Electrical Mechanical and Milling News

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ELECTRICAL,

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics pertinent to the electrical, mechanical and milling interests.

IT is probable that electricity as a motive power will be discontinued on the railway at the Industrial Exhibition in Toronto next September. This was the pioneer electric railway in the Dominion, but as it is anticipated that the extension of the street railway via King street subway and Dufferin street would divert the entire traffic from it, it has not been considered worth while to get up a permanent and elaborate electrical plant. If the subway is not completed this year, there is some talk of using a benzine engine that is being got out by some Toronto parties to run the road. If, however, it does not evolute with sufficient rapidity, or in other words materialize in time for the show, the historic apparatus of the Toronto Electric Light Company which has been utilized in the past will again be brought into requisition and hustle the crowds up the grade to Machinery Hall as per usual.

THE magnificent possibilities that would follow a successful attempt to produce light without heat by accomplishing a coincident vibration of etheric and magnetic waves by means of an electric current, would only be equalled by the dazzling rewards that await the fortunate inventor. Imagine a luminous wire carried the whole length of a street, giving out a soft and beautiful radiance, like the sun at noonday, instead of the vitiated and alternating spots of light and darkness such are the results of the best systems of lighting in use to-day. Imagine it! No lamps to trim or intricate mechanism to get out of order, nothing but the cold and luminous wire shedding its radiant beams upon the darkened earth wherever it may be led. This and the production of electricity direct from fuel without the intervention of steam engine and dynamo, would be alike worthy of the brightest genius of this or any other age. The scientists at work on these problems may be a mile or two out of the highway to success just at present, but in the light of past discoveries it would be idle to say that it will not be accomplished.

MR. David Plewes, Secretary of the Dominion Millers' Association, writes as follows on the subject of the grain tester:—"During last session of the Dominion Parliament, great pressure was brought to bear on the Government by some members from rural constituencies to compel grain buyers to use peck or half bushel measures to test the weight of grain per standard measured bushel instead of the two-quart tester now in general use. The chief argument used openly was that if those small measures made ¼ lb. mistake, the ¼ lb. multiplied by 16, would make 4 lbs. difference on a bushel; whereas ¼ lb. on the 1-16 bushel tester, would only be ¼ lb. on the bushel, for the difference on the tester only marked the difference on the full bushel measure. If this assertion were correct, then a tester that made wheat weigh by mistake 4 lbs. less than a measured standard bushel, their system would multiply the 4 lbs. by 16, making a total of 64 lbs. loss on a measured bushel—really making a standard bushel weigh 4 lbs. less than nothing. This was their open objection; the secret desire was to pass off 56 lb. wheat as standard wheat. Under this pressure the Government by Order in Council has ceased to recognize any grain measures less than peck measures, but at the same time does not prohibit the use of the two-quart tester wherever or whenever the grain buyer chooses to use it to satisfy his own mind of the gravity weight of any grain before he buys it. A cantankerous seller sells a buyer standard wheat and attempts to deliver wheat of less gravity weight than standard, then in order to prove a legal breach of contract a peck or half bushel measure would have to be used in order to secure a conviction in a court of law. For all practical purposes this Order in Council need not deter millers from buying wheat by standard as heretofore. All they have to do is to use their tester before buying, and bid according to their regular buying scale after testing. The seller, as heretofore, can refuse and go elsewhere to sell his wheat if he chooses to do so. But to whom will he go but to the Canadian miller who has paid him 5 to 10 cents per bushel for the past two years more than any other buyer would pay? If a slippery seller shows an inclination to deliver poorer wheat than sample sold by (I have known such men) it will be well to have a peck measure near by to test with. However, with a very large proportion of the farmers who know the present testers give correct tests, there will be no trouble. It is only the few designing ones who will cause trouble, and they are generally known even before one sees their sample of wheat or makes a bargain." Some newspapers have asserted that the Government has suppressed the tester, but the following copy of the Order in Council on the subject proves clearly enough that such is not the purpose:—

"You are informed that while this instrument ceases to be a legal arbiter of the weight per bushel of grain as between buyer and seller, it is not the intention of the Department to prohibit its use by grain buyers or millers for the purpose of informing themselves thereon."

IT now appears probable that Harold P. Brown's little machine will be put in operation to experiment on the unfortunate Dutchman, Kemmler—nothing but a technical question as to the right of the prison warden to carry out the sentence standing in the way. It is curious to note how, among the mass of the people, electricity is considered the panacea for all evils. Because there has been, now and again, a bungle in the extremely simple process of hanging a man, the conclusion is immediately jumped at that electricity is the thing to straighten matters out and solve the "knotty" problem, while in point of fact it is the most intricate and tricky method that could possibly be selected. In the first place, the delicate and complicated machinery necessary to insure certain results must be under the control of competent electricians. But while competent electricians have the field all before them that the development of electricity now presents, with its positions and emoluments, they are not hankering after the position of public executioner. Not much! Talent will have to be employed that is the refuse of the profession, and the result will be more horrible and ghastly than the worst ever perpetrated with the hangman's rope. Again, it is an open question as to what amount of current is necessary to effectually kill a human being. That men have been killed by electric currents is beyond doubt, but for one killed, thousands have experienced just as strong shocks with impunity. It is only those who have some constitutional defect such as weak action of the heart who have succumbed to the current, so that this is no argument electricity will be sure death in every case. Take a parallel instance. Men have been killed by sudden emotions of grief or joy and have even been known to drop dead from the effects of a sudden start, but because this is so he would be a bold philanthropist indeed who would attempt to put the murder-committing, hardened tough, out of his misery by scaring him to death. The attempt, however, would be a logical result of the arguments in favor of electricity. If it were not that the whole affair was concocted for fighting purposes by rival electric companies, and a painless and humane death the only object aimed at, it would be a simple matter to administer a dose of chloroform, or morphine or prussic acid strong enough to start the toughest citizen on his journey to the happy hunting grounds with neatness and despatch. It is a very grave question, however, whether this would not be rather more of an incentive to than a deterrent of crime.

SINCE the advent of electric railways in the larger cities, the telephone companies have had what is technically known as "a hard row to hoe." It was bad enough while they had the induction caused by electric light wires to contend with, though that was comparatively a hardship that could be borne as the lights did not, as a rule, interfere during business hours, but since the heavy electric currents necessary to run the railways have been in operation during the day, and have also brought into use the earth as a return conductor, the trouble has been intensified to such an extent as to seriously interfere with the use of the telephones. In the case of the railroads, the trouble is not so much from induction as from direct interference owing to the telephone being grounded in close proximity to the return currents of the electric cars. Several telephone companies in the United States are seeking legislation to compel the railroads to discontinue the use of the earth as a return conductor, claiming that they were there first. There are wars and rumors of wars in the air. Suits have been brought in several courts and the results have been various. In most of the decisions the electric railroads have been sustained. The question narrows itself down to this: Do the telephone companies own the earth, and can they alone use it as an electric conductor? It has been held not, as the telegraph companies used the earth as part of their circuits long before telephones were invented, and their prior use would entitle them to a monopoly of the argument of the telephone companies is held good that *their* prior use gives them precedence over the railways. Most of the trouble can be eliminated by the use of a metallic return wire for the telephones, and this is being adopted by many of the companies as a temporary remedy. The true solution of the telephone difficulties, however,

appears to be the duplicating of subscribers' wires, whether used in an overhead system or underground, placing each telephone in an independent metallic circuit entirely disconnected from the ground and from interfering wires. This will not only eliminate disturbances caused by electric light and railroad induction, but also the thousand and one frying, fizzling and rattling noises, caused by battery wires, telegraph signals, earth currents, atmospheric disturbances, etc. Wide awake companies will see it is to their interest to provide their customers with a quiet line at all times, and though the expense may at first be considerable, it will be an evidence of wisdom on their part to meet it. One of the telephone companies in Montreal use this system, and it is a treat to speak through their instruments, though the wires in many cases run directly upon the electric light companies' poles.

THE unusually heavy rain storms which swept over Ontario in the early part of June were the cause of heavy loss to many mill owners. Mill dams in many localities were entirely destroyed, others partially so. As many of our readers know to their cost, the repairing of a broken mill-dam is an expensive undertaking.

THE day of electricity as a motive power has surely arrived. It is true that steam power or some other natural or artificial force must be brought into play as the actual prime mover, but electricity offers such facilities for the transmission to distant points and the economical subdivision of the power produced by central plants, that it is bound to be the motor of the future. A very bold departure from ordinary practice has been made in the new *Globe* building in Toronto. Owing to the peculiar shape of the premises, being long and narrow, countershafting would have been necessitated to an extraordinary extent. Instead, however, of using shafting, it has been entirely done away with, with the exception of one piece to drive two dynamos of large capacity. The entire machinery on the various floors of the building will be driven direct by electric motors, some 17 or 18 in all, obtaining their supply of power from the two dynamos in question. This is the first time in Canada that a motor plant has been attempted for continuous using on such an extended scale, and we hope the confidence of the projectors in its adaptability will be justified by its ultimate success.

WE have received the prospectus of the Light, Heat and Power Corporation of Canada. The proposed capital stock is $500,000, divided into 20,000 shares, having a par value of $25 each. The object of the corporation is to introduce and operate throughout the Dominion the oil gas system known as the "Brooks Gas Process," the invention of Mr. Henry W. Brooks, of Philadelphia. This process is described as a unique plan by which at a comparatively low cost for apparatus and small attendant expense of production, crude petroleum, as it comes from the wells, with an admixture of decomposed steam, is converted wholly into a fixed or non condensible gas, remarkable for its brilliancy and purity as an illuminant and for the intensity of its heat as a fuel gas. Many testimonials are given of persons in Philadelphia who have used this gas both as an illuminant and for fuel. It is for the latter purpose especially that we believe the company should find a profitable field awaiting them. One of the greatest needs of the present day is fuel that will be cleaner and cheaper than coal, and we shall be pleased indeed to learn that the article which the new company proposes to manufacture fills the bill. Subscriptions for stock in the company will be received by Mr. W. B. Carroll, M. A., Secretary pro. tem., Gananoque, Ont.

MILL and factory owners should see to it that every possible protection is thrown around workmen whose duties bring them into close proximity to machinery in operation. The results of the first case decided under the Workmen's Compensation for Injuries Act, should prove a warning in this particular. The case was that of Stephenson v. Walker, wherein Mrs Stephenson, a widow residing in the village of Norwich, sued for $200 compensation for the death of her son, who was fatally injured in the defendant's mill. The son entered the employ of the defendant on Aug. 5 last, went to work at 7 o'clock in the morning, and an hour later was drawn into the machinery and was brought home mangled and torn so that he died the following day. The mother had no means of support, and had moved to Norwich trusting with her son's small patrimony and a boarder or two to make a living. His death left her utterly destitute. The plaintiff alleged that the young man was not sufficiently instructed in the methods of evading accident, and that the machinery was not properly guarded. Mr. Code, who had charge of the mill, gave young Stephenson very meagre instructions and turned him over to a 15 year old lad named Kelso, whom he was to assist in dusting the mill. The defence alleged proper and sufficient instructions and contributory negligence. Some sixteen witnesses were called, including some expert millers, and the case occupied a whole day. A verdict was given for the plaintiff for the whole amount asked and full costs of suit.

THE recent fatal boiler explosion near Colchester, Ont., by which three men were killed and others injured was followed by a Coroner's inquest. The inquest resulted in a verdict "that the explosion was the result of a defective boiler with no blame attached to any one." "Where ignorance is bliss it is folly to be wise," had the owner or anyone running this boiler known that it was not so strong as was supposed, then they would have been blamed and might have been committed to stand their trial for manslaughter; so according to this verdict it was well they did not know. Others not in the jury, however, might well raise the question, why did the owner not know? Under the law in England, providing for a full investigation in all cases of explosion of steam boilers, the owner, in such a case as this, would stand a very good chance of being tried for manslaughter because he did not know the weakness of the boiler. When any man undertakes to own or run such an explosive thing as a boiler, he ought to know for a certainty, as far as it is possible to know it, that the boiler is safe to use, and if need be, he ought to be compelled by law to take all reasonable precautions in using it, so as to keep it safe. Steam and steam boilers are not hidden mysteries, and boiler explosions are not mysteries, except that it may be a mystery there are not more of them. The explanation of this explosion at Colchester, as given in the newspapers is, that it "was caused by the accumulation of pressure more than should have been allowed, or that the boiler was able to stand." Did any one ever know of a boiler explosion from any other cause? It simply means the boiler burst because it could not hold in. Had an expert engineer examined it before it burst he would probably have discovered the weakness and thereby have saved the lives lost through somebody's ignorance.

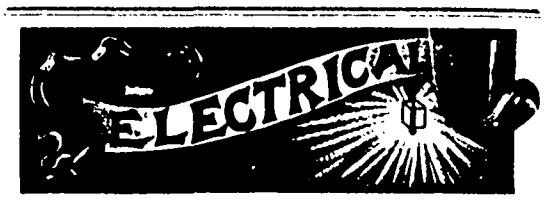
BY-PRODUCTS OF WHEAT.

THE Minnesota experiment station has recently issued a bulletin, the result of an investigation of the manner of manufacturing and selling the large quantities of bran, shorts, screenings, cockle and other by-products of wheat which are thrown upon the markets of that state, and used for food. The report states that the wheat annually grown in Minnesota yields about 200,000 tons of bran and 50,000 tons of shorts, and from the wheat is taken, as estimated from an average year, about 75,000 tons of screenings composed of light grains of wheat, wild buckwheat, foxtail and numerous other weed seeds, also some broken straw, chaff and other dirt. The bran and shorts produced in the state that is, a large part of it is shipped to Iowa, Illinois, Wisconsin, and to eastern states.

The screenings, most of which are taken out after the wheat has arrived at the mill, are constantly gaining in popularity with farmers for feeding all kinds of stock. Even horses are found to do nearly as well on screenings as oats and the cost is much less. Ground screenings have proved most excellent food for cows and hogs, and sheep have been found to thrive upon it.

So large has been the amount of screenings in the mills of Minneapolis during the past year or two that the demand has not equalled the supply. Some enterprising millers have adopted the plan, says the *Modern Miller*, of grinding the screenings in burr or roller mills, and running this meal through a "reel," separating it into "flour of screenings" and "cockle bran." This "flour of screenings" is run into the bran or shorts, generally the latter, increasing the output of that high priced by-product, and the "cockle bran" is sold to local feeders at from $2 to $5 per ton. Other mills, as the Pillsbury "A," the "Minneapolis Mills," the "St. Paul Roller Mill, continue to grind their screenings with roller or burr mills, and sell the meal at about two-thirds the price of bran and shorts.

To prevent the shipping of screenings which now accumulate in terminal elevators and city mills, a far better way than feeding them to sheep in the cities and towns, where the manure is already wasting, or to mix them into the shorts, is for farmers to not "ship the wheat in the dirt." With the improvement now being made in cleaning mills adapted to use on farms and in country elevators, there is no excuse for the farmer wasting three or four pounds of screenings per bushel in average wheat by the system of dockage now in vogue. Farmers can, by a little preparation, clean their wheat for considerably less than one per cent per bushel, and country elevators, by placing proper machines in their elevators, can clean it for them at less than one half cent per bushel. Those who grade wheat seem to have so gotten into the habit of counting something "off" for dirt, even if wheat is neatly clean, that shippers are not encouraged to clean their wheat well, while the tendency should be the other way. Screenings vary so greatly in composition and in value that the judgment of the buyer must be exercised in each purchase. The same is true in buying "screening meal" and "cockle bran."



Manager Nash, of the Windsor, Ont., Electric Light Company, wishes to dispose of his plant to the town.

The generators and dynamos for the electric light and street railway company have arrived at Vancouver, B. C.

Vancouver, will soon be lighted by one hundred and fifty 2,000 candle power Thomson-Houston electric lights.

The Brush Electric Light Company which has been trying to make arrangements with the Portage la Prairie town council for the lighting of that place, have abandoned the idea.

The Edison Incandescent Electric Light Manufacturing Company are negotiating with St. Catharines citizens for the location of a factory in that city to manufacture dynamos for all Canada.

A company known as the Ingersoll Electric Light and Power Company has been formed, with Messrs Harry Richardson and John Gayfer as the leading promoters. They have succeeded in getting a contract for lighting the town.

Mr Allan I. Lawson, electrical engineer, of Montreal, has made an assignment with liabilities of about $12,000. The principal creditors are—The Machinery Supply Association, $1,710; the Brush Electric Company, Cleveland, $799, and Rosa M. A. Horne, $1,750.

Mr. F. N. Snider, manager of the Bell Telephone Company, has placed a small electric motor in the Portage Milling Company's engine room, to be run by the Corliss engine there. This machine will supply a strong current of electricity to the head office of the telephone system to be used for the purpose of calling up the users of telephones.

The Canadian Electric Mfg. Co. are about to open a manufactory of electrical supplies in Terrebonne, a beautiful little city 21 miles north of Montreal. The town gives them a bonus of $10,000. Messrs. M. F. Jannard and Boulard, the principals of the company, are young and active men thoroughly posted in their calling, and are bound to make it a success. Both are Canadians. They now exhibit on St. James street, Montreal, a beautiful working model of an electric tram, which is the talk of the town.

An influential deputation consisting of the municipal representatives of the county of Lincoln and city of St. Catharines, Col. Frances of Montreal, and Mr. Langdon of Sherbrooke, Que., in a recent interview with Sir John Macdonald, petitioned for the use of the water power privileges on the new Welland canal for the purpose of establishing a factory for electrical purposes. Sir John, after discussing the matter fully with the deputation referred the request to the Deputy Minister and the chief engineer of canals for a report.

A Washington despatch says: The Treasury Department has received a letter from Col. A. D. Shaw, of Watertown, N. Y., saying he has obtained a concession for utilizing the waterpower on the Canadian side of the river at Niagara Falls in behalf of an American company, and asking if electricity transmitted by cable to the American side of the Niagara river for lighting purposes would be subject to duty. Assistant Secretary Tichener has replied that the Department has decided that as electricity is an invisible, subtle agent or power possessing no substance as a merchantable commodity, it is not liable to duty.

TRADE NOTES.

Messrs. A. Ludlaw & Co., of Toronto, are supplying all the cleaning machinery for Mr. Millan's new grain elevator at Hillsburg, Ont.

Mr. H. W. Petrie, of Brantford, has sold and recently shipped two outfits of machinery for cheese factories, one for the Qu'Appelle Butter and Cheese Mfg. Association, Qu'Appelle, N. W. T., the other for the Palmerston Co., Palmerston, Ont.

The Dundas *Banner* says: H. W. Petrie, of Brantford, has just put in an engine and boiler in the *Banner* printing office, Dundas, which is giving every satisfaction. Mr. Petrie has a reputation for putting in first-class machinery, and the sample put in here fills the bill.

The Royal Electric Company are to instal a 250 light plant in the Protestant Hospital for the Insane, Montreal. They also placed a 50 light incandescent plant on board the steamship "Sardinian," of the Allan line, to light the Duke of Connaught's staterooms, saloon, etc.

An announcement addressed specially to millers by the Dodge Wood Split Pulley Co. of Toronto, appears in the advertising pages of this number. Millers should address the company for full particulars of the excellent article of which they are sole Canadian manufacturers.

CROMPTON DYNAMOS.

THE present form of Crompton dynamo machines represents the result of eleven years' experience in practical working of Mr. Crompton and his staff. It is well known that the experiments carried out at the Chelmsford works resulted in an improvement of the Gramme type of machines of the same character as that which Dr. Hopkinson had undertaken for the Siemens type of machine, viz., by the introduction of very strong magnetic fields consisting of large masses of the strongest and purest annealed wrought iron. The later types of machines made by the company show that the transmission of mechanical strains from the spindle to the armature winding has been carefully studied. The materials used throughout are of the highest possible quality; for instance, the radial bars and hubs for an armature of the ring or Gramme form, consist throughout of those celebrated alloys of copper and aluminum, which have given, on tests, some of the most remarkable results in resistance to tensile and shearing strains that have been attained by any material in modern times. The insulation of the various parts of the core from one another, and of the winding from the core itself, have been thoroughly thought out from a mechanical engineer's point of view. The materials used are most carefully selected, and every modern device has been introduced to secure the best insulation, notably by baking the varnishes employed, by passing the parts at every stage of the manufacture through specially arranged drying ovens. By this means every part of the armatures and field magnets are exposed during manufacture to a temperature far in excess of any that they could possibly reach when they are at work; all injury due to subsequent changes of form from overheating are therefore avoided.

The efficiency of these dynamos, *i. e.*, the percentage of the total horse power applied to the pulley, which appears as useful horse power at the dynamo terminals, is extremely high.

The following figures will show the remarkable character of the results attained:

Resistance of armature	1.375 ohms.
Loss of E. M. F. in the armature at 25 amperes	34.4 volts.
Resistance of the 4 magnet arms coupled, 2 in series and 2 in parallel	1.39 ohms.
Loss in the magnets at 25 amperes	35 volts.

	Volts.	Amperes.	Watts.
Useful energy at the terminals	1,300	25	32,500
Loss in the armature			850
Loss in the magnetic field			870
			34,220

$$\frac{32,500}{34,200} = 97$$

This efficiency of conversion of mechanical energy into electrical energy is very high, for, taking the low saturation of the ring, the loss due to hysteresis and to foucault currents in the iron ring is very small, so that the commercial efficiency of the machines under the conditions mentioned above is 94%, a result which it is claimed has not been attained in any dynamos hitherto constructed for arc lighting. The weight of the machine whose results are given above is 800 kilos. Its ordinary output is 1,300 volts and 27 amperes equal to 35 units, and it thus gives 45 watts per kilogramme, without any effort, heating, or other harmful consequences.

Another class of machines to which Messrs. Crompton have given the closest attention, has been a very slow speed machine suitable for being driven direct by an ordinary double acting steam engine, *i. e.*, giving the ordinary E. M. F. required for incandescent lighting, at speeds of from 180 to 200 revolutions per minute. This type of machine has been brought to a high degree of perfection, among the first large examples of the class being several machines made for the Peninsular and Oriental Steamship Company for their vessels "Oceania" and "Arcadia" in 1887. The following are the electrical measurements and records of the tests of one of a large number of machines constructed for Messrs. Harland & Wolfe (to the order of Messrs. Holmes and Vandrey of Liverpool), for the new Atlantic liners of which the S. S. "Teutonic" was the first example:

Resistance of armature	0186 ohms.
Loss of E. M. F. in the armature with 240 amperes	4.45 volts.
Resistance of the main magnet winding	0077 ohms
Loss of E. M. F. in the main magnet winding	1.80 volts
Resistance of the shunt magnet winding	13.55 ohms
Current in the shunt magnet winding	7.4 amp

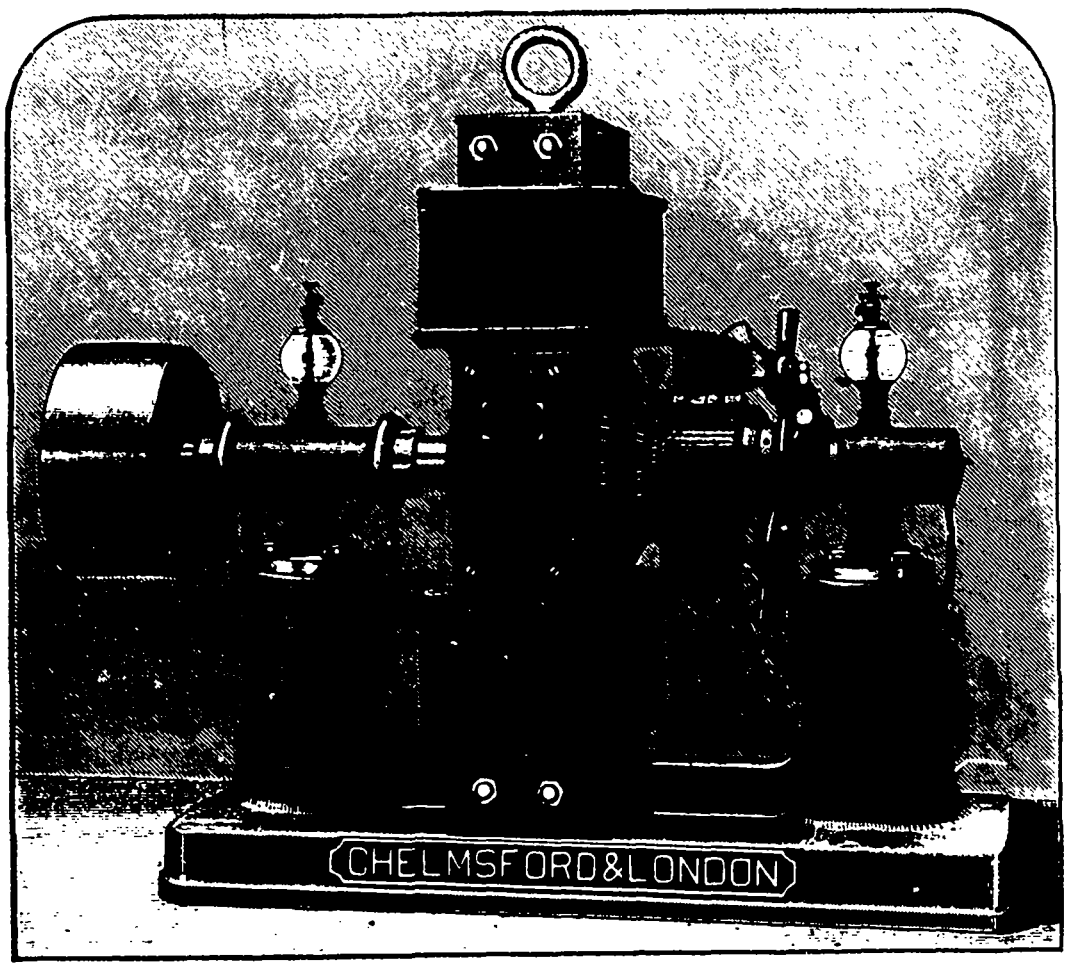
	Volts	Amp	Watts
Useful energy at terminals of machine	100	240	24,000
Loss in armature			1,135
Loss in main magnet winding			445
Loss in shunt magnet winding			740
			25,320

$$\frac{24,000}{25,320} = 94.5$$

TEMPERATURE TESTS.

Temperature of engine room	72 degrees Fah
" armature after a long test	101 "
" field magnet winding after a long test	92 "

It will be seen from the above figures that the efficiency for such a slow speed machine is remarkably high, and the freedom from heating very great; when it is considered that the armatures of these machines are of the Gramme form, with the winding arranged in such a simple fashion that any coil can be repaired or replaced by the ordinary engine-room workman, it will be seen what a high degree of success has been attained.



CROMPTON DYNAMO.

These machines are just being introduced into Canada, the first installation being now in course of erection; and there is no doubt that with their superior merits it will not be long before they hold a prominent place among the high class dynamos used in this country for electric lighting.

The general agents in Canada are the Keegans-Milne Company, with headquarters at Montreal.

SMOKE PREVENTIVE.

AT a meeting of the Manchester, England, Steam Users' Association, after the reading of the annual report, the chairman, Mr. John Ramsbottom, C. E., made the following remarks on the subject of smoke prevention:

It was not necessary for boiler owners to go to the expense of a mechanical stoker to prevent smoke, or at all events to materially reduce its amount. Smoke could be reduced so as to be no practical nuisance simply by careful hand-firing, and the following recommendation might be offered: Adopt the system of "alternate side firing" introduced by Charles Wye Williams many years ago. Instead of scattering the coal all over the fire at every charge, throw it to one side only, say to the left-hand side, on one charge leaving the right-hand side bright; and to the right-hand side on the next charge, leaving the left-hand side bright. After each charge admit a little air through the fire door. By no means fire in heavy, irregular charges, but fire regularly and lightly. Be sure and keep the bars covered at the back. Do not rouse the fires with the rake. Fit each fire door with a ventilating grid for introducing air. Sometimes air was introduced at the bridge by means of what was termed a "split bridge." The split bridge was by no means a modern invention. It was patented by Josiah Parkes in the year 1820, and had been revived on many occasions. Mr. Parkinson, of the firm of J. & E. Waters & Company, Talbot Mills, Hulme, Manchester, had taken a great interest in this subject, and had introduced a split bridge in his own boilers. This he had found most successful. It prevented the emission of smoke, and did this without wasting coal. He had been very generous in giving to others the result of his experience, and the association had furnished drawings of his arrangement of bridge to many of its members. Some firemen seemed to fear lest a constant admission of fresh air at the bridge should lead to waste of fuel. This fear, however, was groundless. It was found at the experiments at Wigan, that the constant admission of air above the bars through an aperture of two square inches per square foot of fire grate did not reduce the economy, and as the aperture at the split bridge had less area than this, it would be seen that waste of fuel need not be apprehended. With careful hand-firing and the admission of a little air either at the fire door or at the bridge, if the draught be fairly good and the boiler not unduly pressed, smoke might be reduced as to be no practical nuisance.

SAFETY VALVE WEIGHTS.

IT is often desired to have cast iron balls of a given diameter for safety valve weights or for other purposes; and the question sometimes is: How large a ball will be required for a given weight? It is not always convenient to turn up several patterns just for the sake of finding out how very deceptive is the volume of a sphere, and how very uncertain is the weight of a ball when you guess at the diameter.

There is a very simple way of approximating very closely to the diameter which will produce a cast iron ball of any desired weight. Average cast iron weighs 450 lbs. per cubic foot; and the volume of a sphere is equal to the cube of its diameter, multiplied by 0.5236. 450 lbs. per cubic foot is practically .26 lbs. per cubic inch; so that to find the weight of any cast iron ball in pounds we have to cube its diameter in inches and to multiply by 0.5236 and by 0.26; or what is the same thing, cube its diameter and multiply this by 0.1361.

Working the thing the other way, to find out how many inches in diameter a cast iron ball would have to be in order to give a certain weight, we must divide the given weight by 0.1361 (or, what is the same thing, multiply its weight by 7.3475) and take the cube root of the product.

Thus, suppose that we desire to have a cast iron ball weighing 50 pounds; we divide 50 by .1361 (or multiply it by 7.3475) and get 367.375; and the cube root of this is practically 7 1/8, which is the desired diameter in inches.

Working under this rule, we may make up for convenience in use the following table:

DIAMETER FOR CAST IRON BALLS.

Wt. lbs.	Cube of dia. ins.	Diam. inches.	Wt. lbs.	Cube of dia. ins.	Diam. inches.
.25	1.8368	1.216	11	80.822	4.326
.50	3.6736	1.547	12	88.17	4.448
.75	5.5104	1.765	13	95.517	4.578
1.	7.3475	1.940	14	102.864	4.687
1.5	11.0215	2.224	15	110.211	4.791
2.	14.695	2.444	16	117.558	4.905
2.5	18.369	2.6407	17	124.905	4.99
3.	22.042	2.802	18	132.252	5.091
3.5	25.716	2.951	19	139.599	5.192
4.	29.39	3.072	20	146.946	5.277
4.5	33.064	3.207	25	183.680	5.687
5.	36.737	3.332	30	220.245	6.036
5.5	40.411	3.420	35	257.262	6.357
6.	44.085	3.530	40	293.9	6.649
6.5	47.759	3.634	45	330.737	6.917
7.	51.632	3.732	50	368.375	7.166
7.5	65.306	3.803	55	405.212	7.398
8.	58.78	3.893	60	440.850	7.611
8.5	62.45	3.958	65	477.687	7.818
9.	66.127	4.041	70	514.325	8.0104
9.5	69.801	4.121	75	551.162	1.198
10	73.475	4.179	80	587.8	8.377

—*Power and Transmission.*

SOME REASONS WHY FLOUR MILLING IS UNPROFITABLE.

By "Experience"

I shall first touch on the small country mills, doing mostly a farmers' grist trade. One reason why at the end of the year the balance is on the wrong side, contrary to the good old stone milling time is, that the grist miller now works more in the dark than formerly. When the farmer got his own wheat ground into flour, the usual plan was to take out of every bushel 5 lbs. of wheat after smutting; thus from a twelve bushel grist one bushel of good clean wheat was put in the toll bin. That profit was sure. All that is now changed; the exchange system compulsory with the roller system leaves the miller to calculate how much such wheat as the farmer brings him will produce of such flour as he is expected to give in return. Thousands of farmers under the old system went home with their grists ground, less the 5 lbs. toll and such waste as the cleanness or dirtiness of their wheat caused, supposing they had 40 lbs. or more of flour to the bushel, whereas the facts were, if the wheat and flour had been weighed, it would oftener have proved to be 38 lbs. flour to the bushel.

Now the only safe plan is, for the grist miller to constantly take tests by say putting all his grist wheat in a bin for one or two weeks, run his mill empty and then grind out the grist wheat he has received from farmers, and thus arrive at the actual facts. It is well to take a test on 60 to 62 lb. wheat, then on 56 to 58 lb. wheat, and so on until he becomes thoroughly conversant with the quantity of roller flour the different grades of wheat will make, and after having become posted on this, to so arrange exchange table as to allow 10 cents per bushel for grinding. Ten cents per bushel under the extra expense of operating roller mills, caused by their extra cost, insurance and repairs, is no more profitable than 7 cents per bushel was under the old millstone process of grinding.

A friend of the writer who started a roller mill in the southern part of this province some five years ago, commenced giving 40 lbs. of flour with bran and shorts for standard wheat grists. Although he did an immense trade he never seemed to make any money. He therefore adopted the plan here recommended, commenced giving only 36 to 38 lbs. instead of 40, on the ground that he had simply been working for nothing. As a result of this change, his gristing went down to one quarter what it had been, but he said he would rather have a living profit on 25 bushels than grind 100 bushels for nothing. After holding out a few months, all the old customers came back under the changed tariff.

Another good plan to suit a few grumblers who must have their 40 lbs. is, to keep a little flour on hand reduced to the grade of stone flour by putting in 20 lbs. of low grade (over and above its own low grade) to every 100 lbs. flour, so as to make the quantity fit the desires of the 40 lbs. applicant, giving him the choice of say 36 to 37 lbs., or the 40 lbs. to the bushel. It does away with grumbling to say, "we will give you 40 lbs., but recommend you to take the 36 lbs." They usually adopt the latter suggestion.

The more I talk with millers who have taken tests on wheat testing 56 lbs. and under, the more I am convinced that as a rule grist millers pay a bonus instead of extracting a profit, to the farmers to bring this class of wheat to be gristed. I am becoming more and more convinced that this system of exchanging grists in the dark is the direct cause of the grist miller's trouble. I know many do it to obtain more than their share of gristing, and give more flour than is equitable in exchange, especially on thin and dirty wheat; but what good is an increased trade if there is loss instead of profit in it? If all grist millers would join the local millers' associations, and meet together, preparing themselves with tests from the different grades of wheat to be given to the association for the mutual benefit of all, much benefit would result, and if a united effort was made, the exchange system could be changed to one of buying the farmers' grists and selling them flour at wholesale price. Many mills have already adopted this plan, and many farmers prefer it, saying the time of barter is past. If farmers perfectly understood that the wholesale price to them of 100 lbs. of straight roller flour would be the price of 2½ bushels of standard wheat, the system of buying and selling would soon be universal. Of course, if farmers desired higher patent flour, then the price would be higher. It is one of the anomalies of the age, that with improved mill machinery for making a much better flour than heretofore, not only is less money made out of the business, but many gristing businesses even done with roller mills is being done at a direct loss. The sooner grist millers become more thoroughly versed in the actual facts by actual tests, and are willing to join their neighbors in applying the needed remedies, the better for all concerned. Nearly half the grist millers either cannot or will not give a straight answer to the question, "how much wheat averaging 58 lbs. do you take to make a barrel of flour?" Any miller desiring to make money should never allow himself to run three months without taking tests. I know with some mills who do their exchanging out of their regular shipping flour and are seldom clean empty of wheat, it may be some trouble to take tests from the different grades of wheat. In such cases adopt the following plan: say you are running on a stack of wheat testing 57 lbs; there will be times when you are packed out and perhaps your feed bins empty at same time; in that case, when mill is running steady, packer and feed bins both clean empty, run, say, 10 hours, and then stop mill, weigh up your flour and feed, add together, and for every barrel of flour made add on 6 lbs. for waste (this may vary a little), and you have the bushels used to make the flour you have ground, then write in your mill book for future reference, bushels ground, flour, bran, shorts, and low grade (if any extracted), with estimated waste, then at some future time when perhaps you are running on a lot of wheat testing 60 lbs. or over, do the same thing, and if ever you are running on a lot of wheat testing only 56 lbs., repeat the experiment, and your eyes will open and you will be a great many years wiser than you were before the different tests were taken. One well-known miller in Western Ontario has scores of test sheets hung up in his office for his own reference of all kinds of wheat, from light Ontario and frosted Manitoba to 62 lb. Ontario and No. 1 hard Manitoba, and the lesson those tests teach is, he don't want light testing wheat even at the reduction in price as published in what is known as the "Millers' Association Buying Table."

DEMONSTRATED AND DISPUTED POINTS IN MILLING.

By J. Murray Case.

NEXT to the rolls the purifier may be regarded as the most important machine in the modern system of milling. There is not so much difference in the results produced from different machines as many people suppose. One fact is clearly demonstrated, that is, to obtain good middlings from any purifier, however perfect its construction, the middlings must go to the machine in a good condition.

The mechanical principle which produces the separation of the fibrous matter from the middlings is simply a current of air passing up through the cloth, which causing the fibrous matter to rise to the top, some of it is floated off over the tail, and the lighter particles are carried out through the eye of the fan. To carry out this principle, a great number and variety of machines have been constructed, in any of which good work may be performed. And it is not infrequently the case that machines embodying the very highest merits are condemned, and those of lesser value put in, for the reason that the material passing to the machine is in an imperfect condition, consequently good middlings cannot be obtained, and the miller blames the machine. In all the efforts to improve the machine it can be truthfully said that no great advance has ever been made upon the simple system of a shaking riddle with air trunk above and a current of air through the cloth. The application of other auxiliary attachments to this principle may assist somewhat, but generally adds so much to the complication that the machines are liable to get out of order unless closely watched, and the result is, in the aggregate, that they do no better work than the simple sieve with suction.

One of the most important points about a purifier is to distribute the material perfectly over the entire face of the cloth. To accomplish this, a shaking tray or vibrating feed box has proved itself unquestionably superior to any other device, is perfectly automatic in its operation, and requires no attention whatever.

In purifiers it will often be found that the material will run backward towards the head of the machine, or gather up in bunches upon some points in the cloth. This may be due to two causes, (1) the sagging of the cloth in such a manner as to form an elevation towards the tail of the machine, which the material has to climb over, and instead of doing this it runs backwards or vibrates back and forth. This may be remedied by seeing that the cloth is perfectly stretched.

(2) Another reason for the material running backwards on the cloth is an imperfect shaking of the riddle. If there is any vibration in the middle which produces an elevation of the sieve at the return stroke towards the head of the machine, this will cause the material to run towards the head, because the material is thrown upward at the wrong end of the stroke, the sieve passes under it, and consequently carries it backward instead of forward. This can be overcome by stopping the vibration.

The material is often found to run sideways on a purifier. This is generally due to some imperfection in the eccentric the stroke of one eccentric being somewhat longer than that of the other, or it may be due to the frame of the sieve striking against some stationary surface.

The purifier is the most sensitive machine in the mill, and should be kept always in absolutely perfect working order. The eccentrics should be perfect; the feed distributed perfectly; the cloth kept perfectly stretched, and suitable devices used to keep it clean. If this is done, and the suction taken near the tail of the machine, whereby the greatest suction is obtained at that point, and gradually decreasing as it reaches the head of the machine, the machine whatever its construction may be will do good work.

The automatic delivery of all the material from the time the wheat enters the first break until it passes off as flour and offal is of great importance; but few mills are so constructed; nearly all of them have hoppers over the different rolls and purifiers, whereby a quantity of stock is accumulated. This accumulation may gradually become greater until it becomes necessary for the miller to open the feed-gate widely and permit it to pass off. If this feed-gate is opened at the head of the mill, it necessarily floods the mill from head to tail, therefore producing a larger quantity of offal. When this surplus material has been run off, the feed-gate will be found to be feeding probably only two-thirds of the space across the roll. Then another injury occurs by the grinding of the material on only a part of the surface of the rolls. Thus it keeps the miller constantly adjusting back and forth, as it is impossible to set the machines so that there will be neither an increase or decrease of material. Consequently it is of great importance that this difficulty should be overcome, and it can be, by the use of proper feeds for supplying the different materials to the different machines; and these feeding devices should be so perfect that there should be a constant and unvarying stream passing from the head to the tail of the mill, precisely the same as a body of water passing over a mill-dam. Then we may hope to produce not only an even result, but secure the very best possible finish, and run the mill to the very best possible advantage.

There are a great variety of systems for the manipulation of the different stocks in the mill, and most of these systems will produce good work, but some of them are far more elaborate than others. They reach a given point by passing around a greater distance, as it were. In the early introduction of the roller system, the manipulations were much more extensive than at present, but gradually the unnecessary operations have been eliminated, until the most perfect system is that which accomplishes the work with the least manipulation possible. Every time the material is passed over a scalper, reel, or elevator, or through a worm, there is a production of a quantity of fine flour which has been produced during the time that the impure material was intermingled with the pure, and consequently this flour is not only soft, but it is of a dark colour; and the greater number of useless manipulations that we have, the greater will be the quantity of this material produced; consequently they should be avoided as far as possible.

I may also say that there are a great many mistakes made on the part of millers who have had only a limited experience in the operation of two or three mills, in undertaking to programme their mills without the employment of thorough expert talent. It generally leads to very many changes after the mill is in operation, and much loss before the mill becomes perfectly successful. Assuming that two men are possessed of an equal degree of natural talent, it necessarily follows that the one who has had the largest experience in the matter of separations will be able to construct the most perfect mill. There are many points in milling which are purely theoretical, and upon the basis of theory seem to be correct; and it is not infrequently the case that those who have not had extensive experience are liable to drift into these theoretical ideas, and condemn the experienced expert who has been through all this field of experiment, and knows its merits and demerits. So I may say that however well posted a miller may be, he will never lose anything by counselling with those whose experience has been more extensive than his own.

I had intended to continue these papers for a considerable time longer, but my time is so occupied that I have concluded for the present to discontinue them, unless it may be upon some subject that may be brought up by those who may have been interested in these articles.—London *Millers' Gazette.*

TRANSFORMERS.

EVERY alternating system for electric lighting or power purposes must use a converter for changing high into low pressure electricity. A converter or transformer in electrical uses, acts exactly as does a reducing valve in steam engines. The core of a transformer should be made of soft Swedish iron wire, about No. 22 B. W. G., and made in the same way as dynamo or armature cores, that is, wound into a cast iron drum which can be withdrawn easily.

The section of the core must contain about one square inch for every 150 watts of electricity delivered. This prevents magnetic saturation of the iron cores. But few turns of the primary wires are required for exciting purposes, but for self-regulation there should be one turn of the primary wire for every volt and a half pressure applied.

For a current of 3,000 volts there must be 2,000 turns of the wire in the primary coils. For the secondary coil the number of turns depends upon the pressure to which the electricity has to be reduced. First ascertain the ratio between pressure received and pressure delivered; received pressure being 3,000 volts, and delivered pressure 100, the ratio should be 30; divide number of turns of wire in the primary coil by this ratio and the result will be number of turns required for secondary coil; thus 2,000÷30=66 and a fraction, consequently there should be 66 turns in the secondary coil.

SAFETY-VALVES ON HEATING BOILERS.

THE proportion of the area of a safety-valve to the area of the grate, according to the United States rule, says the *Locomotive*, should be such that there is half an inch of valve area to each square foot of grate surface, when lever or dead-weight valves are used, and one-third of an inch of valve area to each square foot of grate surface when spring or pop valves are used. It has been shown by actual trial that when these proportions are observed, the valve is of sufficient size to prevent any considerable rise of pressure beyond the point of blowing off—that is, if everything is in good order. This rule, therefore, is a very safe one to follow.

In heating boilers, the valve area should be increased rather than diminished, because the class of help employed to run these boilers usually lacks the experience and intelligence of the class employed to run high-pressure boilers, and the necessity of seeing to it that all pertaining to such boilers is properly designed becomes correspondingly more urgent. But it would seem, judging from our past experience, that altogether too many people consider anything in the form of a safety-valve to be good enough for a heating boiler, and we found one boiler with a grate area of seven square feet, which had a safety-valve area of only 44-100 of an inch (a somewhat less than half an inch), when according to the United States rule the area should have been three inches and a half. If the safety-valve on such a boiler should at any time have to be depended upon to relieve the boiler, a dangerous rise of pressure would take place, the steam being unable to escape as fast as it is formed.

Another trouble with the safety-valves of low pressure boilers is so frequently met with, that it seems almost to be the rule, even when the areas are properly proportioned. It is that the regular high-pressure valve and weight is used, so that even when the weight is pushed as close to the valve as it will go, it takes a steam pressure of from twenty to forty pounds to raise it. In other words, the valve was made to use on a high-pressure boiler, and is so designed that it can be set to blow off at any pressure between forty and one hundred pounds, with the idea that this range would be all that would be required; and this being the case, forty pounds is the lowest pressure at which it can be set to blow off. The safety-valves and weights on all heating boilers should be adapted to the duty they have to perform, and the levers should be marked accordingly.

Let us consider any ordinary heating boiler. The maximum pressure carried is ten pounds, the pressure gauge registers up to twenty pounds, and the damper regulator is adjusted to ten pounds. Now let us suppose that through ignorance or neglect the draft doors are locked open. The pressure rises, and the damper regulator cannot control it, when ten pounds are reached. The safety-valve should have been so constructed and set that it would blow at twelve or fifteen pounds, but with the Ball pushed in, in too many cases it takes thirty-six pounds to lift the valve. The light diaphragms in the damper regulators are broken, and the pressure gauge is destroyed or strained.

The weight of the lever and valve, ordinarily, will balance about two pounds of internal pressure, and the weight placed on the lever should be such that when it is pushed in close to the valve, the boiler will blow off at five pounds or less. Then, if it is desired to set the valve to blow at ten pounds or fifteen pounds, it will be easy to do so by shifting the weight outward along the lever till the proper point is reached.

We have stated what can take place when valves are weighted as we frequently find them, and we will say, further, that just such accidents as these have come under our personal observation, and that frequently in our practice we are obliged to re-adjust valves by having light weights substituted for heavy ones. The only objection to the change is, that the point at which the valve blows off will no longer correspond with the marking on the lever. If those fitting up low-pressure boilers will call upon the valve manufacturer for valves weighted and graduated for low pressure work, they can easily procure precisely what is needed.

TABLE OF REVOLUTIONS PER MINUTE FOR VARIOUS RIM SPEEDS.

Dia. in.	RIM SPEED, FEET PER MIN.				
	9000	10000	11000	12000	13000 ft.
8	4297	4775	5252	5733	6207
10	3438	3820	4202	4586	4966
12	2865	3183	3541	3824	4138
14	2456	2728	3001	3276	3547
16	2149	2387	2626	2866	3104
18	1900	2122	2334	2548	2579
20	1719	1910	2101	2293	2483
22	1563	1736	1910	2085	2257
24	1432	1592	1751	1910	2069
26	1322	1469	1616	1764	1910
28	1228	1364	1501	1638	1773
30	1146	1273	1401	1529	1655
32	1074	1194	1313	1433	1552
34	1011	1123	1236	1349	1460
36	955	1061	1167	1274	1379
38	905	1005	1106	1207	1307
40	859	955	1050	1147	1241
42	819	909	1000	1092	1182
44	781	868	955	1042	1129
46	747	830	913	997	1079
48	716	796	875	955	1035
50	698	764	840	917	993
52	661	735	808	882	955
54	637	707	778	849	920
56	614	682	750	819	887
58	593	659	724	791	856
60	573	637	700	764	828
62	554	616	678	740	801
64	537	597	657	717	776
66	521	579	637	695	752
68	506	662	618	674	730
70	491	546	600	655	709
72	477	531	584	637	690
74	465	510	568	620	671

ENGINE AND BOILER DEFECTS.

ACCORDING to the statement of an experienced inspector of boilers and engines, who was recently interviewed by the New York *Safety Valve*, the commonest defects to be found about the engine come from improper working or regulation by the governor, as the journals and bearings of the governor are quickly worn out if not looked after. The governor should be regularly cleaned, washed off and well lubricated. Engineers often think that their pistons and valves are not working to the best advantage, when the fault is really with the governor. Sometimes pistons leak, an effect of unequal and excessive wear. Belts too tight cause a deal of trouble; a little sag is a good thing for bearings, as they very often get hot because the belts draw too tight. As to boilers, laminated plates over furnace and bridge wall cause endless trouble, complaints come from this cause outnumbering all others. The next thing to demand notice is deposit, which 90 per cent. of boilers is subject to. This causes bagging, burnt plates, opened seams and rivet checks. Another bad fault comes from having the feed and blow of the boilers at the front end. This allows the back end to become covered over with sediment, due to poor circulation. This should never be so. There should always be some means by which the boilers can be thoroughly cleaned and inspected. The man-hole-plate in the front head is an excellent thing. Another great fault in construction is not leaving room enough to clean boilers. Where there is any trouble or labor in getting at the parts, the engineer does not give the boiler the attention it requires, and will not clean any more than is actually necessary; but where parts are easily accessible, and there is no trouble in keeping the same in good condition, the engineer will take pride in this part of the work. Circular bridge-walls should be condemned, for the reason that they are of no use and do not add to the combustion. As the fire is perfectly level, the bridge-wall should also be level, so that part of the shell directly over the bridge-wall can be readily examined by the engineer or inspector at any time. Steam-gauge pipes should also have stop-cocks and blow-off cocks, so that the sediment and dirt can be blown out of the gauge-pipes, or the gauge taken down, tested and replaced while there is steam in the boiler. Many boilers are injured by having fire lines too high, that is, above the gauge-cocks; this will cause cracks, lamination and checks. The metal should not be exposed to fire where there is no water on the opposite side. After the engineer gets the engine working well and in good order, he should not tinker with it, but let him put his screw-wrench on the shelf and not take it down until it is actually necessary.

THE DEVELOPMENT OF THE CALIPER.

TO definitely ascertain when the first piece of mechanical work requiring accurate gauging or measurement was executed, is as difficult as would be the task of settling the date of the deposit of the metals and their ores among the rocks. It is certain that the working of metals is a very ancient art. Some of the ancient work proves the early existence of tools which were at least as effective if not equal in all respect to such as the modern mechanic requires.

Tubal Cain is the first name mentioned in connection with this subject. He is reputed as a skilful workman, and while he may have made many measurements by touch and sight, he must have had certain tools to aid him in securing accurate results.

Without doubt the first tool that suggested itself to the mind of this early worker, for the measurement of diameters or thicknesses, was a gauge something like that shown in Fig. 1, which is simply a notched plate of iron, the width of the notch being the measure-

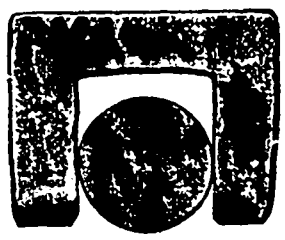


FIG. 1.

ment of the diameter or thickness required, and by repeated applications of this gauge to the work as it neared completion, accurate results were secured; but this tool was what would now be called a special tool or gauge designed for measuring fixed diameters. It lacked the adjustable feature which was necessary to adapt it to work of different sizes. Of course the tool could have been heated and altered, but this would have occasioned

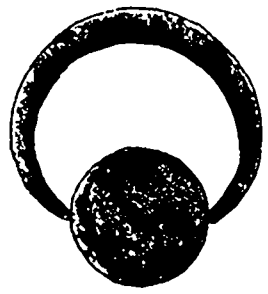


FIG. 2.

considerable labor, as well as the loss of the original gauge. It is therefore probable that for an adjustable gauge or caliper, something like that shown in Fig. 2 was employed. This tool consisted of a curved bar of metal with the ends approaching each other, and the adjustments were effected by bending the bar.

An obvious and early improvement upon this caliper is shown in Fig. 3. The difficulty of bending a bar whenever an adjustment was required suggested the use of a frictional joint at the centre of the bar, which would permit of swinging the arm of the

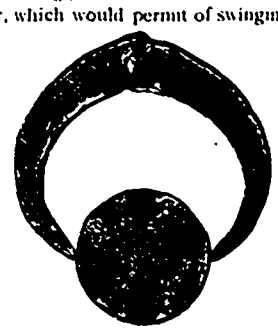


FIG. 3.

caliper to adapt it to the measurement of different diameters. From this crude mechanical device have been developed all the modern improved forms of caliper.

The climax of perfection in this line is seen in the Stevens caliper, represented in Fig. 4. In this caliper the jaws are connected together by a fine joint, and a C-shaped spring is applied, which

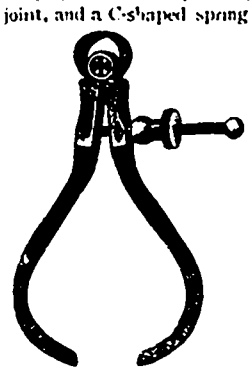
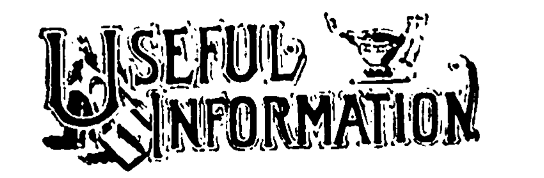


FIG. 4.

tends to separate the free ends of the jaws. The adjustment is instantly effected by a simple and durable slip nut, which together with the joint and spring, forms an ideal arrangement appreciated by every mechanic.



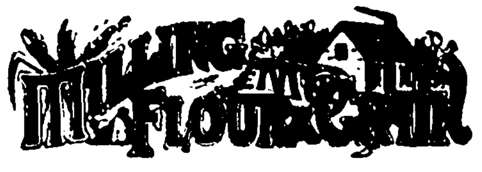
The cost of running street railways with horse power and with electricity have been carefully estimated, and for the purpose of comparison a line running fifty cars is taken. Such a line operated with horses, say the N. Y. Sixth Ave., costs $[illegible] per day, and with electricity $[illegible]. The difference in favor of electricity is $[illegible], or $[illegible] per day saved on each car.

Here is what business men and authors say about advertising: Some say they cannot afford to advertise; they mistake; they cannot afford *not* to advertise. *Barnum.* Advertising is to business what steam is to commerce—the grand propelling power. *Macaulay.* There is but one way of obtaining business—publicity; but one way of obtaining publicity—advertising. *Blackwood.* Advertise: for the life of business is printer's ink. *Spurgeon.*

A process has lately been invented of bronzing steel surfaces so as to prevent the possibility of rust. The steel, which must be free from all impurities, is exposed for two or three minutes to the vapors of a mixture of hydrochloric and nitric acids in equal parts, at a temperature of from [illegible] to [illegible] F. When the steel cools it is rubbed over with ordinary vaseline and again heated until the vaseline begins to decompose; this treatment with the vaseline is repeated once. By mixing acetic acid with the other acids a lighter color is produced. *[illegible] Journal of [illegible], April, [illegible].*

Mr. F. M. Kent in the *Electrical World* describes the following method of approximately determining the speed of dynamos from the hum of the brushes on the commutator. Take any musical instrument which has been tuned into correct concert pitch and find by experiment the half tone which nearest corresponds with the hum of the brushes. Then, if we know the number of vibrations per second required to produce that tone, we have only to divide that number by the number of segments in the commutator and we have the number of revolutions made by the machine in one second. The following is approximately the vibrations per second of the notes of the scale starting with middle C: C 264, C sharp 275, D 297, D sharp 310, E 330, F 352, F sharp 367, G 397, G sharp 412, A 440, A sharp 458, B 495, C 528. For example: If we found that the hum of the brushes corresponded with G sharp, and we know that there are 40 segments in the commutator, then we have the speed of dynamo $\frac{412}{40} \times 60 = 618$ revolutions per minute.

A circular letter sent out recently by the Indiana Millers' Mutual Fire Insurance Company gives the following warnings, which every miller should heed: "First. The value of a good supply of barrels and buckets of water at accessible places throughout the building. If barrels of water with buckets are handy in all parts of the mill they may save a destructive fire. Second. The necessity of positive instruction to employees to make a careful examination of every fast running journal in the mill within from three to five minutes after shutting down, and if a hot journal is found, to see that it is cool before leaving. It is an established fact that a hot journal will not ignite as long as it is kept running, but will do so directly after machinery is stopped. Too much care in this direction cannot be exercised. Third. Experience has demonstrated that a wood split pulley will cause fire if not closely watched. The bolts in these pulleys become loose and the pulley will slip on the shaft and is liable to cause fire. Every bolt in these pulleys should be tightly drawn every time the mill is shut down, and thus prevent this danger. Fourth. Elevator heads should be closely watched and regularly cleaned. Far more fires originate there than millers generally suppose. Conveyors as well need close attention, and should be kept running free. Every conveyor box should have a loose lid that will [illegible] or [illegible] choke up. Fifth. Above all things else, a mill should be kept clean, for fires will originate easier and spread more rapidly in a dirty mill than in a clean one."



A new elevator is being built at Winnipeg, Man., by the Ogilvie Milling Co.

The new Victoria, B. C., mill is expected to commence operations in about a month.

Flour in Manitoba has dropped in price 15 cents per barrel, bran and shorts $2.00 per ton.

Mr. Jas. N. Henry, of Chatham, Ont., will build new warehouses on the C. P. R. at North Glencoe and Newbury.

The bonus of $1,700 offered by Pilot Mound, Man., has been accepted by a Morden miller, who will start a grist mill there.

The Lake of the Woods Milling Co. will erect ten or twelve grain elevators throughout Manitoba with a capacity of 30,000 bushels each this year.

The Regina flouring mill and adjoining storehouse and three C. P. R. loaded cars were destroyed by fire on the 15th June. Loss $14,000, insurance light.

The grist mills belonging to Mr. Campbell, of Summerside, P. E. I., were completely destroyed by fire recently. The loss is estimated at $1,000, with no insurance.

Messrs. Dyson & Son, of Essex, Ont., are asking the town council for an exemption on their mill, stating as their reason for so doing that they were going to put in a lot of new machinery.

It is said that three elevators will be erected at Boissevain, Man., this fall. They are the Ogilvie Milling Co., Lake of the Woods Milling Co., and a farmers' union elevator in connection with their mill.

Messrs. Martin, Mitchell & Co. will build four elevators along the present lines of the N. P. & M. R. this summer, and will also build an elevator at each station on any extensions that may be made.

Messrs. McLaughlin & Moore's mill in Toronto had a narrow escape from destruction by fire on the night of June 28th. Fortunately the workmen discovered the existence of the fire and extinguished it before any damage was done.

At a recent meeting of the Board of Flour Examiners held at Toronto, Mr. John Todd, who came to Toronto from Winnipeg a year and a half ago, was examined as to his qualification for a flour inspectorship, and will receive his certificate.

S. Wigle & Co., proprietors of the Kingston Roller Mills, are thoroughly overhauling the mill. The whole of the machinery will be taken out and replaced by machinery of an improved make.

The council of the Winnipeg Grain Exchange having been asked for a ruling as to the liability of a purchaser of grain for exchange to a point of exchange, has made a rule that the money is payable at the point of delivery of the goods unless special arrangements are made in the contract.

Mr. R. J. Lyons' elevator at Carberry, Man., is being overhauled. The storage capacity will be increased about 65,000 bushels, a brick engine house will be built and a 25 horse power engine will be put in, and the most modern cleaning and elevating machinery will be added. The whole to cost about $5,500.

Mr. McMullen's elevator at Mount Forest, Ont., was destroyed with its contents on June 5th. The building contained about 13,000 bushels of grain belonging to E. Murphy, valued at $8,500, and grain sacks worth $250. Insured in the Royal for $5,000. The elevator was insured in the Waterloo Mutual for $1,000.

Stevenson v. Walker, is an action brought by Mrs. Stevenson, of North Norwich, against Walker, Harper & Co., millers of the village, for $500 damages for the death of her son, who received fatal injuries while in the employ of the firm, owing, as alleged, to lack of proper instructions regarding the machinery. A verdict was returned for plaintiff for the full amount.

Mr. J. C. Vanstone, of Bowmanville, Ont., will suffer severely from the recent storm and flood in that vicinity. The roller mill at Bowmanville is greatly damaged, a large portion of the stone foundation being carried away, and the dam is a complete wreck. The mill at Tyrone is also badly wrecked. The Caledonian Stone Mill, Bowmanville, owned by John Mackay, is injured to the extent of $1,000, and a large quantity of barley and chop destroyed.

The C. P. R. Telegraph Company posted up the following Northwest crop bulletin: "It is now the general opinion among farmers in this country that Manitoba wheat crop for 1890 is assured. Reports received from fifteen grain centres in Manitoba and the Western Territories all give very encouraging news of the condition of the crops; many farmers assert that even if we should have no more rain this season the wheat cannot suffer from drought as the plants have taken good root and are in a healthy and vigorous condition. This is perhaps not owing so much to the recent copious rains as to careful cultivation and the use of the press drill. Eight hundred thousand or an increase of more than 20 per cent. over last year, is the estimated number of acres in wheat alone in Manitoba. In Western Territories there has also been an increase in acreage sown over last year. The C. A. C. Co.'s farms in Western Assiniboine look remarkably well and at Dunmore and Gull Lake the vigorous and strong growth of the wheat equals that of the Portage Plains. Altogether the prospects for a large crop were never more favorable at this time of the year. The Department of Agriculture has also issued a bulletin on the condition of the crops and live stock. Three hundred and seventy eight correspondents reported simultaneously June 15th that the weather was admirable for seeding. Growth was slow early in the season but very rapid later on. The average fall of rain over the whole province has been 1.70 inches, and only a few places are reported as needing any. The acreage under crop is 1,053,265, an increase of 150,000 over last year. The condition of the grain, root and hay crops in almost every district is reported excellent and promising."

One thousand men are employed on the saw mills at Arnprior.

Robinson & Co., of Selkirk, Man., are erecting a large planing mill at that point.

Messrs. McCreary & White will start a new sash and door factory at Arnprior, Ont.

It is said that a new sash and door factory will be started at Boissevain, Man., this year.

The main building of the large wooden foundry of the Lloyd Manufacturing Company at Kentville, N. S., was destroyed by fire recently. No insurance.

It is reported that some large lumber manufacturers from the vicinity of Barrie, Ont., are on their way to the coast with a view of investing in timber land, and building a large mill.

D. L. Adams, who with others applied to the council of Victoria, B. C., for a lease of land long ago, have purchased a quantity of saw mill machinery, with powerful boilers and engines, and will establish a mill on Victoria Arm, at Point Ellis bridge.

A week or two ago a saw mill owned by Warren Farman, of Omagh, Ont., carrying $3,000 insurance and standing idle, was burned. On Tuesday one Nelson Green was arrested on suspicion and admits firing the building at Mr. Farman's instigation. Green could not read and says Farman instructed him that when he got a piece of paper marked with two x's the mill was to be burned. On Saturday he got the sign, and on Sunday the mill was in ashes. People who know Farman discredit Green's story.

FACTS CONNECTED WITH THE INSTALLATION OF ELECTRIC LIGHT PLANT.

MR. John J. Power, superintendent of the Natchez (Miss.) gas company, contributes to the *American Gas Light Journal* the following interesting narrative of experience relative to the installation and operation of the electric light plant under his control:

The Natchez Gas Light Company, nearly two years ago, decided to put in an electric light plant, principally for lighting the streets of our city, which were at that time lit by 110 gas and about 70 coal-oil lamps; we chose the Thomson-Houston system, and contracted with that company for a complete outfit of 100 2,000 candle-power arc light capacity, the gas company reserving the right to choose the kind of steam boiler and engine to be put in. All the work was done under my supervision. The plant consisted of one Hazelton boiler, 125 h. p., and a Beck engine, 100 h. p., with a Stillwell exhaust steam heater and purifier, 3 dynamos—2 of 35 light and one of 30 light capacity—all the lamps and attachments and cost of building to be in the contract, together with 21½ miles of wire. The plant, complete, cost the company $25,000.

The building part frame and part brick, is all covered with corrugated iron, 40 by 60 feet; the boiler and pump room is 19 by 40 feet; the space occupied by boiler is 10 feet in diameter. A brick wall divides the boiler from the engine and dynamo room, which occupies the remainder of the building, 40 by 40 feet. Great care was exercised in having good ventilation, which is absolutely necessary for the safety of the dynamos. In putting in foundations for engine and dynamos, I was very careful to have good work performed. The engine foundation is 6 feet deep, on good solid earth, 1 foot of cement and 5 feet of brickwork, laid in cement mortar, every brick shoved and joints struck. The mortar was composed of 1 part cement to 2 of sand. The sides of foundation have a pitch of three inches to the foot. The foundations for dynamos were similarly constructed, but only 3 feet deep. To-day those foundations are as solid as can be. I have balanced a silver coin on edge on cylinder head of engine when running at a speed of 265 revolutions.

Our repairs on plant have been very slight, and embrace a new wrist pin in engine, nothing on dynamos; and, except for making some changes on extension shaft of engine, which was necessitated by having to put in another engine to run our incandescent dynamo, might be said to be nil.

Our boiler has proved a great success, making a great saving in fuel; for, from several tests which I have made, both with water evaporation and from card from engine, with Pittsburgh nut and slack (very little nut), we have obtained a h. p. for 3.8 lbs. coal consumed. It is easily handled, a very rapid steamer, and from my knowledge of others of the same make, very durable.

We are now running up to full capacity—84 arcs and 51 incandescents (series) 65 candle power. The city has given us a five years' contract at $85 per year, for 2,000 candle power lights all night and every night. We have 79 on the streets; also 1,765 candle power incandescents at 1½ cents per hour each. The balance of our lights are taken in stores.

Our operating expenses for an average month are as follows:

Engineer	$80 00
Fireman	$50 00
Trimmer (who furnishes his own horse and wagon)	$75 00
Lineman (5 days repair line, new lamp ropes, etc.)	$10 00
Coal, Pittsburgh slack, at $3 00 per ton	$175 00
Carbons	$70 00
Repairs, new brushes, commutator segments, new globes, etc.)	$18 50
Oil, $16, waste, $3.50	$19 50
Total	$498 00

To this must be added wear on plant, interest on investment, and insurance. So far everything works smoothly, and every visitor to the city claims that we have the best and steadiest lights that they have met with anywhere. The only credit in this connection which I can claim, is that I take especial care to keep everything around the machinery, especially the dynamos, clean and in good trim.

In conclusion, I would say to the intending purchaser of an electric plant, get the best of everything. First, a good system; second, a good steam plant, that will save cost of fuel, which is the heaviest expense in operating; third, suitable buildings, strong, well ventilated and dry; fourth, good men to operate your machinery—it is poor policy to try to get a cheap man, because he is cheap, to run valuable machinery; and last but not least, get the best wire, and have it well and securely put up. If of poor quality and poorly put up, it will always be a source of expense, dangerous, and a continued worry to all connected with the plant.

CARE OF A DYNAMO.

"WHAT to do and how to do it" is the qualification of a good mechanic, be he millwright, steam engineer, or paper maker, says the *American Engineer*. At present the millwright and steam engineer have about as much on their hands as any of the mechanical force. New machinery, new methods and new men are constantly coming to hand, and they must all be combined to make the greatest possible amount of paper from a given quantity of material, make it cheaply and make it well.

Suppose a single machine is shut down for repairs for one hour during the day. The actual loss does not amount to much, but if the stoppage is repeated time after time, during many days and by many machines, then it is felt badly by the owners, especially when, as is the case nowadays, one-eighth per cent. per pound in the price of paper made means the difference between a fair yearly profit and failure or suspension of payment.

The millwright and steam engineer have to handle new machinery. Their first work should be to post themselves about it. Perhaps a 200 light dynamo has been put into the mill. Nobody knows anything about the machine. It is different from anything they have ever handled. It does no visible work yet consumes lots of power.

The first thing for a man to do when an electrical plant is sprung upon him is to read up on the subject and get hold of every piece of knowledge to be had. Look the plant over. Find out how many lamps are attached to the dynamo. Write to the maker of the machine, giving all of the data and stating number of dynamo. Ask if the thing is overloaded and ask for all the information that can be given concerning the care for and operation of the dynamo.

Sometimes a dynamo persists in sparking in spite of all that the attendant can do. In this case, see that the brushes are in good shape and are set right, moving a brush slightly sidewise. This perfects the bearing between the brush and commutator, forming better contact, and carries off the current without partially breaking its path.

Sparking is merely the establishing of small arc lights between the brush and commutator bars or between two or more of the bars. The way to cure sparking is, therefore, to take off the current without breaking its path. Trim the brushes until they fit the commutator when the machine is not running. See that the commutator is perfectly clean and round.

Small fragments of copper, perhaps fine as dust, are often carried between the commutator bars. These particles of dust form imperfect paths for the electrical current, and in leaping across the imperfections the arc lights appear and the dynamo is "sparking" boldly.

Count the revolutions of the armature. Be sure that it is not much over the speed marked on the machine. A speed under this will have no worse effect than not fully lighting all the lamps. A speed greater than that intended *may* do hurt by increasing the electrical pressure (voltage) so much that the electricity may jump from one wire of the armature through the insulation, and then there is a spoiled dynamo on the engineer's hands, with the armature "burned out."

See that the armature is round. It should be turned once in a while, either by being removed and put in a lathe or by means of a small slide rest which may be attached directly to a dynamo frame. After turning, every bar of the commutator should be examined with a magnifying glass to make sure that no particle of copper dust has lodged in the mica, which forms the insulation between the commutator bars.

All excessive heating of the commutator should be prevented. Too much pressure from the brushes will cause friction and heat, therefore adjust the brushes to run as lightly as possible and keep good contact with the commutator. Feel of the commutator once in a while. Be careful not to get hold of either of the brushes while so doing, or a dangerous shock may be the consequence.

See that the armature or field magnets do not get too hot. The wire with which they are covered is of sufficient size to carry a certain current, and so many amperes and no more can pass without danger of burning the insulation from the wires. Burning out a dynamo is causing so much current through its wires that they are heated hot enough to burn off the fibre with which they are covered.

Once this covering is destroyed, the current does not pass around and around the armature or field magnets, but goes direct from one coil of wire to another, and no current is generated by the dynamo. Electricity passing through a wire always heats it. About 140 degrees is the maximum degree of heat allowed, and this is easily borne by the hand.

By feeling of the field magnets it can be easily told when they are getting too hot. Almost every armature causes a current of air to flow from it, and by holding the hand in this air and noting its temperature the attendant can easily tell if the armature is getting dangerously hot.

The armature should be perfectly balanced. A standing balance is not sufficient. A running balance must also be secured. An armature out of balance, or with its shaft sprung, will often cause sparking at the commutator as well as heating at its bearings. To find if an armature is in running balance, put it between centers, as in a lathe, and have the dead center made long and slender.

A stiff spiral spring between the center and tail stock will answer the same purpose, and may be easily rigged by soldering two centers into a piece of spring; one center to go into the armature, the other into the tail stock or some other bearing for it. Revolve the armature, and if it does not wobble and cause the center to describe a circle, then the armature, or that end of it, is in running balance.

Turn the armature end for end, and repeat the operation. If either end is out of balance it must be corrected by weighting the armature until it runs true. Like all other machinery, a dynamo needs to be "greased with common sense," as well as with oil. Think what you are about and the "electrical millwright" will have no trouble.

ON THE AREAS OF SEGMENTS.

AMONG the calculations that the engineer often wants to make, there is one for which no simple and perfectly accurate rule can be given. We refer to the calculation of the area of a segment of circle. Rules based on the principles of trigonometry can be given readily enough, but they are not at all suited to the engineer, who wants something that is simple, that gives fairly accurate results and that he can easily carry in his head. Following is a rule that is simple enough, but which gives results that may be in error by 15 per cent. or thereabouts. When such an error is permissible, this rule may be used; but when further refinement is necessary, one of those given below should be substituted for it. The shaded part in Fig. 1 may be considered

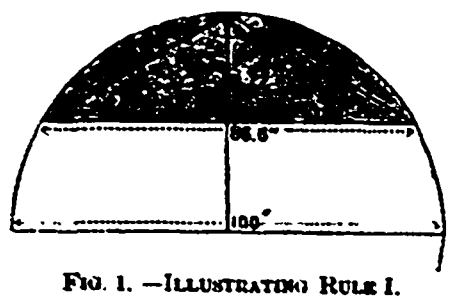


FIG. 1.—ILLUSTRATING RULE I.

as made up of a triangle and two small segments lying on either side of it. The area of the triangle may be found by multiplying the base by half the altitude; and it has been found, by calculations based on more exact methods, that the two small segments, taken together, are about equal to half the triangle. Therefore we have the following: Rule I. Multiply the base by the segment by half the altitude, and to the product add half of itself. (Error may amount to 15 per cent. or so). Thus in Fig. 1, half the altitude of the segment is 12½ inches, and 25 inches ÷ 2 = 12½ inches. Then, by the rule, 86.6 inches × 12½ inches = 1,083. Then half of 1,083 is 541, and 1,083 + 541 = 1,624 square inches, which is the area sought.

The most satisfactory is to calculate the area of a segment by that given in the *Locomotive* for December, 1886. This method is exact, but it requires the engineer or

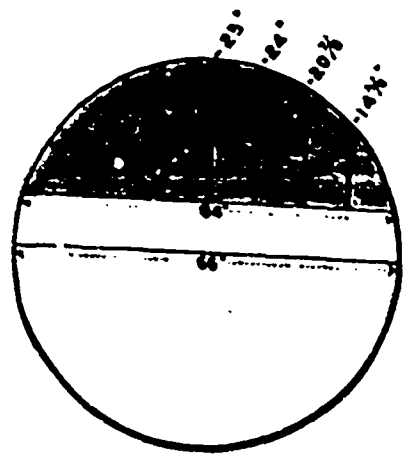


FIG. 2.—ILLUSTRATING RULE II.

inspector to have the table with him whenever he wishes to calculate a segment. A method based on Simpson's rule for irregular figures (see Rankine's "Rules and Tables," *p. 64.*) is shown in Fig. 2. The base of the segment is divided into halves, and one of these halves is again divided into quarters, and a perpendicular line is drawn through each point of division up to the circle. These perpendicular lines are then measured, and each is multiplied by the number written against it in the shaded space; all the products are added together, the sum is multiplied by the base of the segment, and the product, divided by 12, is the area sought. The rule is exact when the small parts into which the curve is divided are arcs of parabolas, and it is only approximate when these parts are only approximately parabolic. In the case of the circle, therefore, the rule is not exact; yet its accuracy is quite surprising. In the case of a 66-inch circle, measurements of the perpendicular lines gave the results written above the lines respectively. The calculation is as follows:

25 inches	× 1 =	25 inches	
24 "	× 4 =	96 "	
20⅞ "	× 2 =	41¾ "	221¼ × 64 = 14,160; and
14⅝ "	× 4 =	58½ "	14,160 ÷ 12 = 1,180 sq. in. *Ans.*
Sum =		221¼ "	

The reader, after studying the preceding calculation carefully, will find the following useful: Rule II. Divide the base of the segment into halves, and divide one of these halves into quarters. Draw perpendiculars through each point of division till they meet the circle, and measure each one of them. Then multiply the middle one by 1, the next one by 4, the next one by 2, and the last by 4. Add all the products together, multiply the sum by the base of the segment, and divide by 12. The result is the area of the segment. (Error is never greater than one per cent.)

A similar but very much simpler rule than this may be given, which is never more than four per cent. in error, and which suffices for every practical requirement except in cases in which the greatest possible accuracy is required. It is illustrated in Fig. 3. The base of the

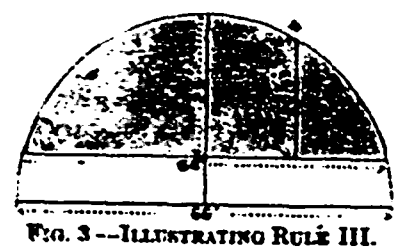


FIG. 3.—ILLUSTRATING RULE III.

segment is divided in halves, and one of these is halved again. Perpendiculars are drawn as before, and these are measured. The shorter one is multiplied by 4 and added to the longer one. The sum is multiplied by the base of the segment, and the product divided by 6. Thus, taking the measurements as given in the cut, 4 × 20⅞ inches = 83½ inches; 83½ inches + 25 inches = 108½ inches; 108½ × 64 = 6,944; and 6,944 ÷ 6 = 1,157 sq. in. This process is summed up as follows: Rule III. Divide the base of the segment into halves, and divide one of these again into halves. Through each point of division draw a perpendicular till it strikes the circle. Measure both perpendiculars, and to the long one add four times the short one. Multiply the sum by the base of the segment, and divide by 6. (The result can not be in error by more than four per cent.) The true area in Figs. 2 and 3 is 1,158 sq. in.; so that Rule II gives a result less than one per cent. too small, and Rule III gives a result about three per cent. too small. Both of these rules are most accurate when the height of the segment is small, and are least accurate when the segment is nearly a semicircle. Rule II is recommended for use in draughting rooms, and Rule III, which is, on the whole, by far the most useful, is recommended for draughtsmen, engineers and inspectors.—*The Locomotive.*

PUBLICATIONS.

Among the contributors to *The Arena* for July are Senator Wade Hampton of South Carolina, O. B. Frothingham, Rabbi Solomon Schindler, Rev. Carlos Martyn, D.D., Junius Henri Browne, Hamlin Garland, H. O. Pentecost, Rev. Minot J. Savage, Hon. A. B. Richmond, Frances E. Willard, and General Marcus J. Wright.

A company has been formed at Collingwood, Ont., to start a foundry and machine shop.

The Hamilton Forging Works have been absorbed by the Ontario Rolling Mills Co. The business will be considerably extended and actively pushed by the new proprietors.

William Hobard Nolan and W. O. Gardner, who did business at Montreal under the firm name of the Machinery Supply Association, have assigned on the demand of La Banque Nationale, with about $45,000 liabilities. The principal creditors are the Bank of British North America, $16,122; La Banque Nationale, $15,975; John Bertram & Sons, Dundas, $3,800; Tees & Son, $1,732; George M. Cheesman, New York, $1,576.

GENERATION, DISTRIBUTION AND MEASUREMENT OF ELECTRICITY FOR LIGHT AND POWER.*

APPLIANCES THEREFOR AND PARTICULARS OF CANADIAN INSTALLATIONS.

By A. J. Lawson, M. Can. Soc. C. E., A. I. E. E., A. A. I. E.

STORAGE BATTERIES.

STORAGE batteries have not been applied on this continent to any such extent as they have been in Europe. Wherever they are employed except for propulsion of about a dozen street railway cars, perhaps fewer, it has been for the purpose of securing light after engines and dynamos have been stopped at night, and for railway car lighting. For the latter purpose they have not hitherto been a success, and have been discontinued on the Pennsylvania Road, on the Canada Atlantic and on the Grand Trunk Railways, the Julien battery having been used in these cases. On the Intercolonial Railway a great number of cars have been fitted up with these batteries, and it is said several additional charging stations are to be erected, it having been found that the two at present in operation, one at Levis and the other at Moncton, together with such current as may be obtained at Halifax, N. S., and Montreal, have been insufficient, or otherwise expressed, the capacity of the batteries has not been enough to last during the runs between the various stations. The fact that the coal oil lamps, which were wisely left in position, are used on nearly every trip, proves the inadequateness of the batteries which have been supplied for this work.

Outside of these plants storage batteries have been used in five or six places in Canada, among which may be mentioned McGill College, the lights which we have here being run from a Gibson battery in the basement. The battery is charged from a small shunt wound dynamo driven by an Otto gas engine made by Crossley Bros. of Manchester.

The same kind of plant and the same kind of battery are used in the residence of Mr. J. R. Redpath, the arrangement of which is shown in Figs. 21-24. The plant is in the basement of the house. The gas engine is an Otto made by Messrs. Schleicher, Schumm & Co., of Philadelphia, and is the steadiest running gas engine in Canada. Its weight, with two 54-inch fly wheels, is about 3200 lbs. It indicates 3.0 h. p., with a gas consumption of 26 cubic feet per h. p. per hour. Over the cylinder is a cast-iron saddle, on which the dynamo, a shunt wound machine made by Holmes & Co., of Newcastle-on-Tyne, imported by the writer, is placed, there being just one quarter of an inch clearance between the rims of the fly wheels and the ends of the dynamo bed. Behind the dynamo and attached to the bed of the engine are two wrought iron adjustable arms carrying the counter shaft and idler pulley. The dynamo pulley is therefore between the idler and the fly wheel of the engine, is double crowned and is lapped over nearly the whole circumference by two belts as shown. The slip is less than 2 per cent. The speed of the machine is 180 revolutions per minute. The dynamo weighs 450 lbs., and the idler pulley and countershaft 100, so that the total weight of engine, dynamo and driving gear is 3800 lbs. A box 7' 4" x 5' 2" would cover engine, dynamo, belting, idler pulley and countershaft, and the whole might be thus shipped to any distance completely set up ready for connection of gas and exhaust pipes. The arrangement of the plant was designed by Mr. Redpath, and is most compact and ingenious.

There are 42 cells of Gibson battery, capacity 150 ampere hours, and they are connected in two sets of 21 each in parallel, the charging current being 35 amperes at from 45 to 55 volts pressure. These cells are ranged on shelves in the engine room. The plates in this battery are placed horizontally instead of vertically as in other batteries, and have thus the advantage of being less liable to short circuiting through paste falling between them as it does in vertically arranged plates. A slight disadvantage is that the internal resistance is higher than some other forms of battery owing to the plates being farther apart, but this is compensated for by the longer life of the Gibson, the makers guaranteeing to keep it in order for ten per cent per annum of the first cost. The electrolyte used is dilute sulphuric acid with the addition of sulphate of soda, the density of the combined solution being 1.220. This battery will stand heavier charging than any other, and has frequently been charged with a current of 75 amperes; but the most economical practical charging rate is about 30 amperes. In charging the current is measured by Weston ammeter and the pressure by a Weston voltmeter. There is also another Weston voltmeter in the library upstairs, and underneath it a resistance switch of German silver in series with the battery, by which the pressure in discharging is regulated, as the battery, when first connected to the lamps after charging, is higher in E. M. F. than when nearly discharged, and the lamps used are of course of such voltage that they will give their full light at the lowest pressure to which the battery in practice is reduced. The maintenance of perfectly uniform light is thus under control from Mr. Redpath's arm chair.

This is the first and only complete private installation for residential lighting in Canada, and was first started five years ago, shortly after the visit of the British Association to this country.

VALLEYFIELD AND BARRIE CENTRAL STATIONS.

Let us describe briefly and compare these central stations, both constructed by the writer, and good samples of their respective classes. Both have water power, but the first is on the Edison three-wire system and the second is a Brush A. C. plant. In Valleyfield the power is in the heart of the town and in the centre of distribution, so that it is in the most favourable position for economical distribution by low tension, and the wire used is as small in area as consistent with even voltage at the lamps and best efficiency of the plant. Both stations were built with rooms for the man in charge over the dynamo room. The running expenses are the same or about the same in both places. Probably no other stations of similar capacity in the world cost less to run, the total annual expense in each being less than $1,600. The capacity of both stations is about the same, say 60,000 watts. The Valleyfield station complete cost $40,000, including building, water-wheels and flume. The Barrie station, including the same items, cost less than $22,000, including over $3,000 for the wire leading into town from the station, five miles distant. In the Barrie station heavily insulated wire is used throughout the 24 miles of street wiring, and rubber-covered wire in all buildings, whereas bare wire is used in Valleyfield for street wiring, and fire and weather-proof wire for inside work. House wiring in Valleyfield is all cleat work, while most of that at Barrie is concealed, the lights in the latter place being principally in private houses and placed on brass fixtures, and at Valleyfield are used exclusively. The pressure in the houses in Valleyfield is generally 220 volts, the three wires being carried in, in all cases where this system is used, in order to maintain as even a load as possible on both sides of the circuit. In Barrie the pressure is 93 volts on the lamps in the houses, and nothing higher than 98 volts can ever enter them. The charge for current averages at Valleyfield is $6 per light a year, and at Barrie $7.50. This means that, making due allowance for all contingencies in both cases the Barrie plant will pay its shareholders better than the Valleyfield plant will, while the customers pay $1.50 per light a year less. In the Barrie station Westinghouse meters are used on the premises of the largest consumers, and these can be read by the consumer as well as the meter man, the cost of operating the station is not increased, the man who attends to the wiring of the buildings in town and to collection of accounts taking the readings; while if the Edison meter be used at Valleyfield, another man will require to be employed to attend to the meters solely, and his wages will have to be added to the operating expense and thus reduce the net revenue.

The respective sizes of wire used in both stations is worthy of study. At Barrie the loss in the feeder is 14½ per cent. at full load, nearly the same as at Valleyfield. The length of feeder at Barrie is 10 miles for the complete circuit, and the size of wire No. 4 B. W. G. At Valleyfield the feeders are three in number and three in a set; the longest is less than two miles for the complete circuit, and the size of the outside wires No. 000 B. W. G. The No. 4 wire used at Barrie weighs 685 lbs. per mile, including insulation, and the No. 000 bare wire at Valleyfield weighs 2880 lbs. per mile.

It may be and has been said that in the one case you have a perfectly safe low tension system, while in the other, to use the pet phrase of the paid advocate of low tension, the New York State electrical executioner, you have the "Deadly Alternating Current." That is admirable as a trade trick, but even the Edison Company now advertise that they are prepared to supply A. C. plant to all who desire it. Either there is less danger than they would have the public believe in the A. C. system, or they are ready to subordinate principle to pocket in the contest. To alter slightly a phrase from Dickens' "Holiday Romance, the Edison people have been advising the public to "Prohibit the use of the alternating current system on the ground of humanity as it makes ours too expensive." Sir William Thomson, the greatest living authority on electrical matters, says:

"In passing I may remark that 100 volts in the house is perfectly safe to the user, whether the current be alternating or continuous, as is proved by large and varied experience in England."

It must be freely admitted that the accidents reported from New York were real and not invented for sensational purposes, but it must also be acknowledged that in no other city in the world is there such an organization as the Board of Electrical Control, to which appointments are made by political influence only, regardless of qualification, and one of whose advisers is, or was, an individual whose business it was for the past two years to discredit the alternating system, for which service he was well paid. In no other city in the States or Canada is there such bad construction of overhead conductors as there was in New York, and the under-ground construction there is nearly as dangerous on account of existing grounds on the wires and leakage of current, and the consequent liability to cause explosions of gas in subways as has already been repeatedly done, besides turning the paving stones into "a molten mass."

Furthermore, the insulation of the overhead wires, which have been in use in some cases over eight years, had rotted off, being of the quality known as "Underwriters," or "Undertakers" if you will.

Four deaths have occurred in the whole history of electric lighting in Canada from shocks of electricity, and two of these were the result of bad insulation of wires and faulty construction by a purchasing company doing its own work without employing anybody having any knowledge of the business, in order to cheapen the first cost of the plant, and which purchased a job lot of poorly insulated wire, and ran two dynamos in series with 100 arc lamps in circuit at a tension of nearly 5,000 volts. The current used on that system was a continuous one, not a pulsating high tension current as stated in a circular which some of you may have received.

Reverting to our main subject, thirty wires radiate from the Valleyfield station; one pair carries the current from the Barrie station. In the Barrie station the pressure of primary current is the highest which has yet been used in this country, being about 2,100 volts average on the feeder. This pressure is raised or lowered by increasing or decreasing the exciting current according to the load shown on the central station ammeter, which is graduated to single amperes, and is indicated by a Cardew voltmeter, which, as elsewhere mentioned, is attached through a converter to the armature. Instead of having a compensator, as is used in the Westinghouse system, a table of loads and the corresponding pressures to be carried at the station is used. This method, though of course not absolutely perfect, owing to the rise of current with increase of voltage and vice versa, answers very well. The Cardew voltmeter in the company's office in town, which is an excellent check upon the dynamo attendants' work, shows an average variation of only two volts in a night's run. The mains in town, which aggregate nearly fourteen miles in length, are calculated for a loss of only 2 per cent., at full load, which gives a difference of ⅔ of a volt per lamp up or down from the standard. The house wires, which are insulated with rubber and tape, are calculated for only one per cent. loss only at full load. As most of the lights are taken in private residences, where the whole number are hardly if ever in use at one time, the loss of light through resistance of the house wiring is practically nil.

MEASURING INSTRUMENTS.

The Ayrton and Perry instruments have been used to a very considerable extent in this country, and until recently were the most accurate of all really portable electrical measuring instruments. There is a sample on the table before you. They are only suited for direct currents, and are open to the objection that they have considerable friction and a high temperature error if kept in circuit, which they should never be except only for a few seconds when taking readings.

The Weston voltmeter is shown in Figs. 25 and 26, and on the table are a voltmeter and an ammeter of this type. These volt meters have the great advantage of extreme accuracy and very high resistance, averaging about 20,000 ohms, so that the quantity of current passing is extremely small. They may be kept continuously in circuit without any material variation in their readings. They require careful handling, of course, as do all electrical instruments, but they are the most accurate and reliable of all portable testing instruments for continuous currents. The voltmeters contain a calibrating coil by which their constancy can be at all times tested. The writer has used quite a number of these instruments which he has checked with each other, and has sometimes compared the higher and lower scale by taking the P. D. difference between terminals of single cells of secondary batteries, and then, putting the whole of the cells in series, compared the reading of total E. M. F. of the battery. Several tests of this nature have come out within one quarter of a volt. The calibrations are in

* Abstract of paper read before the Canadian Society of Civil Engineers at Montreal, May 8th, 1890.

single volts on the higher scale, and thirtieths, twentieths or tenths of volts on the lower scale. The ammeters read to tenths of amperes in the small sizes. In both the divisions of the scale are so wide that one quarter of these values can be read with perfect ease.

For the most perfect readings by these instruments they should be quite level, and five feet away from any other instrument, or from any mass of iron or steel, and so placed that the index will point due west when at the centre of the scale, but these precautions are not necessary for ordinary testing of pressure in buildings, as the error can never be more than ½ volt, if otherwise placed.

The Cardew voltmeter (Fig. 27) is used for both direct and alternating currents, and is made to be used either vertically or horizontally.

The horizontal pattern has the advantage of being steadier than the vertical instrument owing to the disturbance caused by currents of air passing up the tube of the latter. All the more recent forms of this instrument have an adjusting screw outside of the case to bring the needle to zero, which should be done before the current is turned on. No adjustment should be made while the wire remains warm, as the section of the wire may be altered by any tension put upon it while in this condition and the calibration destroyed.

For alternating and direct currents Sir Wm. Thomson's latest instruments are the finest yet produced, but are more suited for standard or station than for use as testing instruments. In the electrostatic instruments no current passes through the instrument at all, and so the conditions of a battery or dynamo on open circuit can be found with perfect accuracy. The electrical balances (Fig. 28) are adapted for both alternating and direct currents. To anybody desiring a fine standard laboratory or station set of large range, none are better than these instruments, expensive though they be. All stations for alternating current work should have a Cardew or Thomson voltmeter, a portable Thomson multicellular electrostatic voltmeter, for testing pressure in consumer's premises, etc., and a Thomson ampere gauge. For direct current stations Weston or Cardew voltmeters for station work and line testing should be used, and Thomson ampere gauges for current measurement. The Westinghouse ammeter, an excellent instrument closely resembling the Thomson ampere gauge, is shown in Fig. 29, and the Edison ammeter in Fig. 30. For rough approximations the latter is a cheap and fairly accurate instrument.

TRANSMISSION OF POWER.

In his address at the annual meeting, the President touched upon the subject of electrical transmission of power, mentioning the installation at the Chollar Mine, Virginia City, Nevada. There a Brush plant is used, as then stated, placed 1,680 feet below the surface of the ground, in a chamber 50" long × 25" wide × 12" high, hewn out of solid porphyry. The small stream of water, which drove the wheels at the surface of the mine, was carried down through two iron pipes one 10" and the other 8" diameter, connected together at the bottom of the shaft by a Y into a single pipe 14" diameter from which 6" pipes lead to the Pelton water wheels' nozzles, and there develops sufficient energy through the dynamos to transit to the surface through well insulated cables 450 H. P. The waste water is conveyed away through the Sutro Tunnel, pierced through the side of the mountain for the drainage of the mines—in itself a monument of engineering ability and western enterprise. This is at present the largest installation in the world for transmission of power by stationary electric generators and motors.

About August last a generator and a motor of exactly the same type as those placed in the Chollar Mine were installed at Messrs. Barber & Co.'s Mills, Georgetown, Ont. The water of the Credit river was dammed over two miles below the mill, and a water wheel and shaft were placed in a building there along with the generator. A copper wire was carried back and attached to the motor, which develops 75 H. P. in the mill.

ELECTRIC RAILWAYS.

Four years ago there may be said to have been no electric railways in operation in America. Yet according to the most reliable sources of information there were 636½ miles of electrically equipped railways in operation and 700 miles under construction at the end of December, 1889: 1063 electric cars were then running and 771 cars were being equipped. The total number of completed roads was 107, and 85 were under construction. Of these roads two were running in Canada, their total length being 10 miles, and these were equipped with ten motor cars. The first, at Windsor, Ont., with two miles of road and two cars, has now been at least five years in operation; the other is at St. Catharines, and the length of road is eight miles, and it is equipped with 8 cars. Both roads use the Vandepoele system. The road at Victoria, B. C., is now running. The track is four miles long, with 6 motor cars. The Vancouver road, now approaching completion, is likewise four miles in length, and will be equipped with 4 motor cars. It will be running about the middle of June. The Thomson-Houston system is used in both cities, and a contract for a short line in Toronto on which two motor cars will be used has lately been closed with the Thomson-Houston company, who have done by far the largest amount of work in electric railways, the Sprague Co. rank next. The table given below shows the amount of work done by various companies and that under construction in January last.

ELECTRIC RAILWAYS.

In operation and under construction, Jan., 1890.

Name of System.	In operation.		Under construction.	
	No. of Roads	No. of Cars.	No. of Roads	No. of Cars.
1 Thomson-Houston	47	490	37	509
2 Sprague	35	498	33	218
3 Daft	10	66	5	15
4 Van de Poele	8	57	"	"
5 Short	3	17	1	5
6 Bentley-Knight	1	6	1	20
7 National Electric Ry. Co.	1	1	5	not given
8 Julien	1	10	"	"
9 Fisher	1	4	2	not given
10 Henry	1	4	"	"
11 Rae	"	"	1	4

STREET WIRING FOR ELECTRIC LIGHTING.

Within the past few months great activity has obtained in electric railways in the United States, and two leading companies in this business have contracted for several hundreds of cars each, the lead of the Thomson Houston company having increased, while the Sprague company has over 1,200 motor cars in operation or in course of construction. The largest electric street railway system in the world is that of the West End Railway of Boston, contracted for by the Thomson-Houston company of which the following particulars may be of interest: At the present time there are 150 cars running, and when completed there will be 600 in operation. Now there are 56 miles of road electrically operated, and 236 are to be equipped. In the power station from 3.30 till 7 p. m. the electrical plant which is capable of developing, if called upon, 2,500 H. P. usually furnishes from 1,000 to 1,500 H. P. The cars generally in use are 16 feet closed cars, carrying 30 passengers and towing a similarly loaded car. Such a motor car, equipped with a single 15 H. P. motor averages in speed 15 miles an hour on the level, and will pass a grade of 5 ½ per cent. at a rate of 9 miles an hour. Such work is, however, rather severe for constant use and for heavy work they are using two 15 H. P. motors. The potential used is 500 volts, and the average rate of speed is from 10 to 15 miles an hour. The weight of a motor car equipped is 6 tons, the cost of steam power is from one to four cents per mile, taking 100 miles per car per day as a basis; the cost of operation and maintenance four to six cents per car mile on the same basis; the cost of repairs to electrical apparatus is from one and a half to two cents per car mile; cost of management from one to two cents per car mile, and the average total cost of operation is nine and a half to sixteen cents per car mile, according to the number of miles operated.

Unfortunately the severe winters and heavy snowfalls of Montreal and other cities in eastern Canada precludes the possibility of working electric railways the whole year on our present street roads, but it is a question worthy of the study of members of this Society whether or no it would pay to operate our roads electrically during the seven months of open weather which we get or if a system of overhead railways along our main traffic thoroughfares operated electrically, and which could be run the whole year round, would not be a good investment.

First, on account of the dangers of break down from heavy sleet storms, and the variation in tension of wire caused by the extremes of temperature experienced in Canada, poles should be placed not more than 135 feet apart, or say 40 to the mile. They should all be good, sound, straight cedar, 7 inches diameter at the top end and not less than 35 feet long, and should be set in the ground to a minimum depth of 6 feet and securely tamped. The cross arms should be of sound timber 4½" × 3½", well painted, and fixed in gains cut in the poles and secured thereto by lag screws 8 inches long, which thus enter into the pole about 4½ inches. They should never be attached by spikes only. Wherever telephone or telegraph wires run in the same streets, the poles should be of sufficient height to carry the electric light wires at least four feet above them. Bare wire for carrying either high or low tension currents in towns should be strictly prohibited.

None but the best double-petticoat glass insulators should be used. The insulation of the wire should be both fire-proof and weather-proof, and be of such tough texture as to withstand abrasion should other wires by any means fall across the electric light wires.

For outside construction some of the English Board of Trade Regulations, which might be adopted with advantage in this country, are as follows, the numbers being those of the regulations:

1. An aerial conductor in any street shall not in any part thereof be a less height from the ground than 20 feet, or when it crosses a street, 30 feet, or within 6 feet of any building for the purpose of supply.

2. Every support of aerial conductors shall be of durable material, and properly stayed against forces due to wind pressure, change of direction of the conductors or unequal lengths of span, and the conductors and suspending wires (if any) must be securely attached to *insulators fixed to the supports. The factor of safety* shall be at least 6, and for all other parts of the structure at least 12, taking the maximum possible wind pressure at 50 lbs. per square foot.

5. Every aerial conductor shall be protected by efficient lighting protectors.

6. Where any conductor crosses a street, the angle between such conductor and the direction of the street at the place of such crossing shall not be less than 60 degrees, and the spans shall be as short as possible.

7. Where any aerial conductor is erected so as to cross any other aerial conductor, or any suspended wire used, for purpose other than the supply of energy, precautions shall be taken by the owners of such crossing conductors against the possibility of that conductor coming into contact with the other conductors or wire, or of such other conductor or wire coming into contact with such crossing conductor by breakage or otherwise.

11. The insulation resistance of any circuit using high pressure aerial conductors, including all devices for producing, consuming or measuring energy connected to such circuit, shall be such that should any part of the circuit be put to earth the leakage current shall not exceed 1-25 of an ampere in the case of alternating currents. Every such circuit containing high pressure conductors *shall be fitted with an indicating device which shall* continually indicate if the insulation resistance of either conductor fall below the conditions required by this regulation.

14. The owner of every aerial conductor shall be responsible for the efficiency of every support to which such conductor is attached.

15. Every aerial conductor, including its supports, and all the structural parts and electrical appliances and devices belonging to or connected with such conductors, shall be duly and efficiently supervised and maintained by and on behalf of the owners as regards both electrical and mechanical condition.

16. An aerial conductor shall not be permitted to remain erected after it has ceased to be used for the supply of energy unless the owners of such conductor intend, within a reasonable time, again to take it into use.

17. Every aerial conductor shall be placed and used with due regard to electric lines and works from time to time used or intended to be used, for the purpose of telegraphic communication, or the currents in such electric lines and works, and every reasonable means shall be employed in the placing and use of aerial conductors to prevent injurious affection, whether by induction or otherwise, to any such electric lines or works, or the currents therein.

The author considers that rules 7, 13, 14, 15, 16 and 17 should be equally binding upon telegraph and telephone companies whose wires are often as carelessly constructed as those of any electric light company, and have in consequence been quite as blameworthy for fires originating from electric currents.

HOUSE WIRING.

In the interior wiring, none but high class rubber insulated wire protected by an outer linen tape or other efficient covering should be used.

None but porcelain or slate base cut outs and switches should be allowed, and the sweating of drop wires for single lights on the main wires, such wires being afterwards twisted together and brought down to the lamp socket, should be prohibited.

Wherever lights are suspended by wires, stranded conductors, equal in area to No. 20 standard wire gauge, covered with a good solid rubber coating and protected on the outside by silk or cotton braiding, should be used, and where taken off from the main wires a porcelain rosette cut-out, such as the K. W. rosette, should in all cases be provided, or a wood base rosette may be used, provided it is rendered fireproof.

No switches should be used which do not break contact quickly and automatically, or in which spring copper makes a connection; such copper is heated by the pass-

age of a large current, and, by losing its hardness there from often fails to make good connection, and so may cause an arc to form. The Plaste switch is the only one at present made on this continent in which these objections are successfully met.

Fuses for cut-outs should not be interchangeable with others of widely different capacity. Over-loading of wires first designed for lighter loads would then be impossible.

The joints in wires are preferably made with connectors such as the MacIntyre wire joint, as soldered joints on which acid has been used, frequently corrode through the excess of acid not having been removed on completion of the soldering, and it has been the author's experience that ordinarily wiremen will not take the time or trouble to make a good joint with rosin as a flux.

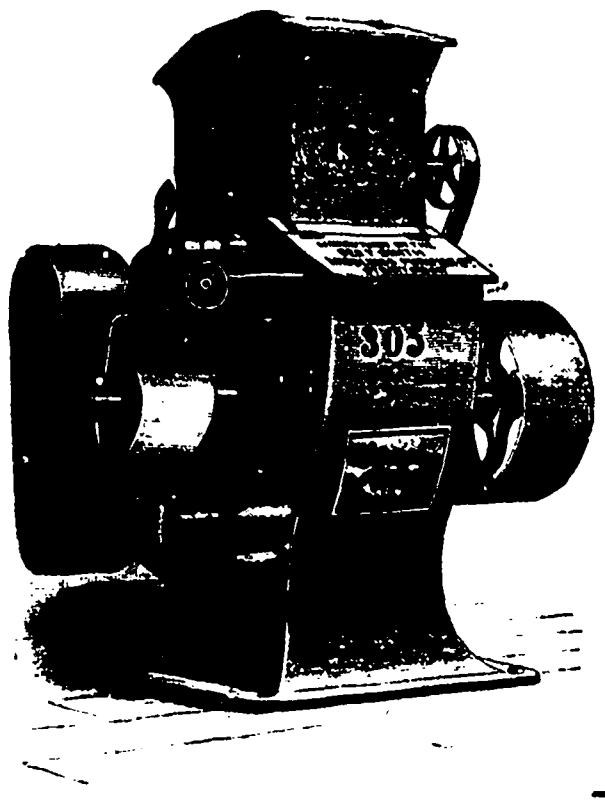
It must be remembered that a low tension continuous current is more liable to cause a fire in case of short circuit between the main wires than an alternating current, owing to the connection which exists directly between the dynamo and the house wires, permitting the entrance into the house of an enormous current, while with the alternating current system the short circuiting of the secondary house wires will only result in the immediate melting of the fine wire fuse in the primary circuit of the converter. There should be no relaxation, therefore, of adopted regulations in favor of low tension direct systems on account of supposed greater safety, a thing which does not exist in their case, but both direct and alternating current systems should be treated alike so far as the wiring of consumers' premises is concerned, and the present standard should be raised, not lowered.

It should not be forgotten, that one of the most important elements in the attainment of perfect safety to everybody concerned is the employment by supply companies of properly qualified and experienced labour both for the construction and running of plants. It will be found to be very poor economy to employ bell-hangers, plumbers and even shoemakers on work requiring considerable electrical and mechanical knowledge and clear judgment, as is done at the present time in some Canadian stations which might be mentioned, merely for the sake of saving two or three hundred dollars a year in wages, a sum which is much more than counterbalanced by the unsatisfactory results in the lighting and the additional cost of repairs. Nor should it be forgotten that a cheap and poorly constructed electric lighting plant is the worst of all possible investments.

To reassure the timid whose nerves have been so skilfully played upon by advocates of low tension systems, the following opinions of Sir William Thomson, Dr. John Hopkinson, Mr. W. H. Preece, Prof. George Forbes and Monsieur E. Fesquet, handed in at a recent meeting of the New York Senate Committee on electric lighting, may be cited. These gentlemen, whose qualifications to speak authoritatively on the subject cannot be questioned, are practically unanimous in the opinion that the distribution by alternating currents can be and is safely carried out by underground or overhead wires at pressures of 2,000 to 2,500 volts, that absolute safety to the person can be and is obtained in the use of such currents, that there is less danger from fire from an alternating current system using converters than from a continuous low tension current connected direct from the dynamo to the consumers' premises (and the higher the tension in the primary, the greater the safety in this respect), that on account of the small current and the consequently smaller area of copper wire required for its distribution, the alternating current has many advantages over all systems of low tension distribution; and that a properly constructed and mounted converter is in itself an effective protector to the user of electric illumination against danger from shock or fire.

In conclusion the opinion may be also hazarded that within the next ten years three-fourths of the incandescent electric lighting on this continent, following the example now set in Europe, will be carried out on the alternating transformer system at increased rather than lower pressures than at present used, and that a large proportion of our mills and factories situated within five or even ten miles of water power will be run by electric motors either driven direct by high tension continuous currents or by low tension alternating currents obtained through converters attached to primary conductors carrying a high tension and small current.

The Geo. T. Smith Middlings Purifier Co



Office of Campbell, Stevens & Co.,
Chatham, Ont., May 15th, 1890.

S. S. HEYWOOD, ESQ.,
Manager Geo. T. Smith M. P. Co., Stratford, Ont.

Dear Sir: I went down to Aylmer Roller Mill, Stevens & Sinclair, as promised, to start up the Three Roll Chop Mill made by you. That Chop Mill was a surprise all round. After getting chop mill in place with spouting to and from, the mill was shut down to put drive pulley on main shaft. Belt to drive it with had not arrived. I found an old three-inch belt, patched it up a little, and put it on, put the feed in and away it went, working on barley and corn at the rate of 15 to 20 bushels an hour, and it was running over an hour before the engineer knew it was running, then he came upstairs and saw it or I do not think he would have known the difference. They got the belt that night, and now are troubled with hard work, taking chop away and keeping spout clear.

Yours truly,

J. R. WALKER,
Head Miller.

St. Louis Hotel, Quebec, 5th February, 1889.

S. S. HEYWOOD, Esq.,
Manager Geo. T. Smith M. P. Co., Stratford, Ont.

Dear Sir: I am favored with your letter of the 1st instant, forwarded to me here, and have to thank you for the liberal spirit in which you have met my suggestions. I enclose check for $500, in full of balance of your account, accepting with thanks your proposal to this effect.

Sincerely yours,
A. CROSS.

P. S. Should have stated that I consider you have acted with great fairness and liberality in your endeavors to have the machinery made complete and satisfactory, and should I be in the position of having another like undertaking, I should be pleased to have it in your hands.

A. C.

River Beaudette, Que., Feb. 7th, 1890.

S. S. HEYWOOD, Esq., General Manager
GEO. T. SMITH M. P. CO., Stratford, Ont.

Dear Sir: Yours of the 4th inst. at hand. In answer would say the short system mill (two breaks) you built and started for us about thirteen months ago is running splendidly, our custom continually increasing. The contract was for a 50 barrel mill. We often exceed that quantity, using much less power than when we used stones to do same amount of work. The millwright work was done in a satisfactory manner, machines run well, and no trouble with machinery. I have no hesitation in recommending your mills to the public.

Yours truly,
WM. BRODIE.

The above letter from the Hon. Judge Cross, of Montreal, deserves a word of explanation, the circumstances under which it was written being perhaps without parallel in the history of mill building. Our contract for the mill at River Beaudette, of which Mr. Brodie is tenant, was with the Hon. Judge Cross, who owns it. After machinery had arrived at mill and millwright had commenced work, the mill building was levelled to the ground by a cyclone. The machinery was, of course, more or less damaged, and considerabe extra expense of millwright work incurred, and it was the adjustment of this account to which the Judge so pleasantly refers.

We are the Canadian manufacturers of the genuine Brown Engine. Our drawings and patterns came direct from the Brown Engine Co., of Fitchburg, Mass. Many of the *so-called* Brown Engines manufactured by other Canadian manufacturers are comparatively worthless, and should not be confounded with the genuine Brown.

SECOND-HAND MACHINERY FOR SALE.

1 No. 2 Smutter, manufactured by W. & J. G. Greey,	$ 50
1 No. 2 Smutter, manufactured by Howes & Babcock,	70
1 Run Chop Stones, against sun, four feet six inches,	60
1 Four Break Machine, 16 in. x 20 in., Goldie & McCulloch,	250
7 Garden City Purifiers, each	50
6 Barter Purifiers, each	100
2 Jones Iron Rolls for breaks, each	30
1 Single 12 x 24 Roller Mill, Gear Drive, manufactured by Goldie & McCulloch,	100
1 Double 9 x 18 Roller Mill, Gear Drive, Barter,	200
1 Double 9 x 18 Roller Mill, Gear Drive, Goldie & McCulloch,	175
1 4-break Machine, rolls 6 in. x 16 in., Goldie & McCulloch,	200
1 Slide Valve Engine Cylinder, 10" x 14" manufactured by Corbett & Sons, Tubular Boiler, 42" x 10', 47 3" tubes and all connections, Stack 60' x 20", necessary guy wires, pump and heater,	800
3 Run of Stones, all attachments, each	100
1 3 Becker Brush, manufactured by Goldie & McCulloch	50
1 Double 9x11 Style B Roller Mill, E. P. Allis & Co.	175

We have for sale a full line of special machines of our own manufacture, which includes a full line of Upright and Horizontal Cleaning Machinery, and Upright and Horizontal Bran Dusters.

We are Canadian Agents for the Knickerbocker Co., of Jackson, Mich., for the manufacture and sale of the Celebrated

Cyclone Dust Collector.

THE GEO. T. SMITH MIDDLINGS PURIFIER CO.

STRATFORD, ONT.