winston-Salem plant is another example of the opportunities for profitable investment to be found in the electrical field, and will, we hope, be the pioneer of many others, as its promoters themselves have been pioneers in two of the most important branches of applied electricity. A feature of the Winston-Salem enterprise which also deserves special notice is the introduction of freight traffic as a part of the railway business. This has already been attempted in one or two instances, and no reason is apparent why the handling of freight should not be equally as profitable as that of passengers, especially as it could be carried on at night when the passenger traffic does not of itself pay.

SOME PRACTICAL HINTS ON ROLLER MILLING.

I.

IF the practical, intelligent miller should ask himself the question, "Am I producing the best possible results with my mill?" his answer would invariable be "No"—he can always see some place where there could be some improvement made. Nearly all the causes for complaint have their origin in the beginning of the work, that is, in the reduction of the wheat. All systems have their advocates, and all millers have their opponents. The practical test and results are what carry conviction. The writer has before his mind a mill of modern equipment, the results of which are, however, not quite satisfactory to the owner. The careful observer does not have to look far to discover one cause for dissatisfaction; it is in the manner in which the feed is carried to the rolls. No roll will produce good results that does not take its feed to the point of contact in an evenly distributed manner. Various devices have been introduced for this purpose—some of them good, others bad. If the best results are to be obtained, no mills should have more feed passing through them than can come in direct contact with the rolls. In most mills this is not the case; the general practice is to crowd the rolls to the full measure of the spring tension. The results of such work are that the material is not ground but pressed to pieces. This applies more particularly to the second, third and fourth break stock. In consequence, the flour loses its granular character, and to a great extent its commercial value; and while it is admitted to be a difficult task to properly feed rolls running horizontally, the difficulty would be much less if the feed was reduced. The output would be less, but the quality of the flour would be improved. Some of the intelligent millers are waking up to the idea suggested here; namely, that the manner of feeding the rolls and the quantity of feed has much to do with their profits. It was this thought, I imagine, that led the proprietors of the Dominion Mills in Toronto to throw out all their horizontal rolls and put in others which they had proved to be superior in the way they carry the feed to the point of contact. Mr. Case, in an article in the American Miller, refers to this point, and says the roller mill of the future is a two-high roller, giving as his reasons for this belief that the feed can be more evenly distributed on these rolls than on rolls built on the horizontal plan. This fact doubtless will become more apparent as the principle becomes better understood. In my next letter I will try to show the effect of imperfect reductions in the subsequent work of the mill.

I. O. U.

PERSONAL.

We deeply regret to learn of a serious accident which befell Mr. Alexander Kennedy, of the Owen Sound firm of Kennedy & Sons, at Niagara Falls, on Oct. 15th. While engaged in lubricating some water works machinery his arm became caught and was cut off two inches above the wrist.

We have been favored with an invitation to attend the fourth annual dinner of the Canadian Association of Stationary Engineers to be held at the Richardson House, Toronto, on the evening of Wednesday, the 5th inst. This annual event is one that awakens pleasant recollections and anticipations. There is certain to be a good attendance and a pleasant reunion.

LUBRICATING OILS.

THE following is a synopsis of a paper read at the Indianapolis meeting of the American Association for the Advancement of Science, by J. E. Denton, of Hoboken, N. J.:

Experiments to determine the coefficient of friction between lubricating rubbing surfaces have been prosecuted for 200 years and have resulted in the construction of many forms of satisfactory apparatus for such measurement, which are now known as oil testing machines. Such machines are now being resorted to by large consumers of oil as a means of discriminating between the lubricating value of numerous oils offered by manufacturers, and which, while practically alike in fluidity and general oily qualities, are nevertheless claimed to differ in their respective abilities to afford satisfactory lubrication.

The only differences of behavior of all these lubricating oils shown by the oil testing machines, are simply such differences of frictional resistance as can be ascribed to the variation in the viscosity of the substances in the fluid condition, and this difference of friction fails to account for the well-attested fact that some of the oils are unable to prevent excessive heating and cutting on heavy machinery bearings, which exhibit no such action when lubricated with other oils.

Experiments were described which have been made with a special apparatus constructed for the lubricating committee of the Standard Oil Company, proving that the overheating of bearings is due to accidental abrasion of the rubbing surfaces, caused by the gradual and inevitable variations of the smoothness of these surfaces by metallic wear. This abrasion generates a comparatively intense heat at some point of the bearings, and tends to vaporize some oils more than others. Oils which are incapable of resisting excessive vaporization by such accidental heating are those which permit bearings to more frequently overheat than do others not so affected by temperature.

The prevailing oil testing machines fail to reveal such differences: (1) because they have invariably been operated with artificially smooth surfaces; (2) because whenever accidental abrasion takes place observations are suspended until the heating tendency due to abrasion has been eliminated; and (3) because the oil supply to the testing journals is artificially abundant, instead of being restricted by feeding through practical forms of oil cups. By this means accidental deficiencies of supply, which are frequently the initial cause of abrasion and overheating, are eliminated, and differences among oils, depending on their ability to feed more or less uniformly by virtue of capillary action, cannot be noted. It is therefore concluded that in order to enable mechanical oil tests to reveal the actual differences of lubricating value among current lubricants, each oil must be tested with a series of conditions of the rubbing surfaces and practical feeding devices which involve opportunities for abrasion and overheating. The lecture was illustrated by lantern views of various new devices for testing lubricants under the actual conditions of service, and also by samples of bearings which have been in service under various conditions, representing unsatisfactory lubrication. Explanations were offered of the paradoxical fact that overheating is often relieved by supplying sand or emery to bearings.

OATS AS HUMAN FOOD.

WRITING on oats and oatmeal, Albert Larbaletrier says: Of all the cereals cultivated in the world oats is the least used for human food, because it is not really a cereal for panification, or rather because the bread it furnishes is heavy, dark in color, compact and bitter. Is this fact in itself sufficient to exclude it from human alimentation? We do not think so, and it is because we are of opinion that nothing which concerns so serious a problem as the supply of food for man should be neglected, however slight the contingent obtained. Moreover, the reason stated above for excluding oats from alimentation is not sufficient, for maize and rice are in an identical case, and although they are not suited for panification, no one thinks of disputing their utility. At the present day wheat is almost exclusively used for panification, bread being the basis of our nutriment. Barley and rye flours are disappearing every day from French bakeries, and much more so is oat-flour. Nevertheless, our ancestors in Gaul and Germany consumed oats in the form of pap, which constituted even the chief part of their food.

Every one knows that oats gives strength and vigor to horses, why should it not have the same effect on man? Oat-flour gives a bad quality of bread. This is due to its chemical composition, which gives too slight an amount of gluten, this last varying in the proportion of 3 to 4.8 per cent.; and again, the substance thus designated in the analytical reports is more like albumen than gluten properly so-called, which in wheat is found in the proportion of 10 to 18 per cent. This in no wise prevents a mixture of oat, wheat and rye flour from giving in Brittany a very savory bread of the best quality. M. Grandeau analyzed 174 specimens of oats and gave the following average composition: Water 12.97; azotined substances 9.59; fatty substance 5.15; starch and sugary substances 59.18; cellulose matter 9.82; mineral matter 3.28.

One sees, from a chemical point of view, oats differs from wheat in the small proportion of azotined substances and its richness in fatty and mineral matters. There is another substance contained in oats, called avenine. This substance, which is a kind of alkaloid, is contained in the pericarp, and it is this which gives the piquant properties to oats. By grinding of oats one obtains 68 to 72 per cent. of meal, the rest being bran, or small bristles, or awns of great tenacity, representing about two to three hundreths of the total weight. As for oatflour, it is difficult to obtain, owing to the large proportion of fatty substances contained by this cereal; if it is crushed directly under mill stones, these last are clogged and stop, and scarcely give 20 to 25 per cent. of a coarse pulpy flour. In Brittany oat-flour is prepared by placing it in bread ovens, and after a few hours it is passed under the stones, then through the winnowing machine. In Ireland oatmeal is made by passing steam into the double bottom of a caldron, where the oats is placed. The operation is concluded when the mass gives off abundant steam on its surface. The oats thus prepared is placed in an oven with a low temperature, remaining twenty-four hours; a beginning of fermentation takes place, which renders a portion of the starch soluble; then it is passed under stones suitably distanced, and finally through a winnowing machine, which separates the grains from the glumes and awns. Oat-flour is undoubtedly a healthy food, pleasant and nutritious, which might find a place in current consumption if bakers would try to blend it with other flours.

HIDDEN DANGERS IN DAM BUILDING.

IN the constructian of water storage dams there is an element of insecurity to be guarded against in some cases, which does not seem to have been publicly noticed. John D. Emersley, in Mining and Scientific Press, referring to the swelling of the ground under or near the dam, considers it a source of danger.

A valley or wide ravine with a slight descent, and having side hills coming near to each other at its lower end, is economically favorable for water impounding purposes, provided that the collecting surfaces above are large enough to insure the supply required. In the arid regions such a valley is usually so dry that, on the side hills at least, the general water level can only be reached by deep sinking. If solid primary rock, with little permeability, is available in founding the dam, its bulk, when submerged, will not increase; but if dependence is placed on a stratified formation containing layers of clay, talc or shale, its expansion when exposed to pressured water must certainly be expected. Every old miner has had trouble with swelling or "creeping" ground, and builders of escarpment walls are aware how hard it is to keep some kinds of rock in place during wet weather.

Assuming that a dam has been built on an unstable foundation of the kind described, what will the effect be when a pressure of fifty, seventy or one hundred feet of water comes upon it? The whole "country rock" above the dam will, in the centre of the ravine especially, both underneath and outside of the dam building, be saturated to a great depth. Under the abutments on the converging side hills the pressure will be less, yet every pore and interstice will be filled. Should there be the slightest tendency of this watercharged rock to expand, either laterally or vertically, it is easy to understand how even a dam in itself well planned and carefully built may in time give way, owing to such expansion.

The sapping and weakening effects of water percolating under high pressure may go on for years without being noticed, but if the dam erection is ultimately, though it may be imperceptibly, lifted or compressed by the slow swelling of the ravine or hillside formations, so that cracks and veinlets are formed in or beneath it, increased pressure may suddenly destroy it.

The wearing or mechanical effects resulting from a sweating process going on in the dam, or the rock underlying it, is not the only evil which is to be feared. The air acting on wet surfaces promotes chemical changes which are followed by disintegration of the affected rocks, and thus slowly, yet surely, there may be destructive agencies at work where least expected. Should there be veins of porous rock dipping under a dam from its upper side, the passage of water through such veins may of itself proves a hidden cause of disaster. The escape may be small at first, but a softening and widening work going on for years cannot fail to weaken a heavy dam building not very far above it.

If I am right, continues the author, in assuming from reasons stated above that the building of dams on some kinds of stratified rock renders them unsafe, I trust by calling attention to the subject to encourage investigation and the adoption of adequate engineering remedies. It would be some satisfaction to know whether the Johnstown and Walnut Grove dams were built on stratified rocks. If they were, affording evidence long before they collapsed, which they did not give when first in use, that cracks had been opened in them, it is reasonable to assume that they had been injured by the expansion of the foundation and hillside rocks.

NO LOSS OF POWER BY SLIPPING BELTS.

WHILE there are a great many losses of power to power-users, and those which do exist and which can readily be remedied, are neglected, a great many people seem to unite in blaming on slippery belts a great deal of what they are pleased to term "loss of power," says Robert Grimshaw, in Electric Power. The impression is so general that, belt slips cause "loss of power" of just the same kind as that occasioned by defective firing, excessive back pressure, undue friction, etc., that it should be counteracted.

As in many other instances, the error arises from misuse of a word. An engine and boiler generate power; a belt and its pulley merely transmit it. If the belt slips, it merely transmits less power and the engine and boiler, if the former has a proper governor and the latter a suitable damper regulator, generate less; the production being in proportion to the demand at the engine shaft. If the belt shifts, there is less work done at the driven pulley; and less called for at the driver—which may be either the engine fly-wheel, or some other, in the system.

This can be shown very readily where there is an idler which will permit of belt slack being taken up; or where the power is used by a dynamo on a carriage which can be screwed towards or from the engine shaft, to lessen or increase the belt grip. Where the grip is increased by giving either greater belt tension or greater arc of contact, there is more work done, and the cut off takes place later. When the grip is lessened, so that the belt slips, the cut off runs back proportionately, and the steam consumption is lessened. No coal waste, no steam waste, no power waste, is necessarily caused by the belt slippage.

There may be, in fact, a gain in economy by belt slippage. We will suppose that an engine develops 100 horse power at that point of cut off at which the steam economy, coal economy, and money economy are greatest. It is well known that there are such points for every engine; and that there may be a point which will combine all three.

Now suppose that this engine, loaded for maximum economy, has put upon it fifty per cent. more work, by adding more machines or heavier feed; and that in consequence the belt slips so that the power indicated at the cylinder or passed through a transmission dynamometer remains at 100 horse. That shows that by reason of the slip, the rate of work has been slowed up. Fifty per cent. more work or heavier machines may have been thrown on, but the slip keeps the speed of the driven pulley so low that there is no more work done than before. That is, if there had been 10,000 lineal feet of ten inch boards planed in a given time, while the engine was indicating 100 horse, and fifteen inch boards, or harder boards, were run in to add fifty per cent. to the belt pull, the speed would be run down to only 6,667 lineal feet in the given time; so that the horse power would still be 100.

Now let the belts be tightened so that there will be 10,000 lineal feet turned out in the given time; the consumption of power will raise to 150 horse, the transmission being 150 horse also. At this 150 horse power the engine may work with so much poorer steam economy as to much more than offset the increased money economy by reason of fifty per cent. more power being furnished without increase of such fixed charges as rent, interest, insurance, engineers' wages, etc. Here then, may come in decreased engine economy by reason of abolition of belt slip. Now let the belt gradually stretch so that slip commences and lineal speed of board output decreases. The power carried may drop to 100 horse, and the engine economy again be at the maximum.

Things should be called by their right names.

UTILIZING NIAGARA'S WATER POWER.

LONDON Engineering recently published an extended article concerning the utilization of Niagara's water power. Among other things it notes that several projects are now or have been before the public, all having the water power of Niagara on a grand scale as their base. The Cataract Construction Company has been organized to carry out a scheme that is to take from the falls about 120,000 horse-power. General attention is called to this work through an effort that is being made by that company to obtain the highest scientific knowledge to be applied to the solution of the problem.

This company has before it the task of developing water power, not at the falls, but from one to two miles above the falls on the American side of the river. Land has been secured above Port Day between the line of the New York Central Railroad and the river bank, to the extent of nearly 400 acres, and other additional property on the other side of the railroad, in all about 1,400 acres. A tunnel not over 6,700 feet in length and 490 section is about being constructed on the river below the falls and close to the upper suspension bridge, passing under the town of Niagara from a point on the land of the company, where a central station can be constructed and the water taken from where the river is deepest close in shore, and where borings on either side of the location, corresponding in result, show the rock formation well fitted for the purpose. From this point, the upper end of a straight line tunnel, an extension can be carried if found desirable, and along this extension, as well as along some portion of the main tunnel, mill sites can be located, each site or cluster of small sites being operated by independent wheels in one pit or excavation.

The present company have obtained control of all the franchises necessary to secure their full right of the water power not covered by that owned by the Hydraulic Canal Company (referred to later), and with a full appreciation of the sentiment against any enterprise that will detract from the beauty of the falls, they are seeking for such method of accomplishing their purpose as shall in no way run counter to public opinion; and it may be said that they themselves in placing their factory buildings so far above the falls, and constructing their tunnel in the manner hereafter to be shown, are themselves acting as guardians to this public property.

"The plan under consideration contemplates the development of a large tract of country by the establishment of water-driven factories, the wheels used being fed from the river by comparatively short surface canals, the wheels for each mill or cluster of mills being erected in pits of suitable depth. From the bottom of wheel-pits the water is to be carried by lateral tunnels into one main artery, a larger tunnel passing under the town of Niagara Falls and falling into the river below the falls. To carry out such a scheme the construction of the tunnel tail-race becomes the first consideration, and presents a plausible method of developing a large manufacturing district. If, however, the same thing can be accomplished by concentration of the wheels at one point at one great central station, from which station the power may be carried to the mill sites near and far by one or more of the known methods of transmission, the question is naturally asked, why not place that great station near to the lower river and carry the water to it by a surface canal of sufficient capacity?"

This would be a repetition of what has been done by the Hydraulic Company, so far as taking the water to the site is concerned, but not as to the final generation of the power. The hydraulic canal supplies separate mills, each having its own turbine just as the Evershed scheme contemplates the construction of a tail-race underground to enable separate mills each with its own wheel, close to the water supply, each wheel discharging its used water into this tunnel or tail-race.

Borings are now being made above the falls on the property controlled by the Cataract Construction Co. and the carefully prepared notes of these borings will furnish as valuable information as to the rocks not yet exposed as do the exposed strata below the falls. Enough is known of the character of the rocks to make the engineers engaged on the work recommend an unlined tunnel to carry off the water from the wheel-pits.

The president of the company, Mr. Edward D. Adams, deciding that a consultation of eminent engineers was necessary, owing to the importance of the problem to be worked out, organized what has been termed an International Niagara Commission. The president of the commission is Sir William Thompson, familiar with the falls of Niagara through frequent visits, and probably the first person to suggest the distribution electrically of the water power of Niagara; Prof. E. Mascart, membre de l'Institut, Paris; Proffesseur au College de France; Directeur du Bureau Central Meteorologique, representing France; Switzerland, Mr. Theodore Turrettini, of Geneva; Lieutenant-Colonel d'Artillerie, President de la Ville de Geneve; Directeur des Travaux d'Utilisation des Forces Motrices du Rhone a Geneve; Directeur de la Societe Genevoise d'Instruments de Physique, who as the engineer of the St. Gothard Tunnel, the one who carried out the improvement of the Rhone and lake at Geneva, is prominent as an engineer. Prof. Coleman Sellers, E. D., M. Inst. C. E., etc., Philadelphia, Professor of Engineering Practice, Stevens Institute of Technology, Hoboken, N. J., and Professor of Mechanics, Franklin Institute, Philadelphia, was selected as the only representative of the nation most deeply concerned in the success of the project.

In summing up the preparations made for this great work Engineering says: "It is believed that the importance and novelty of the scientific questions involved in dealing with so very great a volume of water and in distributing such an immense power, have had much influence with the commissioners in leading them to cooperate with the Cataract Company in this inquiry. What is done at Niagara will probably influence the plans adopted for the utilization and distribution of power all over the world. And the selection of the best methods has fortunately proved to be a problem attractive to the very eminent scientific men who have consented to act for them.

THINGS TO REMEMBER ABOUT SHAFTING.

DON'T buy light hangers and think they will do well enough, when your own judgment tells you that they will spring, says the Western Machinist.

Remember that shafting is turned one-sixteenth inch smaller than the normal size.

Cold rolled and hot rolled shafting can be obtained the full size.

The sizes of shafting vary by quarter inches up to three and a half inches.

The ordinary run of shafting is not manufactured longer than from 18 to 20 feet.

For line shafts never use any that is smaller than one and eleven-sixteenths inches in diameter, as the smallest diameters are not strong enough to withstand the strain of the belts without springing.

The economical speed of shafting for machine shops has been found to be from 125 to 150 revolutions per minute, and for wood working shops from 200 to 300 revolutions.

A jack-shaft is a shaft that is used to receive the entire power direct from the engine or other motor, which it delivers to the various main shafts.

Keep the shaftings well lined up at all times and this will ward off a breakdown and avoid a waste of power.

Know that the pulleys are well balanced before they are put in position, as a pulley much out of balance is quite a sure method to throw shafting out of line.

Look to the pulleys, and see that they have been bored to the size of the shaft, for unless this is done the pulley may be out of centre on the shaft and prevent smooth running.

If possible, apply the power to a line of shafting at or near the centre of its length, as this will enable you to use the lightest possible weight of shafting.

Hangers with adjustable boxes will be found to be the most convenient for keeping the shafting in line.

Keep your drip-cups cleaned, and do not allow them to overflow or get loose.

Have a supply of tallow in the boxes; in case of accidental heating it will melt and prevent cutting; this rule, while good for general use, applies particularly to special cases where there is a supposed liability to heating.

Never lay tools or other things on belts that are standing still, for they may be forgotten and cause a break down when the machinery is started.

Don't attempt to run a shaft in a box that is too large or too small, as you will waste time and fail to secure good results.

A loose collar held by a set screw will cause the collar to stand askew, and it will cut and wear the box against which it runs.

In erecting a line of shafting the longest sections should be placed at the point where the power is applied. The diameter can then be gradually decreased towards the extremities remote from this point.

Don't put loose bolts in plate couplings, as this will give no end of trouble in shearing and the wearing away of the bolt holes.

Don't think that because your shafting has been well erected, and you oil it regularly, that it will never need any inspection or repairs.

Don't try to economize in first cost by having long distances between hangers, for a well supported shaft will always do the best work; short shafts are the surest to be straight and to remain so.

The length usually adapted to shafting bearings is twice to four times the diameter of the shaft, varying with the diameters of shaft, kind of bearings and the material used in them. Large shafts in the gun metal or bronze boxes may have bearings only twice their diameter in length. Cast iron bearing up to and including three inch shafts are often made four diameters of the shaft in length, particularly for self-adjusting hangers.

If babbit is used for the boxes use only a good material; do not adopt the common mixture of tin, antimony and lead.

Insist upon having good iron in your shafting, as the bearings will take a finer polish and you will not be subject to sudden ruptures.

If the strain on a pulley is so great that the set-screws already in will not hold it, do not let them score in the shaft, but put in an extra screw, or cut a key-way and put in a key.

The width of a key-way should be one-quarter of an inch for each inch of diameter of the shaft.

The depth of the key-way is one-half its width.

TABLES OF AREAS AND DIAMETERS OF GRATES, ETC.

THE following table is intended, says Power and Transmission, to give the areas in square inches and in square feet, of circles of various diameters in feet and decimals of a foot; and also to give the equivalents in lineal inches of the diameters in feet. It will be found particularly handy in steam engine, pump, and boiler work.

To get the second column, or areas in square feet, the squares of the diameters in feet in the first columns are multiplied by 0.7854.

To get the fourth column, or equivalents in inches of the diameters in feet as given in the first column, the figures in the first column are multiplied by 12.

To get the third column or areas in square inches, either the numbers in the second column are multiplied by 144, or the squares of the figures in the fourth column are multiplied by 0.7854.

Thus $0.25 \times 0.25 \times 0.7854 = 0.04909$; $0.25 \times 12 = 3$; $3 \times 3 \times 0.7854 = 7.0686$, or practically 7.069 or 7.07.

The areas are given to two decimal places, not because that degree of accuracy would be required in practice in designing grates, but to make the same table serviceable in other work requiring more exactness.

Dia. feet.	Area sq. feet.	Area sq. inches.	Dia. in.	Dia. feet.	Area sq. feet.	Area inches.	Dia. in.
.25	.04969	7.069	3.	3.	7.0686	1017.87	36
.30	.07009	10.178	3.6	.25	8.2958	1194.59	39
.33	.08769	12.56	4.	.5	9.6211	1385.44	42
.40	.12537	18.085	4.8	.75	11.045	1590.43	45
.50	.19675	28.27	6.	4.	12.566	1809.55	48
.60	.28244	40.712	7.2	.25	14.186	2042.82	51
.66	.34982	50.26	8.	.5	15.904	2290.21	54
.7	.38475	55.42	8.4	.75	17.721	2551.75	57
.75	.44109	63.62	9.	5.	19.635	2807.43	60
.8	.50267	72.38	9.6	5.50	23.758	[illegible]1.18	66
.9	.63617	91.61	10.8	6.00	28 274	40[illegible]1.50	72
1.00	.78540	113.09	12.	6.5	33.183	4778.36	78
1.25	1.2272	173.71	15.	7.	38.475	5541.77	84
1.5	1.7671	254.46	18.	7.50	44.179	6361.72	90
1.75	2.4053	346.36	21.	8.0	5[illegible].265	7238.23	96
2.	3.1416	452.38	24.	8.50	56.745	8171.30	102
.25	3.9761	572.55	27.	9.	63.617	9160.90	108
.5	4.9087	706.85	30.	9.5	70.882	10207.05	114
.75	5.9396	853.29	33.	10.	78.540	11309.76	120

EFFECT OF COPPER UPON RUBBER.

IN a paper read before the British Association, Sir William Thomson made interesting remarks relating to the decay of india-rubber.

Prof. Dewar observed, accidentally, that metallic copper when heated to the temperature of boiling water in contact with the rubber, exerted a destructive effect upon it. With a view of finding whether this was due to the copper *per se*, or to its power of conducting heat more rapidly to the rubber, I laid a sheet of rubber on a plate of glass and on it placed four clean disks, one of copper, one of platinum, one of zinc and one of silver; after a few days in an incubator at 150° F., the rubber under the copper had become quite hard, that under the platinum had become slightly affected and hardened at different parts, whilst the rubber under the silver and under the zinc were quite sound and elastic. This would infer that the pure metallic copper had exerted a great oxidizing effect on the rubber, the platinum had exerted a slight effect, whilst the zinc and silver, respectively, had had no injurious influence on it. A still more curious result was this, that the rubber thus hardened by the copper contained no appreciable trace of copper, the copper therefore presumably sets up the oxidizing action in the rubber without itself permeating it. I have pleasure in acknowledging the assistance rendered to me in these experiments by my assistant, Mr. Frederick Lewis.

TRADE NOTES

G. A. Graves, of Goshen Mills, Ont., has bought a No. 1 flour dresser from Wm. & J. G. Greey.

Wm & J. G. Greey, of Toronto, have shipped a No. O Cockle machine to John Lawrie, of Perth, Ont.

John I. Hodgson, of Hudson, Ont has bought a No O smutter from Wm. & J. G. Greey, of Toronto

The Keegans Milne Company, of Montreal, will put in an electric lighting plant in the Brunette saw mill, at Westminster, B C.

The Manitoba Milling & Brewing Co have been increasing their capacity and have purchased the machinery from the Geo. T Smith Co.

Preston & McKay, of Boissevain Man., are putting up a 30,000 bushel elevator. The G T. Smith Co. furnished the necessary machinery.

Mr. J. H Ingram, of Aylmer, Ont., has made a contract with the Geo. T. Smith Co. for one of their three break mills of fifty barrels capacity.

Stanley & Dight, of Lucan, have recently placed in their mill a double 9 x 24 roller mill, and 1 No. 1 Centrifugal reel purchased from the Geo. T. Smith Co.

Mr. J. Rumble, Hillsdale, Ont., has been making some changes in his mill, putting in a purifier and two elevator bolts manufactured by the Geo. T. Smith Co

During the past month the firm of Wm. & J. G Greey have completed and started mills at Shawville, P Q., Lockalsh, Ont., and Plainfield, Ont., besides several mills that have been partially refitted under their supervision.

The three break Geo. T Smith system mill recently built by that company for W. J. Macartney at Port Robinson, is now in successful operation and the proprietors would take pleasure in showing it to any parties who are interested in mill machinery.

J. W. Cochrane, Crystal City, Man., has been making some changes in his mill, putting in a separator, bran duster, cyclone dust collector, packer, two elevator bolts, purifiers, and double roller mill, all purchased from the Geo. T. Smith Co., Stratford.

The Beautiful Plains Milling Co., of Neepawa, Man., are building a 100 barrel mill. The machinery is supplied by the Geo. T. Smith Co., including one of their Brown engines, steel boiler, five roller mills, six inter-elevator bolts, and other necessary machinery.

The Standard Fertilizer & Chemical Co., of Smith's Falls, are putting in a double roller mill with porcelain rolls for grinding phosphates, and a No. 3 Centrifugal Reel for bolting same. The machines were manufactured by the Geo T. Smith Co., Stratford.

Campbell & Stevens, of Chatham, have made a contract with the Geo. T. Smith Co. to put them in a 150 barrel corn meal mill. Campbell & Stevens express themselves as highly pleased with the change recently made in their flour mill from the long to the short system.

Messrs. Wm & J G Greey have received an order from J. D. Shatford, of St. John, N. B., for a complete outfit of corn meal machinery, consisting of improved roller mills bolts and purifiers, together with packing machinery, elevators and supplies necessary to complete the mill.

Mr. John Labatt, of London, Ont., is making some extensive changes in his brewery, placing a double 9 x 24 roller mill to grind the malt; a malt cleaner, a magnetic separator, a scouring screen, etc. The machinery was purchased from the Geo. T. Smith Co., and they are doing the work.

Messrs. M. N. Stephens & Sons, Glencairn, have made a contract with the Geo. T Smith Co for one of their full roller mills on their three break system. An examination of Mr. Noble's mill at Noval, resulted in Mr. Stephen's decision to place the contract with the above company.

The Geo. T. Smith Co. contracted in May with P Kyle, Merrickville, to build him a 75 barrel short system mill furnishing the complete outfit from the Separator to Flour Packer. This mill was started in September, and rented to Mr. Arbuckle, who is reported to be very much pleased with it.

Mr. Fred Purvis, of Bryson, Ont., has placed an order with Wm. & J. G Greey for an outfit of roller machinery and dressers, it being his intention to fit up the old stone mill in a first class manner, and supply people in that locality with grades of flour that now have to be brought from surrounding towns.

Messrs. Robin & Sadler, of Montreal, have manufactured for the Manitoba Electric and Gas Light Co. what is claimed to be the largest and heaviest belt ever made in Canada. It is made of three-ply heavy leather, each outer ply being a single width of 40 inches, and the centre ply two 20 inch strips.

In 1886 the Geo. T Smith Co. built a 75 barrel mill for Mr. J. C. Vanstone, of Bowmanville. The mill has been in successful operation ever since. Mr. Vanstone finds its capacity too small, and has made a contract with the Smith Co. to increase his capacity to 150 barrels, asking no better guarantee than that the new mill will do as good work as the old.

The fifty barrel two break mill recently built by the Geo. T. Smith Co. for A. E. Howse, Nicola, B. C., is now in successful operation. The millwright work was done by Mr. John McKay, formerly with the Geo T. Smith Co., but now in business for himself at Boissevain, Man. We publish a description of this mill copied from the paper published at Kamloops, B. C. It seems to have been a great success.

George Neeller, of Millbrook, having decided on changing his old stone mill in Cavan township, near Millbrook, to the roller system, has placed an order with Wm. & J. G. Greey, of Toronto, for the whole plant, which will consist mainly of ten pairs 9 x 18 rolls, purifiers, dressers, bran dusters, etc. This will be the third mill the Messrs. Greey have sold to Mr. Neeller and his brother William of Bobcaygeon.

E Dyson & Sons, Essex Centre, made a contract in June with the Geo. T. Smith Co to change their mill to the three break system, putting in five of their elevator bolts, one of their purifiers and other machinery necessary. The mill was started in August to Mr. Dyson's entire satisfaction, and he cordially invites interested parties to examine the mill and compare its present with its previous workings.

The Nottawasaga Farmers' Milling Co., of Duntroon, Ont., are building a 50 barrel mill at that place, the Geo. T. Smith Company furnishing the building plans as well as a complete outfit of machinery, including their celebrated Brown engine, noiseless belt rolls, purifiers, horizontal cleaning machinery, etc. This is expected to be one of the most complete little mills in Canada, and will be running about the 1st of December.

The Dodge Wood Split Pulley Co., have opened a general office and stock room at 83 King street west, Toronto, where they will be pleased to see their friends and customers. Here they will keep samples and stocks of all the different styles of pulleys manufactured by them, and also models and specimens of the many different ways of applying their patent rope drive system. All interested in the transmission of power should give them a call.

MACHINERY AND MFG.

The first sod in connection with the Niagara Falls Water Power Company's undertaking was turned on Oct 4th.

Mr. J. P. Hammel, of Barrie, is looking for a suitable site near New Westminster, B. C., on which to erect a saw mill.

The citizens of Georgetown have requested the council to submit a by-law to grant a loan of $4,000 to the Wardlow Split Pulley Co, the latter to pay at least $2,000 a year in wages, or half the interest on the loan.

On Oct. 16th the Beck Manufacturing Company's shingle and planing mill at Penetang, Ont., was destroyed by fire. Loss, $3 500; insurance $2,000, divided between the British American and Commercial Union company

A syndicate has offered to construct the works necessary for utilizing the water power of the Assiniboine river at Winnipeg, and to furnish to the city power for water works, electric light or other purposes, at the rate of $20 per unit for the first 400 horse power and $20 per unit between 400 and 2,000 horse power.

"An official calculation upon the best data obtainable brings out the extraordinary fact, says the Electrical Engineer of New York, " that the rivers and streams of the United States, averaged throughout the year, show over 200,000,000 horse-power." The returns of the 1880 census showed that there were in use in the United States no fewer than 55,404 water-wheels, developing a total of 1,225,379 horse-power, or 36 per cent. of the total power employed for industrial purposes. In 1880, therefore, only ·6 per cent. of the total available water-power of the United States was utilized.

The steam plant at the electric light station on Toronto Island got out of order recently, and the services of the Steam Boiler Inspection Co. were obtained to locate the trouble and suggest a remedy. The company's chief engineer reported the existence of a peculiar condition of affairs as follows. "The chief defects are in the fire box, and the little cracks and leaks are so numerous that it would be better to cut out the defective plates and put in new ones. Some one had attempted to stop the leaks by putting in oatmeal or something of that nature. The inspector removed about 12 lbs. of it from the water legs of the boiler. Fortunately it had settled down below the level of the fire, had it got fast on the plates acted on by the fire there might have been a serious rupture."

A decision of interest to factory owners was given in the Montreal Courts the other day. A girl named Albina Sigouin sued the Montreal Woollen Mills Company for the recovery of a week's salary, which the company had retained owing to her having absented herself from her employment without leave. During her absence the company decided to dismiss her and instructed the cashier to retain her wages in lieu of a week's notice. The company is in the habit of retaining the first week's wages of their employes as a guarantee, and when they desire to leave they are required to give eight days notice, at the expiration of which they receive the whole of the wages due them. In this case the company pleaded that they had a notice in a prominent place that wages would be confiscated if the required notice were not given. The plaintiff declared that she had no personal knowledge of such a notice and the court decided in her favor on this account.

Square leather ropes have been successfully used in England. They are especially suited for what are called "quarter-twist" belts, not being affected by the diagonal strain as a flat leather band is. The sections are square, equilateral, and the grooves in which they run are made to an angle of 45 degrees, so there is a perfect fit of one-half the surface of the rope, and more than is possible with a flat band of equal weight, and the traction is more because of the angles. The square leather ropes employed for main driving are about 1¾ inches square and made up of layers of leather cemented so the whole is uniform and continuous. A rope of this size weighs a pound for each foot of length, and will sustain a pull of 600 pounds. A single rope of similar size will, at a speed of 2,500 feet a minute, transmit 25 horse-power. They are driven at a much higher speed than this, and in some cases to 6,000 feet per minute. A safe or suitable speed is from 4,000 to 5,000 feet a minute. These square ropes are worth a trial, and the leather band manufacturers would no doubt be glad to furnish such ropes, as they could be made up from "small stock."—Industry.

There are very few lines of manufactured articles that have not undergone wonderful changes, especially in the means and methods of their production, in the last half-century, says the Manufacturers' Gazette. Hand work has been succeeded by machine work, and notwithstanding the very common argument against this change, the claim being made that the quality of the work is thus less accurate and perfect, it is a fact that not only is it more accurate and perfect, but every piece is exactly alike, the quality equally good, and the quantity largely increased. A machine once carefully and accurately set and kept in proper repair never varies. The work is uniform and true. An example of this is well illustrated in the manufacture of that very useful article in every shop and factory, the file. It is but a few years ago that these were all, or nearly all, made by hand, enhancing their cost, and not materially increasing their durability and service. To-day nine-tenths of all the files used in this country are made by machinery. The competition in the business, largely controlled by quality, has worked to make their manufacture one in which the most perfect machines are necessary, and this spirit of rivalry has brought the machines to such a state of perfection that wonderfully fine and accurate work is accomplished by them. With the machines now in use a file is cut with teeth varying from 14 to the inch to a number so fine as to require a magnifying glass to count them, and as accurate and perfect in shape as the coarser cuts. For their production about 5,000 tons of specially prepared steel are consumed annually.

BOTH SIDES OF THE PICTURE.

A very large proportion of those Europeans who have been hornswoggled into going to Manitoba finally cross over into Dakota and Minnesota, and "still there's more to follow."—Milling World.

Wm. Johnston, president of the Brandon Board of Trade, says he is receiving a large number of letters from the people in Dakota asking if they could get some assistance to leave that country, saying that they want to settle around Brandon.—Winnipeg Commercial.

CANDLE-POWER OF ELECTRIC LAMPS.

IN your issue of the 3rd inst., you drew attention to the exaggeration of candle-powers in arc and incandescent lighting.

With arc lighting, I think most engineers take account of this and allow somewhere about 600 effective candle-power for an arc of 2,000 nominal C.P., as in the tests carried out at Berlin, but with incandescent lighting little or no reduction is needed.

As a matter of general interest I send you the results of some tests carried out at the Vienna Central Station in 1888. The lamps burnt out at the two Court theatres were replaced by the company, and as these amounted to somewhere about 25,000 per year, it was of the greatest importance to choose between the different makers. Five of each make were taken, and lighted from a constant pressure of 100 volts, the pressure of the lamps, the current being taken from a reserve battery and the pressure exactly adjusted. Each day the lamps were taken out singly and measured on the photometer, filament broadside on, and the sum of the candle-powers of each make plotted out.

LAMP CURVES—WATTS PER CANDLE.

Hours burning.	Swan.		Allgemeine Electric Ges.		Siemens and Halske.		Edison-Paris.		Khotinsky.	
	C. P.	Watts.	C. P.	Watts.	C. P.	Watts.	C. P.	Watts.	C. P.	Watts.
100	18.8	3.45	16.3	3.31	14.3	3.41	32.8	4.15	13.8	3.6
200	17.2	3.79	14.3	3.66	12.3	3.84	28.1	4.85	12.5	3.79
300	15.6	4.1	13.4	3.87	11.1	4.2	26.3	5.25	11.2	4.22
400	15.2	4.17	11.8	4.33	10.5	4.33	23.2	5.9	9.6	4.75
500	14.8	4.29	11.1	4.59	9.7	4.74	21.0	6.5	9.4	4.8
600	14.4	4.38	10.1	5.01	9.3	5.01	16.5	8.3	8.9	4.98
700	14.1	4.5	8.9	5.51	8.3	5.36	—	—	7.8	5.49
800	13.3	4.68	7.8	5.79	7.8	5.67	—	—	6.9	5.96
900	12.4	4.9	8.0	5.9	7.1	5.95	—	—	6.6	6.1
Avrge.	15.1	4.25	11.3	4.66	10.05	4.72	24.7	5.83	9.6	4.85

If a lamp broke it reduced the total height of the curve. The splendid instruments in the possession of this station ensure the reliability of these figures. Allowing for improvements in the Edison-Swan Company's manufacture during the last two years, and taking the mean candle-power as representing the mean effective illumination of a building, I think one can fairly speak of a 16 C.P. lamp at 4¼ watts per candle with a life of 1,000 hours.—S. T. Dobson in London Electrical Review.

The statement is made that flour was sold for $1.50 a pound at Frazer river, Canada, in 1838.

Mr. Adam Watson, of Mitchell, has accepted a position in Thomson's oatmeal mills at London, Ont.

Mr. J. M. Robb, for some time employed in Saunby's mill, at London, Ont., has accepted a position at Lynden.

Mr. Wallace of Chicago, the well-known oatmeal mill builder, will erect Brackman & Kerr's new mill at Victoria, B.C.

An annex to the C.P.R. elevators is being erected at Fort William, which will have a capacity of 1,200,000 bushels.

A number of the large Ontario mills have announced their intention of sending exhibits of flour to the Jamaica Exhibition.

J. S. Crerar, of Saltcoats, has leased the York Farmer's Colonization Company's flour mill at Old Yorton, in the Northwest.

The Canada Atlantic railway recently carried the first train of Minneapolis flour to Providence, R. I., in eight days. The length of the haul was 1,480 miles.

Incorporation is applied for by the Standard Trading and Manufacturing Company, of New Brunswick, for the purpose of operating in flour and meal, purchasing, manufacturing, etc.

The Todd Milling Co., and Cranston & Scringeour, of Galt, purchased for shipment to the United States prior to the coming into operation of the McKinley Bill large quantities of barley.

A circular has been issued by the Grand Trunk Railway which says that the full capacity of the company's elevator at Midland for both storage and transportation is fully engaged up to the close of navigation for this season's trade.

A new oatmeal and cornmeal mill, with a capacity of 100 barrels, will be erected at Victoria, B. C., by Messrs. Brackman & Kerr, who also own and operate a grist and oatmeal mill at Saanich, on Vancouver Island, a short distance from Victoria.

The Northwest Transportation Company has contracted to store 500,000 bushels of Manitoba wheat with the Botsford Elevator Company, Port Huron. The wheat is placed in bond there pending shipment to Canada during the winter for milling purposes.

A question has arisen in connection with the Dominion regulations respecting the grinding of corn in bond for human food, as to what constitutes kiln-dried corn. Several Ontario millers who are interested in the trade have recently interviewed the Government on the subject.

The new Victoria (B.C.) flour mills will commence operations at once. They have now in store 750 tons of wheat, the greater part provincial grown, which is of decidedly better quality than that imported from the other side of the line. The new mills have a guaranteed capacity of 200 barrels per diem, but will probably exceed that output by 50 or 100 barrels.

An interesting case to grain buyers came up in the Division Court at Brantford, recently. A farmer named Leritt sold 350 bushels of barley to a Mr. Harold for 58 cents. He delivered one load to him, and then sold the remainder to a Mr. Wood at 60 cents. Mr Harold refused to pay for the first load, and Leritt entered action. Mr. Harold also put in a claim of four cents per bushel for non-delivery. The counter claim was allowed.

A rumor gained currency a few days ago that the formation of a flour milling syndicate in Canada was on the *tapis*. The names of the Ogilvie Milling Co. and the Lake of the Woods Milling Co. were given as the leaders in the movement. The former company promptly denied the truth of the rumor. Whatever possibility there may be for amalgamation of these two concerns, it is a well understood fact among persons familiar with the business that no combination of any considerable number of Canadian mills is either probable or possible.

At the recent meeting of Russian millers, at Odessa, it was resolved that every endeavor should be made to extend the export trade in flour. In answer to the question as to the quality of South Russian flour, compared with that of other countries, it was stated that it not only equalled all other flours in quality, but exceeded many of them. Great Britain is the largest buyer of Russian flour, English buyers being very well satisfied with its quality; and with a view to develop the trade, an association is to be started at Odessa, which will inspect the flour, and give it the proper number or standard of quality. For the first time on record a full steamer cargo of flour is now on the way from Odessa to Leith, with 10,000 sks.

It is learned from the Northwestern Miller that in the flour inspection department of the Pillsbury mills, baking bread is now done by electricity. Inspector Bradley and Electrician Hughes have gotten up an oven which is a great improvement over gas or oil stoves. By its use bakings can be made in 12 minutes. There are two compartments in the oven, it being thought that the different grades of flour bake best separately. An electric bulb, by which the interior is kept lighted, is placed on the inside, and through a peep hole the bread can be watched as carefully as though taken out frequently. Mr. Bradley says that his experience with new wheat makes him believe that whenever new wheat has been mixed with old, the quality of the patent flour produced was improved. This has been most perceptible in the color.

A conference took place last month at Montreal between representatives of the Dominion Millers' Association and the G.T.R. and C.P.R. on the subject of Ontario mills being given the privilege of grinding Manitoba wheat in transit. The Grand Trunk appears willing to grant the privilege, but as that road only touches a small part of Manitoba with the Northwestern Pacific, the C.P.R.'s consent is of most importance. The mills on the main line of the C.P.R. already enjoy the privilege, and are to that extent at an advantage over their less favored competitors. The C.P.R. say the extra haul of 140 miles, if wheat were to be brought by the North Bay route, would be a dead loss. If the C.P.R. grant the privilege it will be because it is afraid to refuse and have the Grand Trunk grant it.

According to the Montreal Transportation Company not a bushel of wheat has come out of Manitoba so far and forwarders are doubtful if they will have much or any for export before the close of navigation. Traffic manager Olds, of the C.P.R., who returned recently from a three week's trip over the road, said so far as he had been able to see the farmers appear to have more grain than they could take care of themselves. All wheat was in stacks awaiting threshing, but bad weather was delaying the movement. He thought that not much would be exported before the close of navigation but the exportation will be large in the spring. He is of opinion that there will be this year five times as much grain of all kinds for export and domestic purposes as last year.

From the Manitou, Man., Mercury, we learn that the main building of the new flour mill at that place is 24 x 40 feet, three stories, with store room 13 x 24 feet, and engine room 24 x 24 feet. The engine is sixty horse power. A portion of the plant of the mill is composed of the stone mill owned by Watts & Co., Brantford, Ont., and formerly located at Norquay, Man. A full set of roller machinery has been added. The first floor of the main building contains two wheat cleaners and the line shafting for driving the rolls, and the three run of stones. There are also on this flat the receiving hoppers, and storage bins capable of holding 1,000 bushels of grain. On the second floor are to be found the rolls, of which there are seven set together with three run of stone, nineteen sets of elevators, two flour packers, and four scalpers. The top storey has two purifiers, six bolts, one bran duster, flour and bran bins, dust room, sack hoppers, etc. McIntosh Bros. are operating the mill.

The United States Miller says: "For the numerous flour mill failures in this country there are many and widely diverse reasons. Some fail for lack of capital, some for lack of a competent miller, some on account of the mill-builder's inferior work, some because there is not trade enough to support them, some on account of outside speculation on part of their owners. But it is more likely, if they could be sifted down to the bottom, that in the majority of cases millers are deceiving themselves in regard to yield. There are indeed many who are constantly laboring under a delusion. It pays to make frequent tests, and when making a test to keep an accurate record of each step which is made and every controlling circumstance. The value of a test does not alone consist in the determination of the result sought for, but a test made to determine one thing often furnishes the data for other matters; is of value in many ways for reference, and is the more valuable the more complete the data which acompany it.

A great many millers refuse to take kindly to the method of sieve scalping, says the St. Louis Miller, because they fail to see "wherein the shaking screen can possibly have any superiority over the rolling screen; especially on grinding stock that has been thoroughly scoured and polished, and properly broken." They claim it to be "absurd that a slow revolving reel having no more severe rasping action than the abrasion of grain against grain, and contact of the grains against smoothly woven wire cloth, should take any sort of dirt or discoloring matter off of wheat that has passed through a full line of grain cleaning machinery which has been invented, patented and boastingly advertised as scouring everything off of the wheat berry down to the tough bran." To those who indulge in this misleading theory to introduce themselves not to buy that very excellent milling machine—the sieve scalper, we have this to offer: Don't judge of these machines by your theory, but look around you and determine as to their merit, by practical results. You will find that all the mills making the biggest yields of best brands of flour, are using sieve scalpers. "Your theory" about it not being possible for the reel scalper to take impurities off of well screened wheat is correct—provided you run the wheat to the reel unbroken. But begin to break the grains once, twice, thrice, four or five times; each time exposing a new ragged edge of bran with loose fibre, ready to break away at the most gentle stroke or jar of falling, and it can readily be seen where the reel scalper is bound to do improper work. Not so with the sieve scalper. For as the grains are broken, they are at the same time flattened. And as the break stock glides over the screen cloth, either on the clean flour-side or thoroughly polished outer side, there is no chance for the impurities adhering to the ragged broken edges to be brushed off into the break-flour.

Mr J. A. Chipman, a well-known flour dealer of Halifax, writes as follows to a local paper concerning the necessity for Canadian transportation facilities to Newfoundland: "As early as July or August last, when the crop reports were being confirmed, showing that crops were short in the United States and large in Canada with a considerable export surplus, I saw, as others must have seen, that Canada would, or should, control largely the export trade of all kinds of breadstuffs and farm produce to the neighboring province, Newfoundland. Early in August the Canadian produce began pouring into Newfoundland, via Montreal, and in order to be in advance of the closing of navigation in the St. Lawrence, I wrote letters urging Mr. Taylor, general freight agent of the Intercolonial, to get, if possible, an export tariff on Canadian products for export to Newfoundland and the West Indies. Mr. Taylor's final answer, recently received, was to the effect that he was unable to secure any better traffic arrangements with the managements of the great railways west. I saw then what is already coming to pass, that as soon as navigation in the St. Lawrence was closed the Canadian export, even to the province of Newfoundland, lying at our very door, would pass into the hands of American middlemen and be handled through American territory. Newfoundland requires 565,000 barrels of flour per annum and we have this year the article to give them, cheaper and better adapted to their wants than that of the United States, besides oatmeal, peas, beans, butter, cheese, hay, oats, vegetables and a thousand other things, and if we must be dependent upon foreign ports and middlemen of the United States to supply that trade the sooner we haul down our flag and confess our utter dependence upon the United States the better. I write this from no spirit of arrogance, in no desire to taunt the distinguished Ministers of the crown with their late utterances, but in absolute humility at the position in which our trade, with a province lying almost within sight of our own, is placed. I write this in the hope of inspiring throughout the length and breadth of our Dominion a spirit of loyalty of our people and exporters everywhere to enforce the natural channels of our trade. And I protest as a Canadian that the great bulk of our trade and commerce shall no longer be carried on through a hostile country."

ELECTROLYTIC PRODUCTION OF PURE IRON.

A process for the direct conversion of pig iron into wrought or ductile iron, without decarbonization by heat, has been invented and worked out to a practical shape, says the New York Electrical Review, by Dr. Stephen H. Emmens, of Emmens, Pa., the inventor of the powerful explosive which bears his name and is now most successfully going through the ordeal of government tests. Wrought iron, so-called, is to-day almost universally produced by the process of puddling cast or pig iron, the higher and costlier grades of pig being used, especially in the production of the finer brands, known as "Norway" and "Swedish" iron. The puddling process may be said to be simply the burning out of the contained carbon by the agency of heat and oxygen, and successful puddling requires great skill and extremely hard labor, which must be paid for accordingly. The Emmens process, as to the actual conversion, requires no heat and no skilled labor, but for merchantable bar or sheet iron, the product is simply heated and rolled or hammered. The process is hardly to be described as decarbonization of pig iron. To coin a word for the purpose, "deferrcation" of pig metal would more accurately describe what takes place. The process is electrical, and the pure iron is extracted from the crudest and most impure pig iron or pot metal with as much facility as from the best charcoal pig.

Many attempts have been made to force iron into the list of electrolyzable metals, but failure has marked all efforts except in the electroplating of engravings or copper electrotypes with a coating of hard iron. The difficulty has been completely overcome by Dr. Emmens, whose electrolytye and current treatment are such as to form a perfectly reguline and closely adherent cathode of iron of almost chemical purity, which then only needs washing, heating and rolling to produce an article equal to the finest Swedish iron, being very soft and easily worked. The inventor claims to be able to make the iron from pig and put into merchantable shape at a less cost than the ordinary puddling process, and at the same time to further cheapen the cost by using the very lowest priced grades of pig iron. If this be true, and there seems to be no reason why it is not, the effect can hardly be safely predicted. Electricity as a commodity is now a very cheap article, and its production is as certain and uniform as the laws of science can make it. It is said that the residue of the anode, composed of graphite, silicon, sulphur, phosphorus, etc., from which the iron is, of course, absolutely freed, makes a valuable basis for mineral paint, and probably this is the case.

The metallurgist will at once realize the value of this process, if for no other reason than that it at once makes available for the production of iron, immense deposits of iron ore in various parts of the country, which are now useless owing to the prohibitive quantities of phosphorous and sulphur they contain. Such ores are not available even for the Bessemer or open hearth process, which produce low steels containing a very small proportion of carbon. But for the Emmens process these ores are practically as good as any. They can be smelted, run into slabs of proper size and shape and the only effect of the impurities is upon the character of the anode residue. The cathode will in all cases be practically and almost chemically pure iron. Not only that, but when heated and rolled or hammered, its quality is of the very highest grade. If, as seems to be fairly within the truth, such iron can be produced from such pig at a cost below or even the same cost as an equal quality by the puddling and refining furnaces, the result must be necessarily important in the future development of the iron industry.

The process is of interest also to the electrical fraternity in point of utility. The forged product is said to be surpassing in its fitness for magnet cores for all purposes on account of its great purity and the low resistance of a magnetic circuit composed of it. This would seem to be true by comparison. The most impure cast iron has the least magnetic permeability, and the co-efficient of the latter rises as the cast iron approaches the character of wrought iron. Swedish iron is the purest commercial iron we are acquainted with, and we all know its splendid magnet making properties when energized. The Emmens iron, being still purer, ought to make a proportionately better electro-magnet. If it does, the electrical industries alone will create a heavy demand for the new product.

THE RELATIVE COST OF GAS AND ELECTRICITY IN COTTON MILLS.

WHEN it is intended to draw comparisons between gas and electricity and their relative cost, it is not unusual, says the London Electrical Review, to estimate the former by simply referring to the actual cost of the gas consumed as registered by the meter, whilst the cost of an electric light is obtained after every possible charge has been put down to its account. Such a result not infrequently places the electric light at a serious disadvantage from the economical point of view.

But an estimate of this character is far too one sided to give a true statement of the case. Those who are interested in the electrical industry do not object in the least to have the electric light properly debited with all the incidental and necessary items, but they do naturally object that, on the gas side, all the incidental items save that of actual consumption, should be omitted. Neither is it fair altogether to omit from these calculations the relative benefits or otherwise derived from the use of the two illuminants.

As we have remarked, an electric light installation is debited with all its charges to the capital account, and in its maintenance not only is the depreciation of the plant considered, but every item due to repairs, wages, &c., is fully considered and provided for.

On the gas side however, no such items are usually taken into account, but, dealing with the gas question in a large mill or manufactory, there are a number of expenses necessarily entailed, which should certainly be taken into account when a perfectly true and reliable comparison is desired. For instance, the installation of a gas plant of 1,000 or more lights into a large mill entails the expenditure of a considerable amount of capital, although it is known that a gas plant can be put in at the present time for a very small sum. There are however many mills where the capital expended upon the gas installation has cost 20s. per light, whilst at the present time they can be installed for as low as 5s. or 6s. per jet. Still, this requires some capital, and, necessarily, should be subject to some charge for depreciation. The lighting up of a large mill, and the extinguishing of these lights requires a considerable amount of labor and time. The value of wages taken up per annum in this alone is a serious item, but it does not count. It will be found that where there are a large number of lights in use there is almost always a "gasman" employed in looking after the fittings, and keeping everything in proper repair, but his wages are not counted, nor are the various items which usually come under the head of repairs, for it is impossible to conceive that gas-pipes and fixtures are never out of order.

When the relative charges are properly considered, a more reliable estimate can therefore be obtained, but there are circumstances which prevent such a comparison from being made; this is owing to the fact that it is very rare for the cost of the maintenance of an electric light installation to be kept. We are aware, however, of several cases where this has been done, and we have had the following statement presented to us for publication, which gives the information in a comparative form, prepared by the proprietors of some very large mills in the neighborhood of Manchester. These results give the relative cost of gas and electricity for a period of six years, taken from the actual working experience of one of the company's mills at Mossgate, near Bolton. The statement is given exactly as handed to us.

HORROCKS, CREWDSON & CO., LIMITED, BOLTON.

Gas v. Electricity at Mossgate.

SIX YEARS TO 31ST DECEMBER, 1889.

	£	s.	d.
826 gas lights, cost for piping, meter, &c.	245	2	2
Depreciation at 5 per cent. per annum, 6 years, £73 12s. 11d.; or, per annum	12	5	6
Average gas account, per annum	217	11	3
	826) 229	16	9
Cost of gas per light per annum	0	5	6¾
Electric installation (263 lamps) cost, including gearing, belting, &c.	416	17	9
Depreciation at 7½ per cent. per annum, 6 years	153	10	1
Renewal of lamps, repairs, &c.	101	11	4
Power estimated at 30 I. H. P. at £5 = £150. Depreciation on £150 for 6 years, at 5 per cent. per annum	34	14	4
Coal at 3.7 lbs. per I. H. P. per hour (275 hours per annum), for six years at 6s. per ton	22	2	0
	6) 319	17	9
Cost per annum	263) 52	16	3½
Cost per lamp per annum	0	4	0¼

Cost per light per annum: Gas, 5s. 6¾d. Electricity, 4s. 0¼d.

Gas costs 38.34 per cent. more per light, and as one electric light displaces two gas lights in weaving sheds, gas costs 176.68 per cent. more per loom.

It will be observed that in the foregoing statement, the gas account is simply debited with the average gas consumption and a depreciation charge of 5 per cent. upon the original cost, nothing being allowed for repairs and such other charges as we have previously mentioned.

The account for the electric installation of 263 lights includes dynamos and everything that is necessary to a complete plant. The work in this case was satisfactorily done by the Manchester Edison Swan Company, Limited, and it is gratifying to notice here that, throughout the six years, the working has been of a satisfactory character. The charge for depreciation is 7½ per cent., or one half more than in the case of gas. The power of the steam engine is estimated at 30 I. H. P., that being the proportion of the main engine of the mill, utilized for the purpose of driving the dynamo. Tests subsequently made showed that the actual I. H. P. utilized was only 27 H. P., and at this figure the coal consumption has been calculated. The item for repairs, etc., includes the cost of oil and sundries, besides lamp renewals. It will therefore be seen that full charges have been debited to the electric light account. It may probably be remarked that no charge has been made on account of wages, but as the engineer in charge of the engines has done this small amount of work as part of his ordinary duty, no charge has been made, for no extra expense has been incurred.

Under these circumstances, the electric light shows a very distinct economy over gas, and it must be acknowledged that, in the case of a weaving shed, the result is very remarkable.

The present is a case where the mill engines have had their surplus power utilized in favour of the electric light installation, a case by no means unusual, and one which would undoubtedly be more frequently adopted if mill-owners were more alive to this fact. In a very large number of instances, the power required for the electric light has been in excess of that which could possibly be obtained from the mill engine, and an independent engine has been provided; and in other instances it has been considered advisable to have the power for the electric light quite independent. In these circumstances, again, an economy in the use of the electric light has been proved, and in a succeeding number we propose to give some details of the cost of working, with the additional charge of independent engines.

EXPLOSION FROM UNKNOWN CAUSES.*

BY JAMES C. BAYLES.

THE most unsatisfactory occurrences in the experience of a manufacturer are those from which he suffers damage and learns nothing useful. That there are such incidents, and that they occur with annoying frequency, is unfortunately true. An accident which can be understood and explained always carries some consolation with it. However bad the consequences, one finds comfort in reflecting that they might have been worse, and that the knowledge of how to avert a more disastrous calamity from the same cause is worth what it cost. But when an accident occurs which remains unexplained after anxious days of investigation and sleepless nights of reflection, and which is as liable to occur twice or twenty times as once, very little satisfaction of any kind can be extracted from it by the most philosophical victim. Three such incidents have come under my notice in one establishment. Fortunately, none of them was attended with very serious consequences, as no one was hurt and the damage to property was slight; but in each instance loss of life and great destruction were escaped by so narrow a margin as to make them extremely disquieting. I have recorded them in the hope that, from the experience of others, may be gained what my own careful investigations have failed to reach—satisfactory explanations.

The first of these curious occurrences was the bursting of a 16-inch pipe carrying air under a pressure of about one pound. The pipe was made of light galvanized iron with soldered seams. Into it a rotary fan-blower delivered air, and from it smaller pipes were carried to the furnaces. The blower was run continuously. Neither the main pipe nor its branches had any connection with the gas conduits. Both air and gas pipes delivered into the furnaces; but although the gas was under much higher compression than the air, there appeared to be no good reason why, having free escape in case of leakage, it should ever make its way back into the air-pipe. One warm afternoon in June the main air-pipe exploded with great violence. Every window in the mill was blown out, a considerable section of the roof was raised an inch or two, and in several places it was blown through. The pipe was torn into a thousand pieces, and a wagon-load of fragments not larger than my hand were scattered all over the mill. Several of these fragments were driven edgewise into the roof timbers. The disk closing the end of the pipe was projected against a brick wall with such violence that it remained fastened in place, and is there yet, a mural tablet commemorating the event.

I promptly investigated the accident and learned the following facts: The pipe in which the explosion occurred extended the whole length of the mill. The machines then in use were placed together near the end connected with a blower, leaving some eighty feet of what may be called dead end. It was in this dead end that the explosion occurred. The portion of the pipe from which outlets were taken was substantially uninjured, but seventy-five feet of the eighty feet beyond the furthest outlet were utterly destroyed. The fact that, with very little mending, the part of the pipe which the explosion had not reached continued for some months to supply the machines with air, shows how local the explosion was, and the damage to the mill building gave sufficient evidence of its violence.

The natural explanation of this explosion is that gas found its way into the air-pipe and was packed away in the dead end, and that when mixed with air in explosive proportions it reached a furnace and exploded. I can only say that the most rigid investigation failed to explain how the gas got into the air pipe against the pressure it carried, and why an explosion, beginning at a furnace, should have restricted its effects to the dead end of the air-pipe. It was undoubtedly a gas or vapor explosion, but I can find no other explanation of the presence of gas or vapor than that it was formed by the volatilization of the oil consumed in lubricating the trunnions of the blower. It is conceivable that the large amount of oil consumed by the blower is volatilized, and that it becomes a hydro-carbon gas, which would behave like any other gas of similar composition. This gas, being lighter than air, would occupy the upper part of the pipe, and remain undisturbed while air was drawn from outlets taken from its under side. This light gas may have worked along and accumulated in the dead end of the air-pipe until it reached, in admixture with air, the explosive condition. But whence the spark? And why, if fired by a furnace, was the destructive force of the explosion exerted so far from the point of ignition? This hypothesis assumes that the volatilized or gasified oil of many days running would remain undiffused for as many nights, until its accumulated volume was great enough to explain the phenomena of the subsequent explosion. The best that can be said of it is that perhaps it is better than no theory at all.

Nothing similar has occurred since. We replaced the galvanized iron pipe with a sixteen-inch steel tube, 400 feet long, to meet the increased requirements of the establishment. All the other conditions remain the same, except that a small opening was left in the end of the pipe, which cannot be wholly closed. Whether this is necessary we do not know. The accident taught us nothing whatever, and, so far as we are aware, the same causes are now at work, and may at any time produce like results. The fact that no great damage was done is due to the frail character of the tube in which the explosion occurred. If the sixteen-inch steel tube should ever be destroyed with equal thoroughness by such an explosion as I have described, I hope I shall be in another State.

The second of the curious actions I shall mention was the explosion of a No. 6 Sturtevant blower. I was a witness of this amusing, though somewhat alarming, occurrence, and can speak of it from personal knowledge. The blower was inside the mill, and was driven by two belts from pulleys on the main line of shafting. It was used to furnish blast for the gas generators. Some trouble with the main driving belt necessitated a stoppage of the mill engine, and the blower stopped. In a few minutes the engine started again, and with it the blower. It had been long in use, but as this was its first day of service in that position, I was naturally curious to see how it worked. So I stood watching it. Suddenly it disappeared. One side passed close to me and lodged against a post. Fragments weighing twenty to fifty pounds were distributed in all directions. The explosion was accompanied by a violent report, and succeeded by a dense cloud of yellow-brown, offensive smelling smoke, which rose to the roof, rolled right and left, and finally escaped at the monitor.

Again I investigated, until there remained no questions to ask. That it was not a centrifugal rupture I know without being told. The conclusion was that during the stoppage of the engine some air-gas from the producers had worked back through the pipe into the blower. When the blast was resumed, these products of imperfect combustion were carried with the air current into the producers, and being mingled in explosive proportions, had been fired by contact with the incandescent fuel and exploded. This explanation was never quite satisfactory to me. An explosion which began in the producer could only reach the blower through two branches of a tee, six feet of vertical pipe, an elbow, twenty-five feet of horizontal pipe underground, another elbow, six or eight feet of vertical pipe, another elbow, and four feet, more or less, of pipe connected with the outlet of the blower. Some of these pipes were light and some heavy, and the section underground was much larger than the section at either end of the run. If an explosion violent enough to wreck the blower completely had occurred through the whole length of this very circuitous pipe, I should have expected to find some evidence of it in the pipe itself. It was intact. Not a joint was started. Furthermore, as the blower had been running at least four minutes immediately before the explosion, what could have remained in it to explode? The fact was, however, that the blower was shattered, while the pipe was undisturbed, even the delivery nozzle of the blower remaining coupled to the length of pipe on the mill floor, which was not thrown out of line. As in the first instance, this explosion taught us nothing.

*Abstract of a paper read before the New York meeting of Mining Engineers.

The Ries Electric Traction and Brake Co., of Baltimore, has recently been giving exhibitions in Montreal, where Mr. Albert H. Henderson is looking out for the company's interests. The system appears to command the approval of railroad men.

ON THE STRENGTH OF TRIPLE-RIVETED DOUBLE BUTT-STRAP BOILER JOINTS.

By John H Cooper, M. E.

SOME discussion having arisen regarding the proper method of computing the strength of a triple-riveted butt-strap boiler joint, in accordance with the Philadelphia rule, an example of such a calculation will be interesting and is here given. The Philadelphia law says that, in estimating the strength of the longitudinal riveted seams in boilers, the following two formulæ shall be applied:

Formula A. From the pitch of the rivets subtract the diameter of the holes punched to receive the rivets, and divide the remainder by the pitch of the rivets. The result is the percentage of the strength of the net section of the sheet at the seam, as compared with the strength of the solid part of the same sheet.

Formula B. Multiply the area of the hole filled by the rivet by the number of rows of rivets in the seam, and divide the product by the pitch of the rivets multiplied by the thickness of the sheet. The result is the percentage of the strength of the rivets in the seam, as compared with the strength of the solid part of the sheet.

It is to be assumed that the boiler will fail by fracturing the plates or by shearing the rivets, according as plates or rivets are the weaker; so that in finding the working pressure we take the lowest of the percentages as found by formulæ *A* and *B*, and apply that percentage as the "value of the seam" in the following formula.

Formula C. Multiply the thickness of the boiler plate, expressed in parts of an inch, by the "value of the seam" as obtained above, and again by the ultimate tensile strength of the metal in the plates. Divide the product by the internal radius of the boiler in inches, and by the desired factor of safety. The result is the pressure per square inch at which the safety-valve may be set. (The factor of safety is 5, or, under certain conditions specified in the statute, it may be as low as 4.)

There is no difficulty in applying this rule to ordinary lap seams riveted with one, two, or three rows of rivets, all of equal pitch; but in the case of a joint such as is mentioned above, in which some of the rivets are exposed to double shear and others only to single shear, and in which some have a wider pitch than others, it has sometimes been asked what interpretation should be put upon the rule. The accompanying example shows what the proper interpretation should be, in my opinion.

In the joint about to be considered, the arrangement of the parts is as in the cut. The pitch in the double-riveted part is 4½ inches, the outer row of rivets being pitched 9 inches apart. The rivet holes are 1¼ inches in diameter, the shell of the boiler is 60 inches in diameter, the rivets are of iron, and the shell plates are of steel ¾-inch thick, and having an ultimate tensile strength of 55,000 pounds per square inch. In order to get the relative area of section of the shell plates through the holes pitched 9 inches apart, we have, in accordance with formula *A*:

$$A = \frac{9 - 1.25}{9} = .861.$$

(It is not necessary to calculate this percentage across the other lines of rivet holes, since the joint could not fail by simple fracture along one of these lines unless both the straps broke; and since the two straps taken together are considerably stronger than the solid plate, it follows that no danger need be apprehended from this source.) The area of the 1¼-inch rivet hole being 1.227 sq. in., formula *B* gives us, as the rivet section in the holes of a 4½-inch section of the joint, the following:

$$B = \frac{1.227 \times 4.5}{4.5 \times .75} = 1.636.$$

I have taken the number of rivet sections exposed to shear as representing the number of rows of rivets required by the formula. Two rows of rivets, each through three plates, that is, through two outside plates with boiler shell plate between them, will present 4 sections of the rivets to shear in one unit, *A B C D*, of the joint, and the single row through two plates at 9-inch pitch must be counted as a ***half a rivet.*** The result would be the same if we were to take a 9-inch unit of the joint, as *A E C F*, and then include the actual number of rivet sections exposed to shear within this limit; we should then have 9 sections of rivets within 9 lineal inches of the joint, which would give the same result by the formula as 4½ sections in 4½ lineal inches of the joints. Either case fills the intentions of the City Rules.

We must next understand that formulæ *A* and *B* of the City Rules do not determine the strength of anything; but they do consider the sectional areas of the two components of the joint, which may be taken to stand for relative strength when all the materials of the joint are homogeneous, having shearing and tensional strength the same; and we are to note that formula *C* also supposes the shearing and tensile strength of the rivets and plates to be exactly the same when they have equal areas exposed to the same strain. Therefore, if we admit a difference in strength of the rivets and plates that make up the joint in question, we must search for the exact figures of each before we can ascertain the true value of *B*.

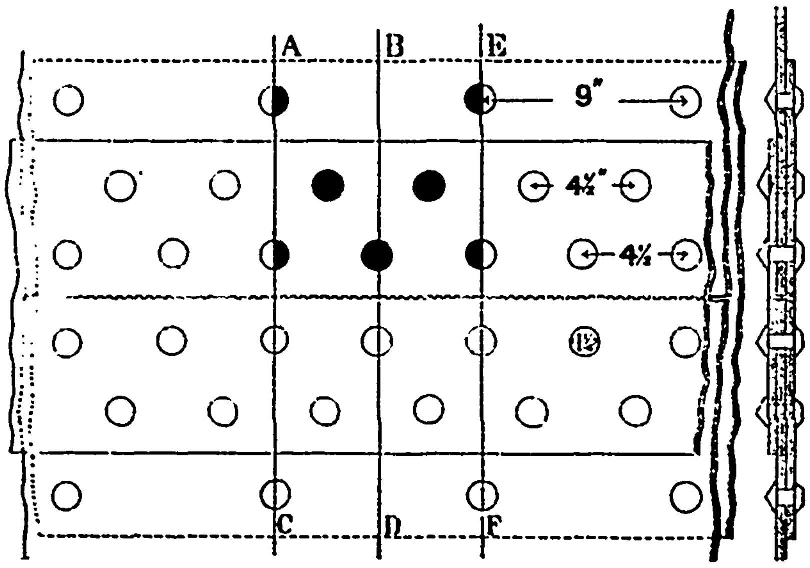
We see by formula *B* that the rivet section is nearly double the plate section. Now we know that the City Rules do not provide for a composite joint, and therefore, as the steel plates of which this boiler is composed are known to be stronger than the iron rivets which hold them together, it is proper that the rivet section should be proportionately greater than the net section of the perforated plates; but *how much* greater is a matter of many opinions and of diverse results of experiments. If we accept Chief Engineer Shock's experiments on bolts of iron subjected to single and double shear, we may take from his tables 40,700 lbs. per square inch for single shear and 75,300 lbs. per square inch for double shear, which numbers represent the shear, pure and simple, and do not include the uncertain element of friction.

With these figures before us (which are amongst the lowest on record), we are prepared to find the true value of *B*, thus:—

The double shear of two rivets, per square inch, = 150,600 lbs.
The single shear of a half rivet, per square inch, = 20,350 "

The sum of which equals . . . 170,950 lbs.

Opposed to this is a corresponding section of the plate, in a unit of the joint, *A B C D*; 55,000 lbs. per square inch, multiplied by 4½ inches, the length of this unit, equals 247,500 lbs.



A Triple-Riveted Butt-Strap Joint.

The two results just obtained must be placed in formula *B* in order to give the weaker material the proper additional area of section, thus:—

$$B = \frac{1.227 \times 4.5 \times 170{,}950}{4.5 \times .75 \times 247{,}500} = 1.13.$$

We see by this result that the effective rivet section is far beyond the requirement of the plates, and might safely be reduced.

Proceeding now according to City Rules we must take the least of the two results found by formulæ *A* and *B* and insert it in formula *C*, thus:—

$$C = \frac{.75 \times .861 \times 55{,}000}{30 \times 5} = 237 \text{ lbs.}$$

This result may be accepted as the working pressure allowed in this boiler; for it is in accordance with the spirit of the City Rule, although it embodies elements that do not lie within the limits of the ordinance.—The Locomotive.

VALUABLE EXPERIMENTS WITH A STEAM BOILER.

WE are informed by the Electrician, in accordance with the instructions of the Executive Committee of the Manchester Steam Users' Association, a series of experiments have been carried out by Mr. Lavington E. Fletcher, their chief engineer, to ascertain the result of injecting feed-water into a boiler when short of water, and with fires burning. These experiments, as may be readily understood, involved no little danger; but the results are very valuable, although they may not all be applicable in their present form to high-pressure boilers. Their principal object was to prove that the common idea that if feed-water be injected when the water in the boiler has fallen so low that the crown of the furnace is red-hot, a sudden and uncontrollable steam pressure will be generated which will blow the shell to pieces. The previous experience of the Association has been that explosions from shortness of water are rare, and that with internally fired boilers they are not very destructive. The furnace crown is rent, but the shell is uninjured, so that unless the attendant is standing directly in front of the furnace in a line with the rush of steam and water, but little injury need occur. Fatal accidents have taken place when attendants have discovered that the water was low, and were engaged in drawing the fire.

A full-sized mill boiler of the Lancashire type was laid down by the Committee on an open piece of ground, suitable barricades being erected, behind which were supplementary water gauges, pressure gauge, and indicators, showing movements of the furnace crowns. After numerous experiments, the red-hot state of the furnace crowns was indicated to the observers by the fusion of a zinc disc screwed to the plate, and connected with a wire strained by a counterpoise. This took place in some cases about 20 minutes after the water had been brought down to the level of the furnace crowns. The feed was turned on either through an ordinary dispersion pipe, or through one which was specially arranged to make the test more severe, by throwing the water directly on the hot plates. Not only was there no sudden rise of pressure, but on the contrary, the pressure at once began to fall in those experiments in which the safety valves were blowing, and even when these were fixed, and all the steam bottled up, the rise was by no means sudden or serious. The report, which contains several other results of great interest to engineers, does much credit to the Association, whose careful inspection of boilers insured by them, and whose readiness to give advice and information to all steam users, are so highly appreciated by those who have had dealings with them.

STOP THE LEAKS.

WITH the results of leaks about boilers and engines so well known, it is certainly strange, says the American Machinist, that so many of them are to be found. About a boiler a leak begins immediately to waste away the material, the rapidity with which this wasting process goes on appearing to be controlled to some extent by the quality of the water used; it goes on, however, whatever the quality of the water. Sheets are thinned down, and rivets are nearly destroyed, till often the danger of an explosion becomes imminent.

It is not always at the place of the leak that the greatest damage is done. The water from the leak may find its way to some part of the boiler resting upon a support, or to some part against which the brickwork rests, and although the leak may be small, the shell may be rapidly wasted away.

Not long since, we saw a boiler that was solidly covered with asbestos. A small drip appeared at the bottom of the boiler, and, owing to the inconvenience of coming at it, and the desire to keep steam on all the time, the leak was permitted to go. Finally the boiler was blown off, and a search made for the leak, which was several inches from where the drip appeared. It was found that for a spot about twice as large as the hand, the shell—of iron—was eaten away to one-half its original thickness.

It is proper to say that the asbestos had nothing to do with the corrosion; it would have been the same with any other covering. The trouble was not with the covering at all, but in the fact that the insignificant leak had been permitted to get in its work for two months or more.

Flanges riveted to boilers sometimes get to leaking slightly, and, especially if on the under side, a slight leak may go on for some time unnoticed, unless such places are systematically examined. The result is frequently a seriously weakening of the shell under and around the flange.

Leaks through the stuffing-boxes of steam engines score the rods, and in time makes it impossible to keep them packed tight except they are put under enormous friction. It is only fair to say, in this connection, that some steam engine builders make so little allowance for stuffing-boxes that it is well on towards impossible to keep them packed against leakage. But every should be made to find some way of so packing them.

Leaks around joints—cylinder heads and chest bonnets, and the like—soon eat away the metal, bringing about a condition difficult to contend with. The moral is: Stop all leaks around boilers and engines, not alone, or principally, perhaps, for the steam wasted, but for the damage such leaks will do.

ELECTRICAL

Messrs. W. H. Verity & Sons, of Exeter, Ont., have purchased an $800 electric plant with which to light their foundry.

The Fort Wayne Electric Co. are said to be on the look-out for a suitable location for a Canadian branch manufactory.

Messrs. Campbell & Stevens have arranged to light the Kent Mills, Chatham, with incandescent electric system. The wires have been placed on four floors.

The Gould Bicycle Co., of Guelph, has asked what inducements the city of Kingston would offer for the formation of a joint stock company to manufacture electric motors.

The St. Johns Electric Light Company, of St. Johns, Que., has been incorporated with a capital stock of $50,000, and will manufacture dynamos, motors, and other electrical appliances.

The Reliance Electric Mfg. Co. are said to be on the look out for a more central location for their works. It is understood to be their intention to engage in the manufacture of street railway apparatus.

The City Council of Ottawa has taken the contract for the construction of the electric street railway out of the hands of Messrs. Howland & Gemmill, and given it to a local firm, Messrs. Soper & Ahearn.

Mr. P. Bowler who will represent the interests of the Royal Electric Co. on the Pacific Coast was presented by his associates in the Montreal works with a gold watch, chain and locket prior to his departure.

The City Council of London has decided upon accepting the offer of the Ball Electric Light Co. to supply an electric plant of 184 lamps at $35,750, and to operate the same at $10,000 per year for a term of four years and two months.

The American Street Railway Association, which met in Buffalo on Monday, had upon its programme for discussion, "The perfect street railway horse." The opinion is rapidly gaining ground that the perfect street railway horse is an electric motor.—Toronto Globe.

Negotiations have been finally closed for the amalgamation of the Kingston gas and electric light companies. The electric light stock was accepted at a valuation of $32,000. A large service will be secured, so that the lights can be run all night, and at the very lowest cut prices.

A new telephone company has been instituted by local capital at Kingston, and it is said to be the intention to extend operations to other towns. The charge for instruments has been reduced to $20 per year, or $30 for two instruments in use by the same firm. It is the intention to use only metallic circuits.

A Mr. Fuller recently brought action in the courts of Montreal to set aside the resolution of the council of that city extending and adding to the contract of the Royal Electric Co., as being illegal and beyond the powers of the corporation. The court confirmed the authority of the council by setting aside the action.

Mr. Paul Brion of Paris, is at present in Canada for the purpose of furthering a new idea in electricity, which he claims will do in 76 hours what the ordinary method requires six or seven months to finish, and by which perfect leather is obtained. Mr. Brion is making experiments to prove his process to Canadian tanners.

We are informed by the Amherst Gazette that an electric company has been awarded a contract for lighting the coal mines near North Sydney with the incandescent system. The company is to put in twenty-five lights, some of which will be 800 feet under ground. This will afford absolute safety from fire damp, and give the miners a better light to work by than formerly. Sydney Mines will be the first mine lighted with electricity in Nova Scotia.

M. Girard has suggested a simple process for preventing the creeping of salts, which weakens and destroys a cell. The idea is to apply with a brush a light coating of vaseline over the surfaces which require protection. Vaseline is unchangeable in air, is easily applied, and resists the action of a great number of chemical agents. An objection, we think, to the employment of this material lies in its stickiness—dust and all kinds of dirt being liable to adhere. A very ready method is the employment of melted wax; it has the advantage of presenting a smooth and hard surface.

The following joint stock companies are gazetted: The Widdifield Electric Brake Co., with Anson T. Button and W. P. Widdifield of Uxbridge, S. S. Fuller of Stratford, James Lockhart, S. F. McKinnon, T. R. Fuller and Hugh Blain of Toronto, charter members; capital stock $300,000, and head office at Toronto. Niagara & Queenston Land & Electric Co., with S. J. Dawson, M.P., of Port Arthur, J. A. McCrea of Niagara Falls, A. Larner Aubin of St. Heliers, Jersey, England, W. H. Dean and W. H. Langlois of Toronto as promoters; capital stock $600,000 and chief office at Toronto.

Several years ago Mr. Alexander Watt, in one of his papers on the electrolysis of metallic salts, suggested an improvement in connection with ornamental brasswork, which consists in depositing copper electrolytically upon certain portions of the work, leaving the remaining surfaces of the brass in the natural color of the alloy, the contrast between the pink-red hue of the copper and the yellow metal produces a very pleasing effect. The idea appears to have been somewhat extensively adopted for some classes of brasswork, and might with advantage be applied to electric light fittings, as electroliers, brackets, etc. Mr. Watt informs us that the following formula will be found useful for a coppering bath for brass: Sulphate of copper, one-half pound; oil of vitriol, one-half pound, and water, one gallon, worked with a copper anode, using a current of four or five amperes. In cases where it is desired to produce a brown or black stain on certain parts of a brass article, as in scrollwork, for example, this may be effected by brushing over such parts, after they have been electro-coppered, with a solution of sulphide of barium (five grains to one ounce of water), the article being well rinsed after the desired effect is produced.

The following proportions for fusible alloys may be of interest—they are due to Wersback, and have been used in actual practice:

Lead.	Tin.	Bismuth.	Melting points in degrees Centigrade.
1	1	4	93·8
5	3	8	94·4
2	3	5	94·4
1	4	5	118·8
1	4	1	125·0
1	1	1	241·1
1	2	1	167·7
1	3	1	167·7
1	3	1	200·0

In a recent number of La Lumiere Electrique M. Henri Wilbrant states that he was lately able to localize a fault in an underground electric light current to within five metres (the total length of the circuit being 900 metres) by the following method. He looped together the lead and return at both ends, and connected a battery, one pole of which was to earth, to one junction. In each lead an ammeter was inserted. If C_1 = current flowing to the earth along one branch of the circuit, and C_2 = current flowing to the earth along the other branch x; and if L = the total length of the looped cable, we have $\frac{C_1}{C_2} = \frac{x}{L - x}$ or $x = \frac{C_1 L}{C_1 + C_2}$. The two cables must, of course, be identical and of the same resistance per unit length throughout, in order that their lengths may be taken as proportional to their resistance.

The Dominion Government has substituted electricity for gas in the penitentiary at Kingston, Ont. An electric plant costing about $15,000 has recently been installed. It includes two large dynamos, one of which, with an engine, is kept in reserve ready for service in case of emergency. Twelve or fifteen miles of wire have been used in the service, and attached to it are 912 lights, ranging from 10 to 32 candle power. Last January the work was begun, and was a difficult undertaking. Wires had to be manœuvered through great piles of solid rock and underneath oak floors of great thickness. Cables are laid underground in conduits throughout the prison and to the warden's residences. Poles are used in carrying the current to points on the farm. The wires are all encased in wood. Each cell is lighted with a ten candle power lamp. There is no danger from contact. The lamps require a pressure of 105 volts, with from one-third to one ampere of current, according to the candle power. The cost for running the lights will be about the same as gas. The life of each lamp is 800 hours. Two huge boilers are used for generating the power and are situated in front of the dynamo room in the engine building. Both dynamos can be used separately or together. They have a capacity of 700 lamps of 16 candle power. The lights are on two circuits. The yard, corridors, residence and farm lights are on one circuit and run all night; the cell lights are on another and run until 9 o'clock. The lights can be cut off in the dynamo room, or by switches in the corridors. The cell lights can be cut off by wings or by tiers.

ELECTRIC MOTORS IN WORKSHOPS.*

By C. Frewen Jenkin, B. A.

THE author describes various applications of electric motors to drills, tube cutters, and cranes. He has used cast-steel in the construction of the field-magnets, and gives the results of tests of the magnetic properties of this material. Tests of two different qualities of castings show that cast-steel lies in an intermediate position between cast-iron and wrought-iron in its suitability for magnets. From the cheapness with which castings may be obtained in any complex shape, in order to simplify the framework of the motor, the advantages of cast-steel are important.

Among the factors which determine the design of small motors it is pointed out that a small armature can be easily wound for running with 50 volts, but becomes troublesome to wind for 150 volts; thus the size of the armature must be kept sufficiently large to make the winding fairly easy. As to whether the motor is to be shunt or series-wound; in a series-wound motor the magnets may be of any form desired, since the winding consisting of comparatively few turns of thick wire can be put on by hand. But in a shunt-wound motor it is almost essential, especially in high voltage machines, to make the magnet cores straight, so that the winding can be put on in a lathe. This difference in the shape of the magnets causes small shunt-wound motors to be heavier than series ones, since it is impossible to arrange them so compactly. When the load varies much, the difficulty of governing series motors becomes very serious. This difficulty does not arise in shunt or compound-wound motors.

In a rough preliminary experiment on a common drilling machine, it was found that to drill a ¾-in. hole through Bessemer steel, at the rate of about a ½-in. a minute, took about one-fifth horse-power. The speed chosen for the electric drill was 60 revolutions per minute, running light, or about 45 loaded. The motor was designed to run at 3,000 revolutions, and a steel worm on the shaft was arranged to gear into a brass wheel on the drilling spindle. The armature was a gramme ring 4-in. in diameter; it was wound with 480 turns of No. 18 for 50 volts, and 1,600 turns of No. 24 for 150 volts. There were 40 sections on the commutator. The magnets were wound with 9,800 turns of No. 27, the resistance being 332 ohms for working at 150 volts. Under a break test, with the 50 volt armature, the results were: 2,950 revolutions, 26·6 amperes, 47·7 volts, B.H.P. 1·05; efficiency, 59·2 per cent. Lightness was considered of greater importance than very high efficiency. The weight of the motor alone without the drilling spindle cannot be given quite fairly, since the magnets have been used to form part of the framing for carrying the drilling tackle. The weights of the different parts, so far as they could be taken to pieces, are as follows:—Magnets, bearings and brushes, 32 lb. 12 oz.; armature, 8 lb. 8 oz.; boring tackle, 15 lb. 4 oz.; total, 56 lb. 8 oz. These figures bear out the claim made by the author for the advantages of cast steel over cast iron; and the general design of the drill shows how much more cheaply the parts can be cast than forged. This was a shunt machine. A ¾ inch hole could be drilled through a ¾ inch iron plate in 45 seconds, the electric power required being 0.732 horse-power.

The next motor that the author designed was for driving a small saw for cutting tubes out of boilers. The copper tubes in locomotive boilers have to be renewed from time to time, and the machine was designed to saw them off just inside the tube plate. A plug is fitted with two eccentrics. The saw spindle runs in a bearing in an inner eccentric, and is either central or eccentric in the plug, according to the relative position of the two eccentrics. The saw is brought into its central position while the plug is introduced into a tube end, and is then thrown out of centre, so that it cuts into one side of the tube. By turning both eccentrics together the saw is made to cut all around the tube. The magnets of the motor were curved, and were series wound. They were made from a single wrought-iron forging, on which were bolted two phosphor bronze brackets forming the bearings. The tests were not carried out at full load; they gave: Watts absorbed 2,600 B. H. P. 2·8, efficiency 71·7 per cent. The weight of the motor alone is 60 lbs. The armature is 5 in. in diameter, and of the Pacinotti-Gramme type, with only 1-32 in. air space. It has 40 slots ½ inch deep, and is wound with 840 turns of No. 19. Each magnet has 190 turns of No. 14. There are three times the number of turns on the magnet which are required for running at full speed, 63 turns being then sufficient. The extra turns were put on to keep the speed moderate on light loads.

A 10 horse-power motor of the Manchester type was constructed for driving a travelling crane. In order to avoid sparking, a pair of small series-wound magnets were placed on opposite sides of the armature, so that their poles were on a horizontal diameter, and were over the section being short-circuited by the brushes. This method is described in Swinburne's patent, No. 6,754, 1887. It was found to answer admirably and entirely prevented sparking, no matter how quickly the load was applied. The power required to drive the four belts on the crane was 2.85 horse-power. To lift eight tons at about 4 ft. per minute, 6.5 horse-power additional were required, and to lift 4 tons at about 9 ft. per minute, 7.0 horse-power. Traversing at 47 ft. per minute took less than 1 horse-power. By arranging the motor to drive the rope by which the crane was formerly worked, it was found that there was a saving of 8.4 horse-power, or 43 per cent.

After the failure of several forms of friction gear a magnetic clutch was made in the form shown in Fig. 1.

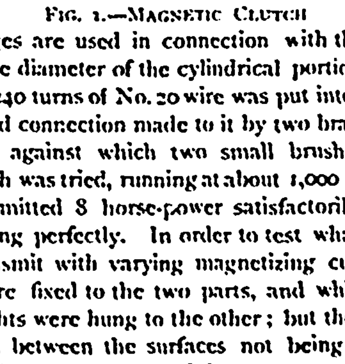


Fig. 1.—Magnetic Clutch.

The flanges are used in connection with the lowering gear. The diameter of the cylindrical portion is 6½-in. A coil of 240 turns of No. 20 wire was put into the recess shown, and connection made to it by two brass rings on the back, against which two small brushes pressed. This clutch was tried, running at about 1,000 revolutions, and transmitted 8 horse-power satisfactorily, stopping and starting perfectly. In order to test what couple it could transmit with varying magnetizing currents, two levers were fixed to the two parts, and while one was held weights were hung to the other; but the coefficient of friction between the surfaces not being sufficiently constant the test was not satisfactory.

* Abstract of a Student's Paper, which was awarded the Miller Scholarship, Institution of Civil Engineers.

EMPLOYER'S LIABILITY.

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ONE who employes servants in and about the conduct of a business which requires the use of machinery, thereby incur certain attendant liabilities which arise out of what is known in law as the relation of master and servant. It is the primary duty of the master to furnish his servant with appliances so constructed that, in the exercise of due care, they may be used with reasonable safety, and they must be, and be kept, without defects which will result in danger to those who use them properly. And a servant has the right to presume that the appliances furnished by his master are safe and sound, and he is under no obligation to give them any more examination or inspection than the work required of him in connection with them involves. But it does not follow from this rule that the law requires the master to furnish such machinery as may be operated without danger to the servant under any circumstances, for in the nature of things this could not be so. There are many machines, which, when operated with the utmost care, still result in subjecting the operator to a greater or less degree of danger, and whatever this danger may be, if it is unavoidably connected with the proper operation of the machine, the servant is presumed to make his contract of employment with reference to that danger and accept it as what is legally termed one of the ordinary risks of the employment.

The ordinary risks of employment which are assumed by the servant and from which the master is relieved, may be, in general terms, said to be all those dangers incident to and necessarily arising out of the employment against which no protection can be afforded, in the exercise of ordinary prudence and foresight, without impairing the ordinary operation of the machine and infracting upon the ordinary duty of the servant. Having constantly in view the proper exercise of the duty of the servant to the master, it is incumbent upon the master to provide every safeguard which a prudent man would exercise, and the test in such a case as to what a prudent man would do is very often in law, the common sense proposition as to whether or not the master would himself undertake the work under the circumstances in which he requires his servant to labor.

In addition to the ordinary risks of employment, the servant assumes the danger arising from any defects in machinery of which he has notice. This notice may be either actual or constructive. That is, it may be knowledge which has come to him either from his own observation or from information furnished to him by or on behalf of the master, or it may be knowledge which he does not possess but which he would have had had he exercised his ordinary power of observation or made the ordinary inquiries which a prudent man under the circumstances would make. He is not charged with the duty of making a thorough investigation, for he has a right to assume that the appliances furnished him are not defective, but he is charged with notice of all defects which are so plain that the exercise of ordinary caution would notify him of them, and he is bound to take notice of irregularities in the operation of the machinery not in themselves dangerous but which might be caused by disarrangements which would naturally result in danger.

It is the duty of the master, in addition to furnishing safe appliances, to know that they remain in a safe condition, and defects which develop in the course of the operation of the machinery, unless they are of such a nature as to bring themselves to the notice of the servant operating it, will charge him with liability for resulting damages, even in the absence of actual notice to him. He is bound as well to keep his machinery safe as to make it safe.

While the rule charging the master with liabilities is broad and somewhat severe, it is founded in reason and equity and is seldom carried to an unjust extent.

Where a servant is employed about a machine which presents no danger when properly operated, the fact that he is injured in its use raises a presumption that he did not exercise ordinary care and the master is exonerated from liability. (Zurn vs Tetlow, 19 At. Rep. 504). The fact that where a servant is injured by falling, in an unusual manner and purely by accident, upon the knives of a machine, if the knives had been covered the accident would not have occurred, does not charge the master with liability when it is not shown that it is practicable or usual to cover such knives, or that such consequences could reasonably be expected to follow from leaving them uncovered. (Young vs Burlington Wire Mattress Co., 44 N. W. Rep. 693). A foreman who orders a lad fourteen years of age to oil and wipe gearing, while the machine is in motion, without giving him careful instructions and full warning of the dangers, thereby subjects his employer to liability for any injury the lad may sustain, and it is a serious question whether or not one so young can be held to assume the risks incident to an undertaking involving so much danger. (Neilon vs Marinette & M. Paper Co., 44 N. W. Rep. 772). It is incumbent upon a servant who seeks to recover for injuries received by reason of defects in machinery, to show that such defect caused the injury complained of, and the specific nature of the defect alleged, and where the master alleges by way of defence that the servant had knowledge of the defect, he must prove that by a preponderance of evidence, and a finding by the jury that there is no evidence on which to base a finding on that point, is, in law, equivalent to finding against the master and in favor of the servant. (Sherman vs Menomonee Lumber Co. 45 N. W. Rep. 1079).

ELIMINATING THE TEMPERATURE ERROR IN VOLTMETERS.

WE read the following in L'Electrician: In all voltmeters based upon electro-magnetic action, the current passing through the bobbin depends on the difference of potential to be measured, and on the resistance of this bobbin. If this resistance is increased by heating, the instrument is retarded, and if when it has been calibrated the heating caused by a given difference of potential producing a continuous current in the bobbin has been taken into account, the voltmeter can only give exact indications on condition that practically the same voltage is always maintained at the terminals. In order to remedy this incovenience, Dr. Kahle has conceived a method of winding the bobbins of voltmeters, which renders their indications independent of the temperature. This result is obtained by winding the bobbin with two parallel wires, acting in opposite directions. The principal wire magnetizes, and the secondary wire demagnetizes the core of the voltmeter: but as the auxiliary wire has a greater resistance than the principal wire, the magnetising action predominates. By taking for the principal wire a metal whose coefficient of temperature is higher than that of the secondary wire, we can easily see that a rise in temperature reduces both the magnetising action of the principal circuit and the demagnetizing action of the secondary circuit. In order that the resulting electro-magnetic effect may remain the same, it is necessary that the difference between the ampere-turns of the two bobbins should be the same for all temperatures, a result which is obtained when the ratio of the two windings is the same as that of their coefficients of temperature.

It is evidently advantageous to employ for the principal wire a metal of low specific resistance, and for the auxiliary winding one of high specific resistance. As, however, the coefficient of temperature of good conductive metals is generally somewhat high, and that of bad conductors rather too low, the condition indicated above for establishing a system of compensation cannot be fulfilled without an accessory arrangement, which consists in establishing an external resistance, the coefficient of temperature of which is not very high, in series with the principal wire. Dr. Kahle has constructed, on these principles, voltmeters whose indications remain quite independent of the temperature.

Stephen Nairn, of the Winnipeg oatmeal mills, has commenced the erection of a 28,000 bushel elevator adjoining his mills.

An Italian contemporary says that iron articles can be protected from rust by sinking them near the negative pole of an electric bath composed of ten liters of water, fifty grammes of chloride of maganese, and 200 grammes of nitrate of ammonia. Under the influence of the current the bath deposits on the articles a film of maganese, which prevents them from rusting.

Please mention the ELECTRICAL, MECHANICAL AND MILLING NEWS when corresponding with advertisers.

FLOUR.*

FLOUR may be defined as grains of wheat, separated from the outer husk or covering in which the seed is enveloped, and reduced to a powder. The term "flour," when used without a qualifying word, is understood to be wheaten flour, flour of other grains having the names of the grain prefixed.

We are all familiar with the grain of wheat and its structure, its firmly adherent fibrous coat, with the fine hairs at one end and the germ at the other. Within is a mealy portion composed of a large number of cells, containing principally starch and gluten, with smaller amounts of oil and mineral matter. It is the object of milling to reduce the floury portion of the grain to a fine powder without injuring its physical condition, and, at the same time, excluding all portions of bran and germ which would injure its color and baking properties.

We gain some idea of the magnitude of the miller's task when we consider the size of the grain of wheat. In one bushel we have about 700,000 grains, and in order to obtain 100 pounds of flour, not less than a million and a half of these grains must be treated.

As has been said, the principal substances found in the grain of wheat which are to be excluded from flour are the husk or bran and germ. The fibrous irritating nature of bran and its indigestibility are well known. As to the germ or embryo, we must remember that the grain, except outermost coverings, is a seed, and the germ is the young wheat plant already formed in the seed and only awaiting the proper conditions to sprout. In all seeds provision is made for the nourishment of the embryo until it is so strongly established that it can take care of itself. This store of food is usually in the form of starch, but the young plantlet can only take in its food in the form of mucilage or thin syrup. There is, therefore, associated with the germ a ferment, as it is called, which has the power to convert starch into a mucilaginous product. This power it exerts whenever the seed obtains moisture and warmth. This is well seen in the process of malting, where grains of barley are caused to sprout and then killed by application of dry heat. The starch of barley is found to be largely converted into a syrupy substance.

With the gradual reduction system experience has shown that 135 pounds of wheat yield 100 pounds of flour variously graded, the remaining 35 pounds being cattle feed and waste in milling. Let us now note the composition of wheat, and also flour from same wheat to perceive the changes undergone in milling, and to credit each ingredient with its proper function:

	Wheat ready for rolls.	Flour—straight roller.
Water	9.07	11.83
Ash	1.79	.51
Oil	2.75	1.72
Carb. hydrates	70.37	71.77
Fiber	1.68	.26
Albuminoids	14.35	13.91
	100.00	100.00
Gluten	11.88	

Now, if the germ be allowed to enter the flour, its associated ferment acts upon the starch, producing a sticky mass, with which it is difficult to obtain a light loaf of good color. In the bran, too, there is a ferment which acts in a similar way. Both, therefore, are to be excluded as fully as possible from the flour. * * *

Let us see that we understand the terms used in the analysis. Ash mineral matter, which represents food for formation of bone, is chiefly phosphates. Albuminoids are very valuable ingredients of flour, and consist chiefly of what is called gluten. We may form an idea of the nature of gluten by considering the difference between starch and flour. Starch when moistened with cold water forms a mass which is brittle and crumbles, whereas flour, when so treated, forms an elastic mass. The cause of this elasticity in flour is in the gluten, and wheat is the only one of our cereals containing any notable amount of it. Now, the gluten is the body whose tenacity and elasticity when in the dough enables it to hold the bubbles of gas which are formed in process of rising, and flour deficient in gluten cannot therefrom make a light bread. It follows that gluten is a necessary ingredient of a flour, for some purposes more being required than for others.

But now we come to a point where we can understand the grading of flour. Flour is graded principally on two points, viz., strength and color, the stronger and whiter a flour the greater its value. But what is understood by strength of flour? It is the capacity to produce a well-risen loaf. In other words, a strong flour is one which possesses a large quantity of gluten of good quality; a flour that is not strong is low in percentage of gluten. It so happens that, while gluten is scattered through the entire floury part of the grain, it is present in greatest quantity in the portion next the husk, the very part which is also richest in oil and mineral matter. The outer part of the grain differs from the inner or central part in degree of darkness, so that it is not very difficult for the miller to separate the two portions, and obtain a flour composed principally of the outer part, and another which represents the inner floury portion. In the process of milling the flour from the outer portion becomes more or less contaminated with particles of bran, and is therefore darker in color than that from the interior.

From the roller mills usually three grades of flour are produced in about the following proportion: "Strong baker's," 54 per cent.; "patent," 40 per cent.; "low grade," 6 per cent. The "strong baker's" is the flour from exterior portion of the grain, containing large proportion of gluten, somewhat dark in color on account of presence of branny particles, and also because of comparative high percentage of oil matter. It is used principally by bakers for producing the ordinary brown loaf, its large amount of gluten allowing production of large loaves which may be baked without pans.

"Patent" is the flour from the inner portion of the grain, which contains less gluten than baker's, but is whiter in color. It is used for making finer qualities of bread and for family use, the strong baker's being too strong, forming a mass that offers too much resistance to passage of gas to be suitable for fine pastry.

The "low grade" is a very dark flour, containing very little gluten, but considerable quantities of bran and germ are present. It is not used to any extent in bread-making, but is used in manufacturing and as a food for cattle.

Analysis of "strong baker's" and "patent" will show clearly the difference:

	Strong Baker's.	Patent.
Water	12.18	11.48
Ash	.62	.39
Oil	2.00	1.45
Carb. hydrates	69.99	73.55
Fiber	.33	.18
Albuminoids	14.88	12.25
	100.00	100.00
Gluten	12.00	

I cannot leave this part of my subject without taking up briefly the question of the relative values of graham whole meal, entire wheat flour and white fine flour.

* * * * * * *

Since graham flour is simply the cleaned wheat ground, the analysis of the wheat is, to all intents and purposes, the analysis of graham flour. Let us compare the graham with patent flour:

	Graham.	Patent.
Water	9.07	11.48
Ash	1.79	.39
Oil	2.74	1.45
Carb. hydrates	70.37	73.55
Fiber	1.68	.18
Albuminoids	14.35	12.95
	100.00	100.00
Gluten	11.88	10.85

We find fine flour to contain much less ash mineral matter or bone food, being only one-fifth in quantity and much less fibre. Undoubtedly the fine flour would be a more perfect food did it contain a greater percentage of ash, but other foods supply this in sufficient quantity. Again, we find a higher percentage of albuminoids and gluten in the graham; but it must be kept in view that there is in graham a very much larger amount of fiber, nine times the amount in fine flour. Now this fiber is bran and germ, and the presence of these in graham flour is the weak point of such flour. As already pointed out, in both bran and germ there is a ferment which acts upon the starch and converts it in part into a sticky substance called dextrine. This excess of dextrine, to which is due the sweetness of graham bread, causes the dough to become dark, soft and clammy, on which account the loaf is apt to become sodden and indigestible. Any one who has tried to make a graham loaf knows how difficult it is to obtain a light loaf. The baker's graham is only partly graham.

Another objection to graham flour is the presence of the branny particles, which besides being unpalatable, cause irritation in the alimentary canal, leading to a quicker removal of the but partially digested food.

Taking all things into consideration, it is evident that white bread is really cheaper, weight for weight, to the poor man than the bread made with unbolted flour. Improvements are continually being made in milling, and in the near future it is probable we shall have a fine white flour containing all the nutritious matter of the grain and in the best physical condition.

*From a lecture delivered before the Natural History Society, Montreal, by Prof. J. T. Donald, M.A.

USEFUL INFORMATION

An alloy that expands in cooling, and is suitable for repairing cracks in cast iron, is made with nine parts of lead, two of antimony, and one of bismuth.

According to Le Genie Civil, a French machine tool builder, M. Burot, of Angouleme, is turning out paper pulleys for power transmission, based on the principle of the paper car wheel. The pulleys have metal hubs and arms on which the soft paper mass is mounted and has been compressed. After drying, the paper pulley is heated in a bath of linseed oil and resin to give it greater resistance against the influence of moisture. The pulleys are said to be very light and of low price and to give excellent results in practice.

ALUMINIUM BRONZE.—The Brass Worker says that representatives of the government began a series of experiments to test the strength of aluminium bronze at the Watertown Arsenal, Boston, July 18. It is proposed to use this metal in place of manganese bronze, which is at present in use, and is more expensive. The tensile strength of aluminum bronze proved to be 90,000 pounds to the square inch, and the transverse strength 6,600 pounds to a one-inch square bar. In the first case the strength is in excess of any other metal as far as is known, and in the second case is in excess of everything but the finest crucible steel.

HOW TO CLEAN GUMMY MACHINERY.—The simplest and most efficacious method of thoroughly cleaning the various parts of machinery that have become gummed and dirty by the use of fat oils, for lubricating purposes, is by using a strong soda lye. For each 1,000 parts by weight of water take about 10 to 15 parts by weight of caustic soda or 100 parts ordinary soda. Let the solution boil and enter the parts to be cleaned; either boil them in this lye or let them steep in it for some time. All the dirt and oil resin is completely dissolved thereby, and it remains only to rinse and dry the parts. The action of the lye is such that it enters into combination with the oil and forms soap, which is readily soluble in water. In order to prevent the hardening of the lubricant on the machinery parts, it is only necessary to add about one-third kerosene. An occasional lubricating with kerosene alone is to be recommended.—Glasgow Engineer.

The purest water, according to the *Locomotive*, often is the most active in corroding and pitting plates, and this makes it probable that the active substance in some cases at least, is air. It is well known that water is capable of dissolving a considerable amount of air; in fact, it is this dissolved air that enables fish to breathe. It is not so widely known, however, that the oxygen of the air is more soluble than nitrogen. If a small quantity of water be shaken up in a bottle, it dissolves some of the enclosed air, and when that is afterward driven off by boiling, and analyzed, it is found to consist of oxygen and nitrogen in the proportion of 1 to 1.87, instead of 1 to 4, as in the natural air. Thus, the dissolved air, being more than twice as rich in oxygen as common air is, and being brought into more intimate contact with the metal by means of the water that holds it in solution, exerts a correspondingly more noticeable effect. It is probable, too, that water plays some other important action in connection with the oxidation of metals, for it has been found by recent experiments that pure oxygen will not combine with things that it has the greatest affinity for, providing it is perfectly dry. Even the metal sodium, which has an intense affinity for oxygen, may be heated in it to a very high temperature without combination, provided sufficient precautions are taken to exclude the slightest trace of moisture. It appears, therefore, that water plays a most important part in the oxidations of metals by air, a part, indeed, that we cannot explain, and that we really know but little about.

A remarkable electrical transmission plant has recently been put down in Nevada, in the Comstock lode and Sutro tunnel. At the Nevada mill there is a 10 foot Pelton water-wheel, supplied by a pipe line delivering water from the side of Mount Davidson under a head of 460 feet, giving 200-horse power. Here the water is caught up, delivered into two heavy iron pipes and conducted down the vertical shaft and incline of the Chollar mine to the Sutro tunnel level, where it is again delivered to six Pelton water wheels, this time running under a head of 1,680 feet. Each of the six wheels is but 40 inches in diameter, weighing 225 pounds; but with a jet of water less than five-eights of an inch in diameter they develop 125-horse power each. On the same shafts, which revolve 900 times per minute, are coupled six Brush dynamos, which generate the current for the electric motors that drive the stamps in the mill above ground. The result is that, where it took 312 miners' inches of water to operate 35 stamps, but 72 inches are now required to run 60 stamps. This is the greatest head of water ever used by any wheel, and marks an era in hydraulic engineering. A solid bar of iron thrown forcibly against the jet rebounds as though it had struck against a solid body instead of a mobile fluid. The velocity of the jet, where it impinges against the buckets of the wheel, is two miles per minute, 176 feet per second. The wheels weigh only 1.8 pound per electric horse power when working with the maximum head, figures which are only surpassed by the Brotherhood engines used for driving torpedoes, and possibly by the Parsons steam turbine. At the Terni steel works in Italy there is a Girard turbine using water under a head of 1,000 feet, and which we believe is the greatest head used in Europe.

PUBLICATIONS.

Perhaps the ablest critical review that has appeared of late on "Cardinal Newman and the Catholic Reaction" in England is found in Prof. J. T. Bixby's critical paper in the October *Arena*. Prof. Bixby is considered by many competent critics, the ablest magazine contributor, in his peculiar line of thought, in America, and his frequent contributions have done much in placing the *Arena* in its present enviable position as the leading review of progressive, ethical, educational, economic, and religious thought on this continent.

LUMBER PRICES.

LUMBER.

CAR OR CARGO LOTS.

1¼ and thicker clear picks, Am. ins..	$30 00@	32 00
1¼ and thicker, three uppers, Am ins.		37 00
1¼ and thicker, pickings, Am ins.....		27 00
1 x 10 and 12 dressing and better......	18 00	20 00
1 x 10 and 12 mill run	13 00	14 00
1 x 10 and 12 dressing.......	14 00	16 00
1 x 10 and 12 common....	12 00	13 00
1 x 10 and 12 spruce culls............	10 00	11 00
1 x 10 and 12 maple culls...		9 00
1 inch clear and picks.......	28 00	30 00
1 inch dressing and better..	18 00	20 00
1 inch siding, mill run......	14 00	16 00
1 inch siding, common	11 00	12 00
1 inch siding, ship culls.......	$10 00	$11 00
1 inch siding, mill culls.......	8 00	9 00
Cull scantling.....	8 00	9 00
1½ and thicker cutting up plank.	22 00	25 00
1 inch strips, 4 in. to 8 in. mill run....	14 00	15 00
1 inch strips, common	11 00	12 00
1¼ inch flooring.....	14 00	15 00
1½ inch flooring.....................	14 00	16 00
XXX shingles, sawn......... ..	2 30@	2 35
XX shingles, sawn.................	1 30	1 35
Eastlake galvanized steel shingles, 24 W. G., per square.......		6 00
Eastlake galvanized steel shingles, 26 W. G., per square................		50
Eastlake painted steel shingles, per sq.		4 00
Round pointed galvanized steel shingles, per sq................ .		6 00
Round pointed painted steel shingles,		4 25
Round pointed, unpainted, Terne tin shingles........		4 00
Manitoba galvanized, steel siding, per square..........................		5 00
Manitoba painted steel siding, per sq.		3 50
Painted sheet steel pressed brick. ..		3 50
Painted crimped steel sheeting........		3 40

Price of Copper shingles according to weight.

YARD QUOTATIONS.

Mill cull boards and scantling........		10 00
Shipping cull boards, promiscuous widths...................		13 00
Shipping cull boards, stocks.........		14 00
Hemlock cantling and joist up to 16 ft.	11 00	12 00
" " " 18 "	12 00	13 00
" " " 20 "	13 00	14 00
Scantling and joist, up to 16 ft.......		14 00
" " 18 ft		15 00
" " 20 ft		17 00
" " 22 ft		19 00
" " 24 ft......		21 00
" " 26 ft.......		23 00
" " 28 ft ...		25 00
" " 30 ft.......		27 00
" " 32 ft		27 00
" " 34 ft... .		29 50
" " 36 ft... .		31 00
" " 38 ft.......		33 00
" " 40 to 44 ft..		36 00
Cutting up planks, 1¼ and thicker, dry	25 00	26 00
" " board,	18 00	22 00
Cedar for block paving, per cord......		5 00
Cedar for Kerbing, 4 x 14, per M.. .		14 00

B. M.

1¼ inch flooring, dressed, F. M.. ..	28 00	31 00
1½ inch flooring rough, B. M......	18 00	22 00
1¼ " dressed, F. M.....	25 00	28 00
" undressed, B. M...	18 00	19 00
" dressed..	18 00	22 00
" undressed	12 00	15 00
Beaded sheeting, dressed	22 00	35 00
Clapboarding, dressed................		12 00
XXX sawn shingles, per M, 16 in....	2 65	2 75
Sawn lath....	2 00	2 20
Red oak............................	30 00	40 00
White..............................	35 00	45 00
Basswood, No. 1 and 2	18 00	20 00
Cherry, No. 1 and 2..................	70 00	70 00
White ash, No. 1 and 2...	25 00	25 00
Black ash, No. 1 and 2............ ..	20 00	30 00
Dressing stocks......................	16 00	22 00
Picks, American inspection		40 00
Three uppers, American inspection....		50 00

MONTREAL PRICES.

Lumber, Etc.

Ash, 1 to 4 in, M....................	$13 00@	$18 00
Birch, 1 to 4 inch, M...	15 00	25 00
Basswood............................	12 00	20 00
Walnut, per M........................	50 00	100 00
Butternut, per M.....................	22 00	40 00
Cedar, flat...............	00 04	00 06
Cherry, per M...	60 00	80 00
Elm, Soft, 1st...............	15 00	17 00
Elm, Rock...........................	25 00	30 00
Maple, hard, M...........	20 00	25 00
Maple, Soft......	16 00	18 00
Oak, M...	40 00	95 0
Pine, select, M......................	35 00	40 00
Pine, 2nd quality, M......	20 00	25 00
Shipping Culls.......................	13 00	16 00
Mill Culls...........................	8 00	10 00
Lath, M.............................	1 30	1 90
Spruce, 1 to 2 inch, M	10 00	12 00
Spruce Culls...	4 50	6 00
Shingles, 1st quality................	2 00	3 00
" 2nd "	1 25	1 50

Cement, etc.

Portland Cement, per barrel	$ 2 70@	3 00
Roman " "	2 70	3 00
Fire Bricks, per M..................	20 00	30 00

NEW YORK PRICES.

WHITE PINE.

Uppers	$45 00@	62 00
Selects..	41 00	53 00
Fine common....	36 00	48 00
Cutting up......................	23 00	30 00
Common	28 00	45 00
Norway..............................	24 50	26 50
Pickets.............................	14 00	23 00
Shippers, according to quality, for different ports.....	17 50	52 00
Coffin boards.......................	21 00	23 00
Box.................	15 50	17 00
Ceiling.............................	24 00	42 00
Shelving............	25 00	32 00
Moulding.......	34 00	37 00
Bevel siding........................	16 00	23 00
Bridge timber.......................	38 00	50 00

EASTERN SPRUCE.

9 to 12 in..........................	16 50	17 00
8 to 12 in..........	16 00	16 50
6 to 12 in..........................	15 00	16 00
6 to 9 in...........................	14 50	15 00
Special lengths.....................	16 50	18 00
Lath................................	2 15	2 20
Piling, per lienal feet........	05	60

SHINGLES.

Pine, 16 in., extra..... ....$	3 10	3 25
18 in., extra..	4 35	4 50
18 in., clear butts..................	3 15	3 25
16 and 18 inch, stocks	4 50	5 30
Cedar........	8 75	19 00
Cypress..................	6 00	16 00
Redwood, per bunch.. . .	1 25	1 50
Various widths....		1 00

HEMLOCK.

Timber..........................	13 50	14 00
Joists...........	12 00	12 50
Board...........................	13 00	13 50
Lath....................... .		2 00

DRESSED LUMBER, CAR LOAD LOTS.

No. 1 flooring, ⅞ in..............	23 00	24 00
No. 1 ceiling, ⅞ in...............	25 00	26 00
No 1 ceiling, ⅜ in	18 00	19 00
Timber..	14 00	15 00

ALBANY, N. Y. PRICES.

SHINGLES AND LATH.

Shingles, shaved pine.		6 50
2nd quality........		5 00
Sawed, extra......	4 80	4 90
Sawed, clear butts	3 00	3 75
Cedar, xxx....	3 50	4 30
Shingles, cedar mixed............	2 60	3 00
Hemlock		2 25
Lath, pine	2 25	2 30
Spruce..	2 00	2 20
Hemlock..........	1 75	2 00

HEMLOCK.

Boards, 10 inch, each...........		13½
Joist, 4x6....		33
Joist, 2½x4.		13
Wall strips, 2x4..		10

PINE.

2½ in. and up, good............	58 00	60
4ths	53 00	55
Selects....................	48 00	50
Pickings	43 00	45
1¼ to 2 in., good.....	50 00	55
4ths.	45 00	52
Selects..	40 00	45
1 inch, good....	50 00	55
4ths...........	45 00	48
Selects........................	40 00	43
Pickings.......................	35 00	38
Cutting up, 1 to 2 in......	30 00	35
Bracket plank..	32 00	36
Shelving Boards, 12 inch and up..	28 00	32
Dressing boards, narrow...	20 00	22
Shipping boards.............. .	16 00	18
Box boards....	13 00	15
10 inch boards and better. .	30 00	34
Common	10 00	22
12 in. boards dressing and better..	32 00	36
Common.....................	16 00	22
1¼ in. siding selected 13 ft.	43 00	45
Common.....................	16 00	21
1½ in. siding, selected....... ...	43 00	46
Common.............	*16 00*	*21*
Norway, selected................	24 00	26
Common.....................	12 00	16
10 in. p. k. 13 ft. dressing and better, each....	45	5
Culls......................	23	2
10 inch boards, 13 ft. dress and better, each..	28	3
Culls......................	17	2

BUFFALO AND TONAWANDA PRICES.

NORWAY PINE—ROUGH.

No. 1, 1 and 1¼ in..	20 00	22 00
No. 2, 1 and 1¼ in...............	15 00	15 50
No. 3, 1 and 1¼ in....	11 50	12 00
Stocks No. 1, 1 and 1¼ in.......		22 00
No. 2, 1 and 1¼ in..........		17 00

WHITE PINE—ROUGH.

Uppers, 1 and 1¼ in............	42 00	44 00
1½ and 2 in..........	43 00	45 00
2½, 3 and 4 in..............	52 00	55 00
Selects, 1 inch............... ..	36 00	37 00
1¼, 1½ and 2 inch..........	34 00	35 00
2½, 3 and 4 inch..	44 00	46 00
Cuts, No. 1, 1 inch...............	28 00	30 00
1¼, 1½ and 2 inch...........	31 00	33 00
2½, 3 and 4 inch............	37 00	40 00
No. 2, 1 inch....	17 00	18 00
1¼, 1½ and 2 inch..........	23 00	24 00
Moulding, 1 inch...............	31 00	33 00