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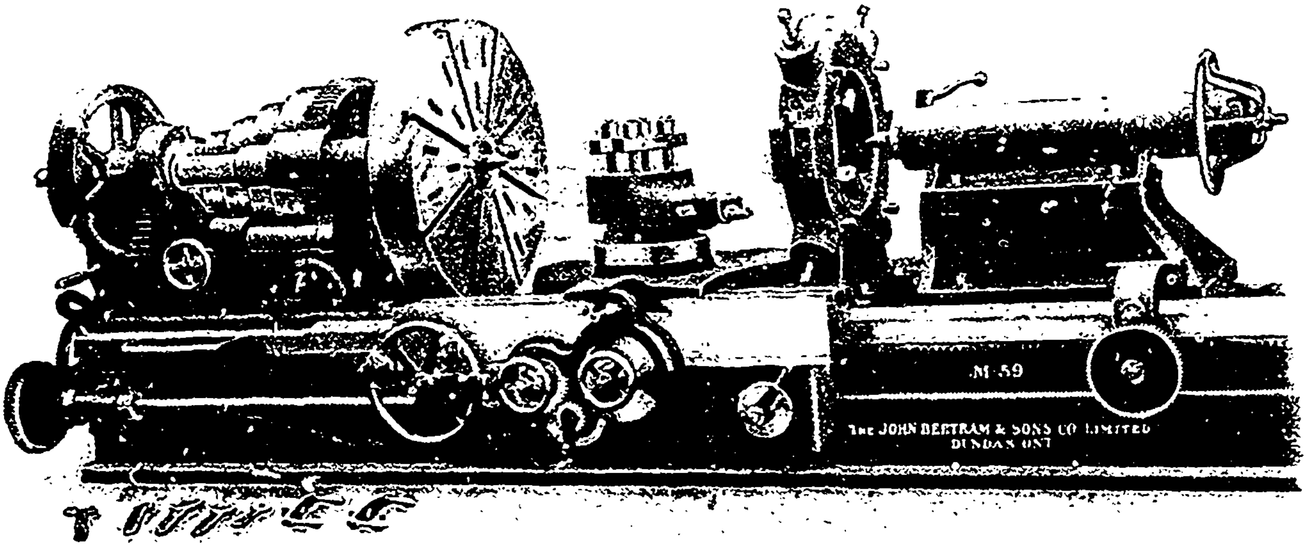

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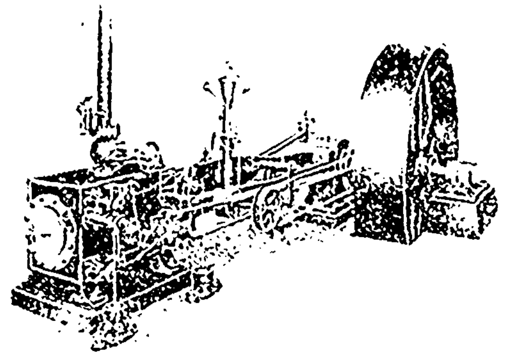

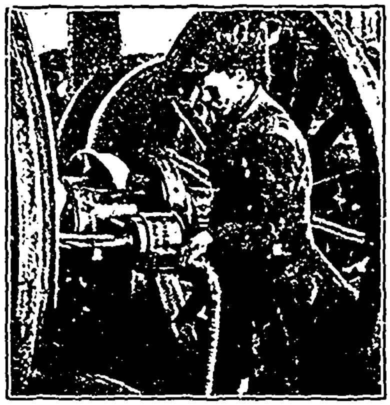

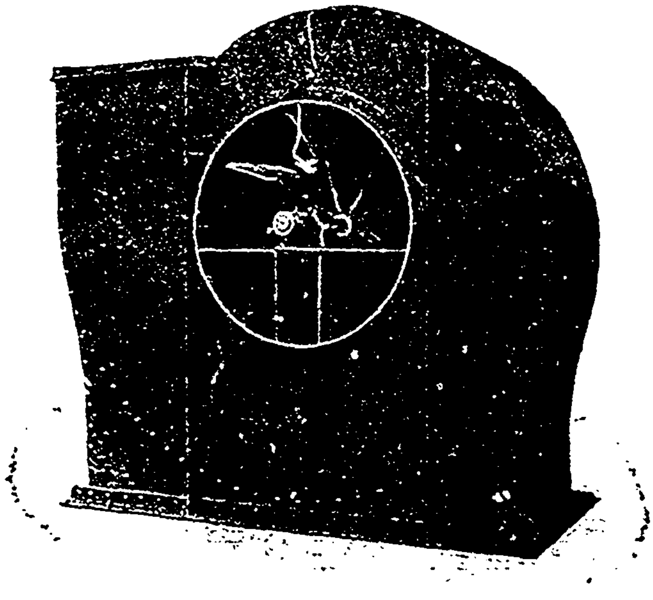

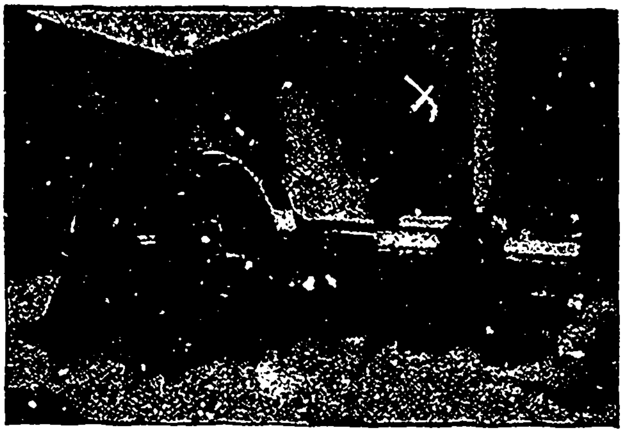

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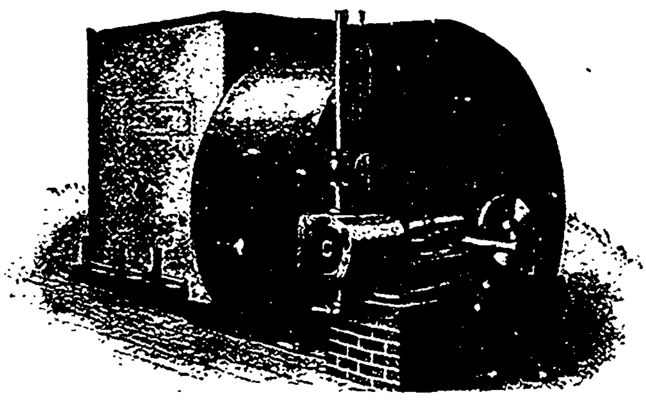

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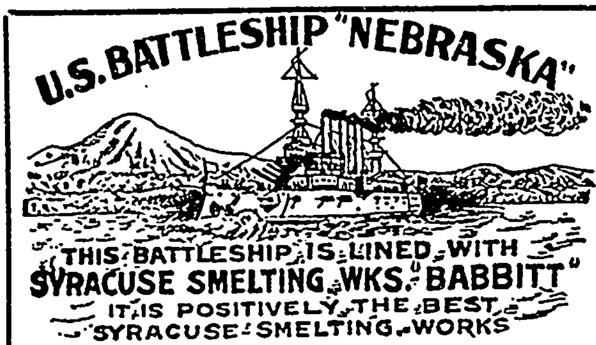

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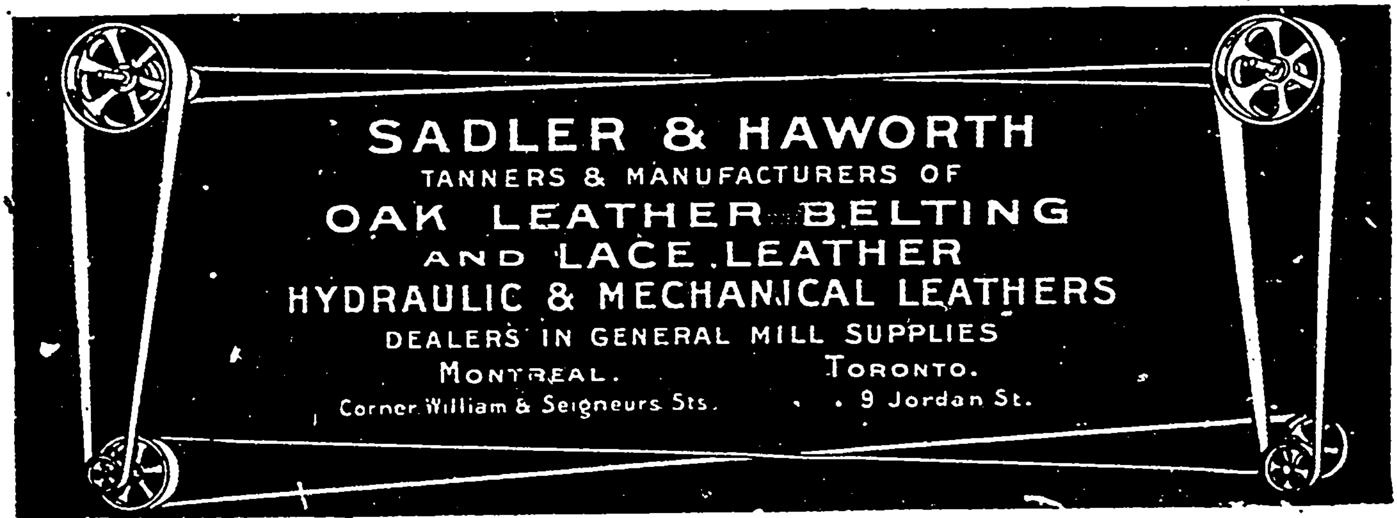

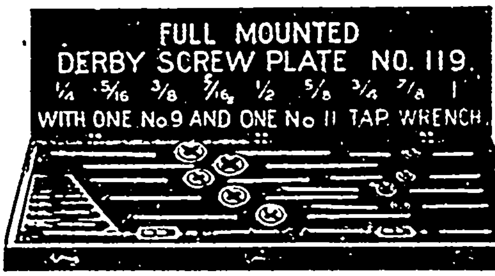

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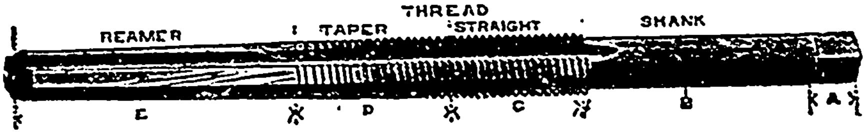

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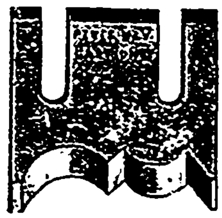

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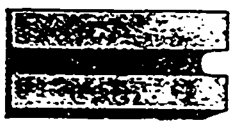

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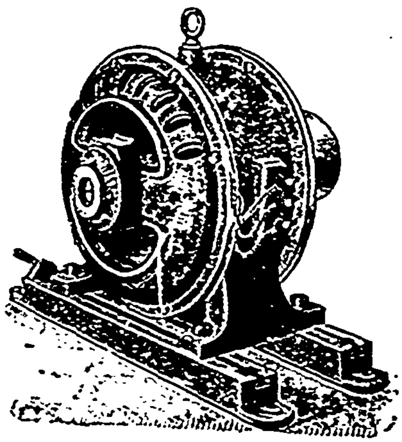

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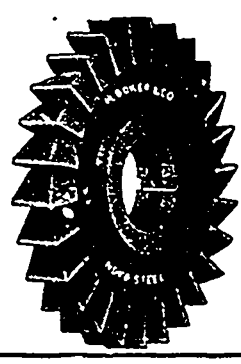

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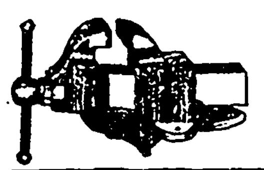

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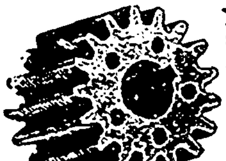

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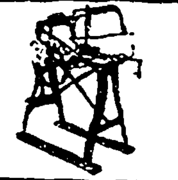

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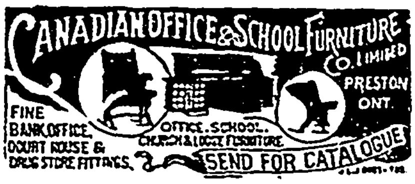

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DEVOTED TO THE MANUFACTURING INTEREST OF THE DOMINION

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CANADIAN TRADE.

The annual report of the Trade and Commerce Department for 1907 has been issued. While, owing to the change in the termination of the fiscal year, from June 30 to March 31, the report in detail covers only the nine months ended March 31, 1907, the trade figures have been recompiled for the purposes of comparison, and the result is summarized thus:

"The total imports and exports during the nine months covered by the report was $465,063,204, as compared with $550,872,645 during the previous year of twelve months, or $399,797,020 during the corresponding nine months of the previous year ; or, again, the total trade during the twelve months to June 30, 1907, was $617,-964,952, as compared with $550,872,645 as above."

A summary of the trade of Canada for the twelve months ended Sept. 30 shows total imports of $362,459,907, as against $296,359,543 during the corresponding period of 1906, an increase of $66,100,364.

Exports of Canadian produce amounted to $244,-180,922, as against $244,796,381, a decrease of $615,459.

The duty collected on imports for the twelve months ended Sept. 30 was $58,661,696, an increase of $10,-619,943.

Exports to Great Britain amounted to $126,805,985, a decrease of $7,403,372.

Exports to the United States totalled $89,981,440, an increase of $4,788,110.

Imports from Great Britain for the twelve months ended Sept. 30 totalled $96,078,752, an increase of $23,221,842, while imports from the United States amounted to $223,040,016, an increase of $38,598,040.

The figures of Canada's trade for the month of October show that the financial stringency has not operated to prevent the continuance of the rapid growth in the volume of imports. The total imports for the month, exclusive of coin and bullion, amounted to $31,484,400, an increase of $2,363,832, as compared with October, 1906. For the first seven months of the present fiscal year the total imports, exclusive of coin and bullion, have been $222,635,138, an increase of $34,053,458, as compared with the corresponding period of last year. The duty collected during the month was $5,119,136, an increasse of $430,892.

Exports for the month show a considerable falling off, principally in animals and their produce, which declined about two million dollars, as compared with the same month last year. The total exports for the month exclusive of coin and bullion, $26,623,078 a decrease of $2,095,362. For the seven months the decrease was $1,117,561, the total amount of exports for the period being $158,299,950.

PROTECTION IN GREAT BRITAIN.

The development of the industries of Great Britain by free trade during the past sixty years is the subject of continual argument by the free traders of Canada to-day. It is strange how they fail to appreciate to what extent protection aided those same industries before the era of free trade. The facts will doubtless be accepted by those who are always holding up Great Britain as a wonderful example of a successful free trade commercial policy.

In the days of Edward III., in the first half of the fourteenth century, the export of English wool was prohibited, as also was the importation of wear of foreign cloths or furs. Thus Sir William Blackstone tells us, and he adds that cloth workers from other countries were encouraged to settle in England. Restrictive legislation of this kind was for a long time crude, and continental countries supplied Great Britain with tapestries, silks, linens, laces and other fine lines of goods. Edward IV. prohibited the importation of many manufactured articles and Henry VIII. and Queen Elizabeth were protectionists of the most pronounced type. English artisans learned well the lessons taught them by the skilled workmen of Belgium and Flanders. Thus we find Henry VIII. summarily expelling thousands of them from England and Elizabeth taking steps to destroy the power of the Hanseatic League, which practically controlled the commerce of England.

From the reign of Queen Elizabeth historians date the commercial prosperity of England, and in no small degree was the progress in the mechanical arts during her reign due to the influx of Huguenots from France, and miners and smelters from Germany. By the beginning of the seventeenth century English manufactures were sold in the markets of the world, and English shipbuilders and sailors were in employment. The British shipping industry was founded firmly by Cromwell's navigation acts, under which goods imported in English bottoms paid less duty than the same goods imported in foreign bottoms, and colonial products were forbidden to be brought to England except in English ships. These acts were subsequently supplemented, and with particular efficiency in the time of Charles II. In 1849 these Acts were much modified, but the end had been already accomplished and the bonus system, extending even to present years, secures to England supremacy on the seas.

Many curious extracts may be made from the ancient tariff laws. In Elizabeth's reign it was enacted that the export of live sheep was punishable by forfeiture of goods and a year's imprisonment for the first offence, and the cutting off of the left hand for the second offence, while a third offence was punishable by death. The prohibition of the export of wool, sheep, and fuller's clay was not repealed till the last century. In the reign of Charles II. and William III., export of these articles was punishable by confiscation of the ship and cargo and three year's imprisonment of the master and all the mariners. In the reign of George I. a statute was enacted against the injury to home manufacturers by inducing artisans to go abroad. The first offence was penalized in £100 fine and three months in prison. In the second offence the fine was discretionary, and imprisonment was for one year. Artisans who left Britain and did not return within six months after being warned by the British Ambassador, were declared aliens and their land and goods were forfeit. In the reign of George II. a first offence under this act meant £500 fine and twelve months' imprisonment, and a second offence £1,000 and two years' imprisonment. George III. increased the stringency of these laws and fixed a penalty of £200 and forfeiture for the export of tools or utensils used in manufacturing silk, linen, or wool (except wool cards to North America); £100 penalty for the captain of a ship or a customs officer implicated, and £200 for collecting such tools and utentsils for export. Practically the same regulation was re-enacted in 1825 and again in 1833, when it held good until 1845.

In the reign of William III. the export of knitting machines was prohibited. In 1782 engraved copper plates and blocks were also stopped from export; and inducing a workman employed in calico printing to leave the country was made an offence punishable by £500 fine and a year in prison. These regulations of artisans were not entirely abolished till 1825. The colonies were even more severely dealt with, and Great Britain attempted to prevent them from establishing industries that England carried on, or was able to supply them with products of. It would not be believed the extent to which England went in this, were not the laws open to be read upon the old-time statute books of the mother land. High duties and complete prohibition were the rule, and the rule was rigidly enforced. To prohibited importation was frequently added a bounty on goods exported. Iron, brass, copper, silk and leather manufactures and hats were common objects of prohibition, and the rates of tariff ran from twenty to seventy-five per cent.

In 1842 the abandonment of the tariff began. Protective duties on many foreign products were retained till 1859. Silks, boots and shoes, and gloves were protected till 1860, timber till 1866, and sugar till 1874. Duties are to-day imposed on tobacco, beer and spirits. With only a half century of free trade Great Britain is losing her hold, and her great thinkers are casting about for means of maintaining the status she reached supreme in the world of commerce. Five hundred years of the strongest protection in the history of a world of protected countries placed her in the pre-eminent position, the credit for which is claimed by free traders for the few years of free trade. The principle of protection to her own industries is the cornerstone of British diplomacy all over the world to-day. There is many an indirect way of protecting her manufactures and she has made good use of them all, but every day strengthens the proof that a tariff is the best protective engine, and it is but a matter of a short time until the British protective system will be extended into a harmonious tariff wall about the whole Empire.

THE GLOBE AND THE SITUATION.

In its issue of June 28 last, The Globe published an editorial entitled "Canada's Natural Expansion," in which it said:—

In the tariff revision of last session the Ministry showed a statesmanlike grasp of the commercial and industrial conditions of the Dominion, and also the firmness necessary to resist and deny when importuned to make changes not in the general interest of the community as a whole. It is true there was not the eager scramble for tariff favors that used to mark every revision and almost every session under the old regime. All who are directly interested in the tariff as beneficiaries now realize that the public interest is the chief consideration with the Ministry at all times, and they confine their demands to such changes as can be made without injuriously affecting the public at large. By firmness in resisting the demands of personal selfishness the Ministry have saved themselves from the many importunities which beset their predecessors in office, but if there is now less to resist the change is due to the courage and intelligent discernment displayed at the outset. The public know that there is now a system and policy in fiscal affairs. They know that every wrong will be redressed, and that this will be accomplished wherever possible by lessening and not by increasing the public burdens. Demands contravening this policy are not made because it is known that they will not be entertained.

The revision has already shown a development in harmony with the policy of the Government. For the period from December to May during which it has been in force, the rate of duty collected on dutiable goods was 26.74 per cent, as compared with 27.05 per cent. for the corresponding period of the previous year. If all imports both free and dutiable are estimated, compared with 16.31 per cent. on imports during the corresponding months of a year ago. The duty collected under the British preference also shows a lowering of the average rate from 21.72 per cent. under the former tariff to 21.15 per cent. durng the period under consideration. These returns show that the policy of the Government in adjusting dfferences by levelling down instead of levelling up has had a practical result in lessening the actual payments by Canadian consumers.

This was the free trade argument as against protection. and also a warning to the manufacturers against any hope of success they might entertain to visiting Ottawa in any tariff matters in which they might be interested. The allusion to the decrease of the rate of duty collectable from 27.05 to 26.74 means that a reduction of 31 cents was affected on every $100 of dutiable imports the lowering of the duty under the preferential tariff amounting to 57 cents on the $100.

In The Globe of June 29, in an editorial "A Time of Great Investments," it said:—

The initial stages of a period of expansion must always be marked by large investments without proportionate immediate returns. This is shown at the present time in the great expansion of imports into the Dominion, for it is, in the last analysis, goods instead of money that we borrow abroad. The financial balances of borrowing are adjusted by the shipment of goods, and the money borrowed abroad simply gives the capacity for buying. The latest bulletin of the Census and Statistics Bureau dealing with investments in manufacturing industries shows that the present period is one of construction and development, preparatory to production at full capacity. It also shows that the growth of the past five years has been phenomenal, and extends to almost every line of productive industry. A grand total of $843,931,178 employed as capital in manufacturing industries in 1905 gives the Dominion a new standing in the economic world, and the fact that this aggregate is an increase from $446,916,487 in 1900 affords a striking proof of the change that is now in progress. It is worthy of note that the ratio of output to capital invested is materially less than in 1900. This shows that many of our industries are still in the early or construction stage. It is not when buildings are being erected, machinery is being installed, and stores of raw material are being prepared that manufacturing industries make large returns in proportion to investments. It is not till the operation is under way in proportion to the enlarged capacity that the output and investment show the regular economic relationship . . . .A great volume of capital is being invested, not in immediate but for future production. Much of this capital is being obtained abroad. Loan companies and other financial corporations float their debentures and bonds in Britain and help to furnish capital for local enterprises. Through such operations much that seems to be borrowed locally is really borrowed abroad. With this borrowed capital we purchase the great volume of supplies and material that makes up our phenomenal record of imports. There are no grounds for regarding the resultant balance of trade as unfavorable. It would be so if the many industries for which it is a preparation had not a good outlook. But the investments that are increasing at a phenomenal rate are eminently sound and are fully justified by the commercial and industrial outook. When the time for repayment comes this capital will be producing an output that will meet all claims and justify the enterprise of the present era of expansion.

At that time Canada, in common with all other nations was experiencing a season of wonderful prosperity; and manufacturers listening to the syren songs sung by the Government to the effect that the tariff had no tinge of antagonism to their interests in it, made large investments of capital in their respective industries; but at this time many of them are not rejoicing at having done so. When the clouds began to darken and thicken, bulletins were sent out which were intended to clear up the country, but with many who could read between the lines the effect was different. Analysis showed that in many lines of manufacture exceeding prosperity was not an attending hand-maiden.

As shown at the time in these pages, the bulletin related to 203 different industries and showed that in 1900 the wage earners in Canada numbered 344,035, and the wages earned amounted to $113,246,350, while in 1905, 391,487 employees earned $164,394,490, an increase of 12 per cent in the number of employed, and 45 per cent. in the amount earned. These increases included 47,452 industrial workers, and $51,145,140 in earnings.

Of the 203 different industries enumerated, 66, or nearly one third, showed a decline in number of wage earners employed in 1905 from what they were in 1900, amounting to 28,031 persons. In 1900 there were 190,174 persons employed in 66 industries and in 1905 there were but 162,143 persons employed in the same industries. The bulletin says that in all the enumerated industries in Canada in 1905 there were 47,452 more wage earners than in 1900, In other words there was a general gain in the five years of 47,452 employees, and in the 66 industries there was a loss of 28,031 employees. The industries that are enumerated in the gaining column are those relating to railroads, bridge building, etc.

Another bulletin relates to the manufactured products of Canadian towns and cities having a population of 1,500 and over in 1900, in works employing five hands and over, the comparison being with the year 1905. The bulletin shows that in all Canada the value of such products were, in 1900, $481,053,375, and in 1905 $712,664,835. Two hundred and eleven towns and cities are named in the bulletin, 170 of which show an increase of value of production, and 41 show a decrease. Of the 211 industrial towns scattered throughout Canada, 41, or about 20 per cent. show an actual decrease of production.

The census bulletins do not show a correct condition of affairs in the manufacturing industries of Canada. Some are progressing, it is true, but many are not doing so, as we have shown. In the meantime the import trade of the country is increasing by leaps and bounds, while the exports of home products is declining. The total imports and exports during the first nine months of the current fiscal year, was $465,063,204, as compared with $550,872,645 of the previous year of 12 months, or $399,797,020 during the corresponding nine months of the previous year; or again, the total trade during the twelve months to June 30, 1907, was $617,964,952 as compared with $550,872,645 as above, an increase of $67,092,307. Truly the bread is taken from the mouths of Canadians to feed the hungry in foreign lands.

WOMEN CHEAPER THAN MACHINES.

The Toronto Globe gives abundant space in its front page to the following sordid tales of sweating from some English industries:

New York, Dec. 10.—The Herald has received the following cable despatch from London:—Mr. Franks, who is here investigating labor conditions on behalf of the United States Department of Labor, has found some of the sweated industries are so disgracefully bad that it is difficult to believe that there are worse instances anywhere. For instance, in Birmingham, the chief of unskilled home trades is carding hooks and eyes. A machine has recently been invented to do this work. but the cheapness of the human machine has hindered the introduction of the mechanical rival. The work consists of stitching the eyes on a card, linking the hooks into them and finally stitching them on the card. The rate of pay varies, a higher price being paid for the smaller and finer hooks, which are more trying to the eyes and fingers. A pack consists of a gross of completed cards with two dozen hooks and eyes on each, which means that 384 hooks and the same number of eyes are linked together and stitched on to the card for the munificent wage of one penny.

One of the worst phases of these sweated trades is the toil they take from the lives of little children. who are at a very early age initiated into the mysteries of linking in order to help to keep the wolf from the door.

The wages are better for button carding than for hooks and eyes. The handsome wage of 5s and 3d a week can be earned by constant work, as against 3s for hooks and eyes. Pearl buttons are considered the best work, though they are trying for the eyes. The rates for these buttons, vary from 2s 9d to 6s 8d per 100 gross; that is, 1d to 2½d for carding 432. Trousers buttons are carded at the rate of 3s per 100 gross.

Some of the women employed in this industry work from three o'clock in the morning to 11 or 12 o'clock at night.

In the chair matting industry the average weekly wage is from 4s to 7s, and often in times of bad trade less than this. The working day is nominally from 7 o'clock in the morning to 8 o'clock at night, a half hour being taken for breakfast, a half hour for tea and one hour for dinner. Should the necessity arise, however, women evade the factory laws and begin work at 6 o'clock in the morning and work later than 8 o'clock at night in their eagerness to earn a little more money.

Factories which do commoner work employ girls, who are dismissed as they get older and want higher pay. Up to the present time the cheapness of women's work has tended to hinder the introduction of machinery. Through always working in front of a hot fire the freshness of youth is soon lost, and the women generally are sallow faced, flat chested and round shouldered. Every woman is expected to work, and a man looks out for a woman who can work.

In the hand nail-making trade a couple can earn fourteen shillings a week. Women and girls are seldom able to earn more than five or six shillings a week making hobnails at 6½d for 1,150.

The average unskilled man in England gets from 17s 6d to £1 a week, so that even with regular work such a man cannot keep his family above the poverty line. And very few unskilled laborers get regular work. Such a wage makes the man's existence one over which worry and terror ever brood. But the wife's lot is worse. The task of making the money go a long way is an extremely difficult one. She has to fill the stomachs of the little ones or send them half-fed to school, and if illness comes along, the heavy burden falls upon her as a rule. The pathetic drudgery of her life destroys all gentle, womanly qualities.

Other pages of the same issue of The Globe contains equally harrowing accounts of the distress that now prevails in Toronto, where soup houses are open for rendering some assistance to the thousands of unemployed people who are shiveringly and disconsolately walking the streets in search of work which cannot be obtained.

We are sorry for the poor of London, but with them the trouble is chronic; but our sympathies are more keenly aroused in behalf of the poor of Toronto, a condition that prevails to a most painful extent at this time throughout Canada.

The trouble in London is chargeable to the policy of the British Government who place no barrier whatever against the free inflow of foreign goods into the country, and also the free inflow of the rough-scuff and off-scouring of the paupers of other countries, to the everlasting discredit of a government that permits such things.

The trouble in Canada is also chargeable to the policy of the Canadian Government who emulate the British policy. If we have not yet reached the ultima thule of free trade as they have it in Great Britain, that Sir Wilfrid Laurier has so often promised us, it is because that condition can only be reached by degrees; and the present policy is that of tariff for revenue only. Cheapness is the thing most to be desired, and cheapness we are getting. Thousands of workmen are walking the streets in idleness, manufacturers are discharging their employees because they find it impossible to compete with the pauper labor of other countries. The exchequer of the cities and towns are drawn upon to feed and shelter the unfortunates and the government "points with pride" at the fast increasing revenue, and the swelling volume of foreign trade. Like Colonel Sellers, "there are millions in it." Yes, there are many more millions of debt to be paid abroad than we have the ability to produce Steamship owners and importers of foreign goods reap the benefit of the situation, but the people of Canada are the sufferers. The Globe produces beautiful cartoons of elegant men, up-holding a casket of "honor" meaning Toronto, proclaiming "Excelsior!" The mountain peak of a half million of dollars for missions will be soon reached, but it has nothing to say about the deplorable condition into which Canada has been plunged by the free trade policy which it glorifies.

EDITORIAL NOTES.

British newspapers are saying that Australia's high-power tariff has killed the policy of tariff reform in Britain. If that be true, Premier Deakin builded better than he knew..—The Globe.

It is somewhat remarkable that the efforts of the Chamberlainites in Great Britain to create a sentiment in that country in favor of preferential trade throughout the Empire should be killed off because Australia has reformed her tariff in which Great Britain receives a tariff preference over every other country of the world.

Australia has a new wonder working device. It is said to create prosperity by legislation. The people are delighted with it because they have not yet seen it results. They wonder why all people do not spring into prosperity by taxing themselves for buying things. They have not yet reached the stage at which all are denounced as disloyal who object to working the device overtime. but that will doubtless come.—The Globe.

The people of Australia are delighted with the new tariff because Australians are guaranteed the work of producing the things they require at home instead of the work being done abroad. Canada would spring into greater prosperity than she has ever known if she followed more closely in the tariff footsteps of Australia, and meddled less in the affairs of other countries. "Canada first" should be our motto.

The Rise of a Canadian Concern.

What a Thorough Organization and Improved System Have Done for Canadian Rand Co., Limited, of Sherbrooke, Que., The Present Plant. Some of the Methods Employed.

The historical page of Canadian industrial growth during the past few years of rapid strides is illumined by no more striking example of genuine and sound expansion than that evidenced by the growth of the Canadian Rand Co., Limited, Sherbrooke, Que., from a comparatively inferior position to one of outstanding superiority. Its history of growth parallels that of Canada's expansion, but in a superlative degree. The men at the helm of this institution, and who are mainly responsible for its development, and who can to-day point with pride to what has been accomplished, have been ever alert to take advantage of the latest that mechanical skill has given to the realm of manufacture as well as the best known systems of organization and control.

In 1890 when operations were first commenced the entire plant was contained in two floors of a 30x25 foot building, together with small outbuildings for smiths' shop and storage. To-day the numerous buildings of the plant occupy several acres. In 1896 new shops occupying a floor space of 90x30 feet were rented, being increased at a later date to 140x30 feet. In 1899 the nucleus of the present plant was commenced in the erection of the machine shop, 200x90 feet, an office building, power house, blacksmith shop and storage buildings. In 1900 a pattern shop and storage buildings were added and in 1903 an addition of 100 feet made to the machine shop.

During the present year the capacity of the plant was quadrupled by the erection of an addition to the machine shop, a foundry 140x100 feet, a new pattern and flask shop 100x60 feet, forge shop 80x60 feet, a two story office building and an addition to the power plant and a most up-to-date machine shop for the manufacture of drills, containing a store room underneath the entire area of the building.

Fig. 2—Plant of Canadian Rand Co., Ltd.—General View of Pattern Shop Showing Individual Workmen's Benches and Iron Lay Out Tables.

All the new buildings are of brick and concrete, the foundry and the new drill shop being equipped with saw-tooth roof and temporary walls to allow for future expansion.

The Plant.

A general view showing the lay-out of the various buildings and the arrangement of the plant is shown in Figure 1. A visit to the various buildings shows the forethought and engineering skill that has been adapted to make the entire equipment work to the greatest advantage.

The pattern shop shown in Figure 2, is a model of its kind in which have been incorporated original ideas in the manufacture of patterns, which have since been adopted in many other works. This department is in charge of R. W. Wyatt, who has grown up in the company's employ and occupies a government position as instructor of draughting. Individual workmen's benches are a feature of this shop in which every mechanic has his own bench and kit of tools with ample room for laying out work. This is illustrated in the cut given herewith. Another notable feature is the iron laying out tables which present a true surface of ample size on which may be built the largest work with great precision. All vises in this shop are of the quick acting type, saving time and trouble. Electric glue-heaters capable of regulation are another feature. A gluing-up press for gluing together small pieces to be used in large work is part of the equipment. This press as well as the iron tables was designed by the foreman. Other mechanical appliances and machinery necessary to the manufacture of patterns are part of the equipment. A machine worthy of notice is the "Oliver" universal saw-bench being made particularly for pattern makers, manufactured by the Oliver Machine Co., Grand Rapids, Mich. It will saw at any angle and its adjustment permits the use of the periphery of the saw to

Fig. 3—Plant of Canadian Rand Co., Ltd—View of Store-Room, Showing Raw Materal, Steel Rails and Office.

cut semi-circle core boxes of any size. By the tilting of the fence it may be set to cut from the perpendicular position to any degrees between 90 and 45 degrees.

PATTERN STORAGE.

As shown in the lay out plan, two buildings are devoted to the storage of patterns, both of which are fully equipped with fire extinguishers, installed by the General Fire Extinguisher Co., Montreal, Que. The newer building in which the more valuable patterns are kept is absolutely fire-proof being built of cement and brick with cement floors and metal incased fire doors. As these buildings are not heated the system of fire sprinklers installed is the dry system, the trap for which is located in one of the other buildings, where a habitable temperature is maintained.

FOUNDRY.

In locating the foundry advantage was taken of a natural slope in the land, the foundry being situated at the uppermost portion of the company's premises. A railroad siding comes in here on a level with a cupola floor, where all raw materials are brought in. This does away with any hoisting which in most works is necessary. This department is in charge of Fred. Moisey, whose experience qualifies him, aided by an up-to-date equipment, to turn out castings remarkable for their evenness and soundness. Since this foundry has been built some very heavy work has been turned out with most satisfactory results. A 20-ton travelling crane with 5-ton auxiliary enables heavy material to be loaded directly on the cars running into the building by means of an additional siding. Iron flasks have been universally adopted, it having been found from the past experience of the company that they enable the best possible results to be obtained.

STORE ROOM.

An industrial railway connects the foundry with the store room and being on a slightly lower level, the heavily loaded cars descend by gravity through the level of the store room floor. This store room is unique. It occupies the basement of the drill manufacturing shop and is one of the features of the establishments of which the company is justly proud. As a stock room to facilitate manufacture and render shipments easy, it has no superior, if indeed there is an equal to it in the country. The cement floor and walls keep the room perfectly dry as is necessary where a large amount of metal is stored. This department is in charge of George Gray, who has spent many years in perfecting storage systems and who is responsible for the system at present in vogue in these works, which will be described later. The ample floor space in this room makes possible the storage of a large amount of castings ready to be made up in the machine shop above into finished drills. Figure 3 gives a view of this store room showing a small amount of the raw material in stock together with a corner of the office and the steel racks for the storage of bar iron and steel. As will be noted from the illustration these racks are arranged on the natural supports of the building, thus taking up little room. Each rack consists of a cast-iron bracket fastened to the upright by means of coach screws and having on each side a shoulder resting against their supports to keep them from shifting. The supporting surface of the bracket is inclined slightly inward enabling a maximum amount of stock to be piled thereon. Figure 4 gives another view of the store room showing the stock bins. There are several thousand of these, each containing but one line. To each bin is fastened a card containing in plain letters the name of the article and the part number, while the card system shows the number of each in stock. The shipping department is included in this room, the same being facilitated by means of a table 51 feet long, containing numerous movable partitions thus allowing a large number of shipments being made up on the table at the same time. A cutting-off cold saw for cutting stock to the required length is also one of the features. Elevators are provided to carry materials to and from the drill shop.

FIG. 4—PLANT OF CANADIAN RAND CO., LTD—ANOTHER VIEW OF STORE ROOM SHOWING STOCK BINS.

FOR MANUFACTURING DRILLS.

The drill shop with its lighting facilities both by means of large side windows and saw-tooth roof construction makes it an ideal building for machine shop work. Here as in other departments a special study has been made to give the most economical results. The machinery is laid out in sections running across the shop with aisles down the centre and each side. The first section is devoted to turret lathes and automatic machinery; the second to chucking and engine lathe; the third to milling machines; the fourth to planing and drilling machinery; the fifth to the fitters department; the sixth devoted to assembling and the seventh to inspection. Figure 5 gives a view of the main floor of the shop looking towards the turret lathe and automatic machinery section and showing in the foreground a fitters' bench and portable

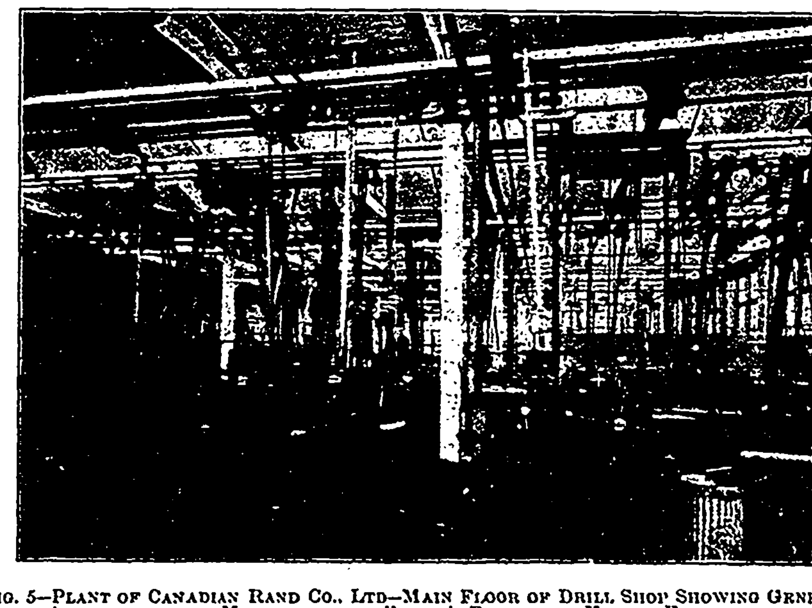


FIG. 5—PLANT OF CANADIAN RAND CO., LTD—MAIN FLOOR OF DRILL SHOP SHOWING GENERAL ARRANGEMENT OF MACHINES WITH FITTER'S BENCH AND VISE IN FOREGROUND.

vise. The economy of operation is shown in the arrangement of the tools by means of which, for instance, a heavy casting having been loaded on a truck in the store room and brought to the drill shop floor by means of an

FIG. 6—PLANT OF CANADIAN RAND CO., LTD—INTERIOR VIEW OF FORGE SHOP, SHOWING RADIAL CRANE AND PNEUMATIC HAMMER.

elevator is taken directly to a boring machine where it is faced. It passes from there to a planer situated adjacent. The next operation and tool is milling; then drilling and from there it goes to the fitting department in which is located a surface grinder that does away with hand scraping. This machine is the only one of its kind in Canada and was made by Brown & Sharpe, Providence, R.I., and is equipped with Norton grinding wheels. From the fitting department the material passes to the assembling, and from there to the inspection department, and back by means of the elevator to the store room.

The majority of the lathes in this shop are] from the works of John Bertram & Sons, Dundas, Ont., while not a few are the products of the plant of the London Machine Tool Co., Hamilton, Ont. The Bertram machines includes four special turret lathes all having friction head and quick change mechanism. Amongst the machines may be noted an extra heavy Gisholt turrett lathe which takes a 5 inch bar through the spindle, and two of the latest Jones & Lamson flat turrett lathes as well as two Cleveland automatics, also two manufactured by the Automatic Machine Co., Bridgeport, Conn., and one four-spindle bolt threading machine made by Webster & Perks, Springfield, Ohio. Another machine of special note is an eight-spindle drill, made by Bausch Machine Tool Co., Springfield, Mass. A special feature of this machine is an air hoist for lifting the spindles, put in by the Canadian Rand Co. This machine is specially adapted for jig work. In the planer department are four crank planers manufactured by the John Bertram & Sons Co., Dundas, Ont.

The old time benches which were generally used as receptacles for all kinds of materials and on which workmen crowded each other, have been entirely done away with in this shop. They are superceded by small portable iron tabes with shelves, mounted on castors so that they may be moved with facility from one place to another. Likewise the old time bench vises have given way to a modern portable vise standing on its own foundation. These vises may be adjusted to any height desired, depending on the nature of the work being done and the height of the workman. Both of these features are illustrated in the view given of the drill shop.

The second-hand department is included in this shop. To it all second-hand material is brought. Some of these parts are sent to the foundry and those in good condition are used to make up second-hand machinery.

An up-to-date wash room is another feature of this modern building, where a large number of individual basins with hot and cold water connections have been installed. Besides this the latest sanitary devices for the convenience of the workmen are included.

TOOL ROOM.

All tools are made in the regular tool room which is a compartment of the compressor shop, the equipment of which includes planed iron tables and the latest type of Sellers tool grinder. Every tool coming to the tool room after being used is inspected. All drills and cutters are sharpened before being put away so that they are ready for use on a moment's notice. The tool room is equipped with shelves and shallow drawers, 2 to 3 inches deep for small tools.

BLACKSMITH SHOP.

The central feature of the blacksmith shop is a revolving circular crane which will reach any spot on the circumference of a 24 foot circle. A case-hardening furnace is located here in which are hardened ratchets, pawls, bushings, nuts and parts of pneumatic tools. There is a tool dressing department. The iron table idea is carried out in this department as well as in others. Its value should be recognized more than it is in manufacturing establishments. Besides the heavy air hammer shown to the right in the illustration of the blacksmith department, is a unique hammer for small work made from a rock drill supported by a heavy standard being an ingenious idea of the company's superintendent. A cold cutting-off saw by the Higley Machine Co., is included in the equipment. It cuts off material up to 8 inches in diameter.

PNEUMATIC TOOL DEPARTMENT.

In this department are machined and assembled all pneumatic tools turned out by the company. It includes a complete machine shop equipped with the latest and best machines for turning out fine, high class work. An illustration of this is given showing one corner of the department. Connected with it is an experimental department for carrying on research work where ideas are

FIG. 7—PLANT OF CANADIAN RAND CO., LTD—SECTION OF TOOL ROOM SHOWING TOOL DRAWERS IN BACKGROUND.

developed that go to improving the product of the entire plant.

COMPRESSOR SHOP.

This department is occupied by what was originally the entire machine shop and is admirably adapted for the manufacture of the arge high class air compressors turned out. An illustration given shows one side of this shop and another shows some of the work that is being done there. Being 300x100 feet and traversed the entire length by a travelling crane it offers every advantage for the serving of the many large machine tools installed there as well as the handling of heavy material, the crane having the capacity of 20,000 pounds. A siding enters this building and the cars are loaded directly by means of the crane. Among the noteworthy tools in this building is a monster lathe manufactured by John Bertram & Sons. Another is a hydraulic press for putting on wheels, crank pins, pistons, etc., a record being kept of the pressure to which every part has been subjected. There are also two 24 inch Bertram turrett lathes.

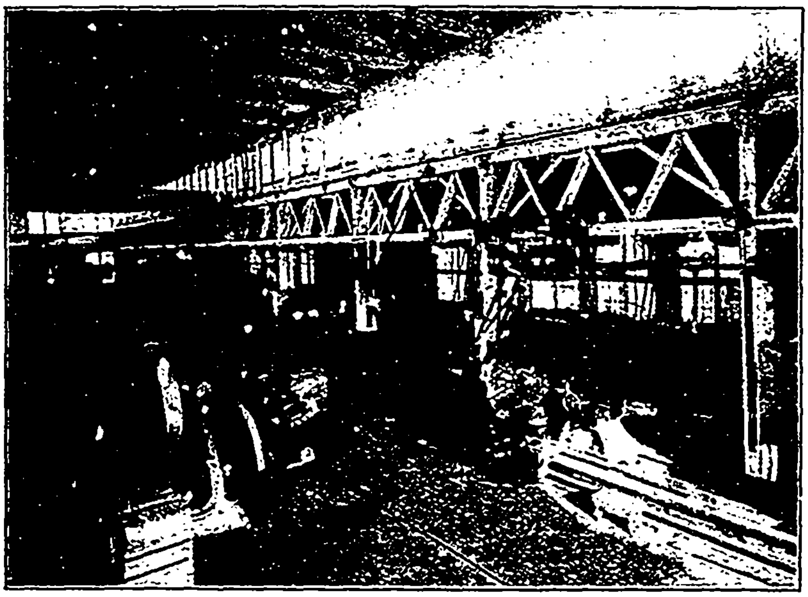


FIG. 8 - PLANT OF CANADIAN RAND CO., LTD—GENERAL VIEW OF COMPRESSOR SHOP SHOWING LARGE BERTRAM LATHE IN FOREGROUND.

POWER PLANT.

The plant is electrically operated from the power house centrally located in the works. Group motor driving is used for running the machinery in various departments. All hangers are equipped with Chapman double ball bearings, the results of which has been to make the management enthusiastic over this friction saving device.

The equipment of the new power plant includes a 36x12 inch Jenckes-Corliss engine running at 100 pounds steam pressure non-condensing. The boilers are Jenckes horizontal return tubular with water-arched furnaces. Tests made of water-arch furnaces by the company's chief engineer show an average saving of about 20 per cent. Not a single part has been replaced in six years. Their use gives practically smokeless combustion. A newer part of the equipment consists of a 75k.w. Allis-Chalmers-Bullock generator driven by a Robb tandem compound engine. The air compressor is a compound steam compound air compressor with a capacity of 250 cubic feet of free air per minute. The fire pump is a Northey steam pump with a capacity of 500 gallons per minute. A De Laval 10 h.p. steam turbine running at 24,000 r.p.m. is run geared to a water pump running at 2,400 r.p.m. to supply circulation for the heating system. Soft coal is used entirely. Alternating current is used altogether and is found satisfactory on the crane as well as for power. The crane motors are of the Westinghouse type and the power induction motors are of Allis-Chalmers-Bullock make. Besides the best use of natural light the various departments are lighted by arc lamps, Nernst Cooper-Hewitt, meridian incandescent and ordinary incandescent.

HEATING SYSTEM.

The entire plant is heated by the Evans-Almirall system, installed by Evans-Almirall & Co., 44 Dey Street, New York, N.Y., which utilizes the exhaust steam from the engine. The beginning of circuit of this system is the centrifugal pump run by the De Laval turbine mentioned above. After leaving the pump the water travels through the source of heat—the exhaust heater. The water is then circulated through the flow mains to the various coils or radiators. There turns from these are merged into one pipe which connects to the suction end of the centrifugal pump. This completes the circuit which is a closed one, hence the head of water on both the suction and delivery sides of the pumps is equal, and there is no static head against which the pump has to operate. The only function then of the pump is to overcome the friction in the pipes. The same water is circulated over and over again continuously and gives up just that degree of heat which may be required. In the exhaust heater the arrangement of the tubes is such that the exhaust steam has a free passage through them and thence to the atmosphere so that no back pressure can be placed on the engine. This system circulates the water in the space around the tubes where it absorbs the latent heat of evaporization in the exhaust steam thus condenses it.

Internal Organization.

EXECUTIVE OFFICE.

The executive office is situated at Montreal presided over by E. W. Gilman, vice-president and general manager, working in harmony with the works office in Sherbrooke and various offices throughout the country. It constitutes the central point of the selling organization as well as the accounting and advertising departments. It is situated on the fifth floor of the Sovereign Bank Bldg., and occupies practically the whole of that floor. A salesroom was lately opened up at 11 St. Nicholas Street, Montreal, where a stock of rock drills and pneumatic tools are kept for the convenience of demonstrating their merits to prospective purchasers in Montreal. The advertising department is likewise located here.

FIG. 9—PLANT OF CANADIAN RAND CO., LTD—A CORNER OF PNEUMATIC TOOL SHOP.

The entire plant is in charge of Superintendent A. M. Sangster, who has achieved a success any man might be proud of. Mr. Sangster has been with the company since it first started business and has now charge of over 400 men. It is interesting to note that J. P. Cotter, assistant superintendent, started with the company about the same time as Mr. Sangster.

The works office is the medium between the executive office in Montreal and the different shops. The office superintendent and purchasing agent, W. R. Elliott, has been with the company nearly ten years, having been connected with the Montreal office before coming to Sherbrooke.

H. V. Haight, chief engineer, who is a graduate of Toronto School of Science, was with the Rand Drill Co., at Tarrytown, N.Y., before coming to Sherbrooke. Mr. Haight is mainly responsible for the efficiency of Rand products, having continually worked on new designs and improvements, and is to-day recognized as a leading authority on compressed air.

The works are so laid out that each department is in charge of a foreman who is responsible to the assistant superintendent, the latter acting as a medium between the shop and the superintendent. In the larger departments of the works the foremen are assisted by sub-foremen, mostly young men, who having learned their trade with the company, are selected to fill the positions rather than outside men. It is the policy of the company to follow closely the work of its employees, and when a man shows that he possesses the necessary qualities, he is selected to take charge of new departments, which owing to the expansion of the company, are continually formed.

FIG. 10—PLANT OF CANADIAN RAND CO., LTD—WORK IN OPERATION IN COMPRESSOR SHOP SHOWING ROPE WHEEL FOR COMPRESSOR IN COURSE OF ERECTION.

ORDERS.

The order department in Montreal issue an order on the works for all material that is to be shipped. That order is checked by Mr. Elliott, and then goes to the order clerk who makes out the shop order in triplicate. The original remains in the office, the duplicate goes to the shipper and the triplicate to the cost department. When material has to be made specially as is the case of compressors an additional order is issued. Departmental orders are made up and sent to the different persons interested, as for instance, to the engineering department, assistant superintendent, and foremen according to the department in which work will be made up, first going to the cost department, to be given a shop order number. When goods have been shipped the duplicate is turned in to the office, and attached to it are bills-of-lading or express receipts and copies of the packing slips. The order is then checked off, the specific data as to weight, date of shipment and routing being endorsed on the original copy. This original copy is sent to the accounting department in Montreal, and from this copy invoices are made out and sent to each customer. In the case of partial shipments being made the duplicate is turned in to the office and such items as have not been shipped are transferred to what is termed a transfer order. This transfer order will bear the same serial number, but with the addition of a letter, as A, B. C, etc., according to the numbers of transfers that have been made. In this way the accounting department are kept advised of everything that has been shipped and will bill accordingly.

TRAFFIC DEPARTMENT.

In these days of slow railway transportation it frequently happens that shipments are a long time in reaching their destination and the necessity of having a regular system to follow up matters of this nature caused the formation of the traffic department. On receipt of advice that goods have not reached destination the original shipping documents are taken from their file, and a letter written to the railway company to start the tracer after the shipment. All papers relating to any specific shipments are kept together in a separate folder and are given a number. Follow up letters are sent out continually until definite information is obtained from the railway company that shipment has been found and delivered to consignees.

CASHIER.

The cashier takes care of all petty cash transactions, looks after the entry and passing of material imported, and makes up the pay from the roll supplied from the cost department.

PURCHASING DEPARTMENT.

The duties of the purchasing agent are more or less manifold. Each requisition as it comes in from the store keeper or from such others persons are are authorized to make such requisitions, has to be sifted to see that quantities are not excessive. If not a regular article of purchase, of which there are prices on file, various firms are communicated with and quotations obtained. An order is then made out in triplicate, the original being sent to the purchaser, a duplicate on file in the office, and a triplicate sent to the store keeper. Attached to each original is an acknowledgement slip on which the firm supplying articles called for, sign and fill in data as to when shipment will be made and return to the company. On the duplicate there is a space for the date of acknowledgment of order and the promised date of shipment. Below are a number of spaces in which is kept a record of follow ups. In connection with the orders there is follow up system on the card index plan. As each order is made out, cards are made in duplicate bearing the number of the order, the name of the firm supplying the goods and a synopsis of the material called for. A date is endorsed on the card as to when the acknowledgment of the order should be received. One card is placed in the alphabetical index and the other card at the date set. If no reply is received a follow up form is sent out and this system is kept up until the goods are finally delivered. In some cases the forms are varied by letters or telegrams if necessary. As the invoices are received the order is checked off and the date of invoice shown. The invoice is checked immediately for price and placed on file. When goods are received the invoice is checked with the receiving bond and providing found correct is then ready for the approval of the purchasing agent. As soon as it is approved, it is sent to the accounting department in Montreal for payment.

The form shows cost sheet, the article, from whom bought, date of invoice, quantity, size, list price, discount, net price, duty, freight or express and the total cost f.o.b. Sherbrooke. The cost department uses this information in connection with making up the cost of machines or parts.

The quotation sheets show the date of enquiry sent and the subjects, description, then the quantity of each, price asked which means the firm quoting which is characterized by the letter.

DRAUGHTING OFFICE SYSTEM.

The draughting office is in charge of S. R. Newton, a graduate in mechanical engineering of McGill University. This office adopts the system of having all drawings laid out on buff detail paper and checked up by the chief draughtsman. In checking, all dimensions must be verified and assurance made that it fits in with the design intended for. When the drawing has been checked and corrected, it is handed to a tracer. After tracing it is checked again and blue prints made. Any patterns required are at once ordered to be made, the order going directly from the draughting office.

When a complete set of drawings for a machine have been made they are bound in a book. It has been found from practice that drawings, 17x11¼ inches make a convenient size for handling and filing so that this is the universal size in use here. The book of drawings made is delivered to the shop foreman, which enables him to set up the machine, order his finished parts and have his men do the detail work required. A duplicate set of blue prints is supplied for the men working on the material. The book is returned to the draughting office when the machine is completed and kept as a record of that machine. Hence it may be used to build a number of similar machines. This system of having the drawings made in small sheets and in book form not only adds to the convenience of handling, but preserves the drawings. Moreover, it does away with the drawing being lost or laid aside and thus leaving out a detail of machine under construction, as has been found to be the case from time to time where separate sheets are used. It also does away with the inconvenience found in the case of large sheets of the drawing becoming shop worn where it is folded. This system has been in use for some time and has been found to give universal satisfaction.

STORE ROOM SYSTEM.

Raw material is received into the store room from the foundry and outside points, being checked off on the copy of the original requisition issued from the office. At the same time, this material is entered on a stock card figure (13). This card gives all information as to material, weight, number, etc., also a minimum and maximum showing when a new supply should be ordered.

The applied column is the distinguishing feature of this system showing as it does the quantity which would be left were all outstanding orders filled. For example, the cut shows 42 parts in stock, but the last two orders, namely 721 and 820 calling for four and two parts, respectively have not been filled, thus the balance in the applied column is 42 less 6 or 36.

In the case of such parts as nuts and bolts, where a dozen or more orders are filled in one day, only one entry is made. Where this system is properly followed there is no liability of any errors creeping in and all information necessary to a store keeper can be obtained at a glance.

An order must be issued for all material taken from the store room for use in the works. This order is made out on a card signed by a foreman and shows for what purpose the goods are to be used.

System of Cost Keeping.

NON-PRODUCTIVE LABOR.

Non-productive labor cost is covered by standing shop orders. Work done under the numbers designated will always show the cost department exactly what expense has been entailed for shop benefit or plant equipment. It covers in fact everything not on a productive order. These are listed under various heads each lot being enumerated under a lot number.

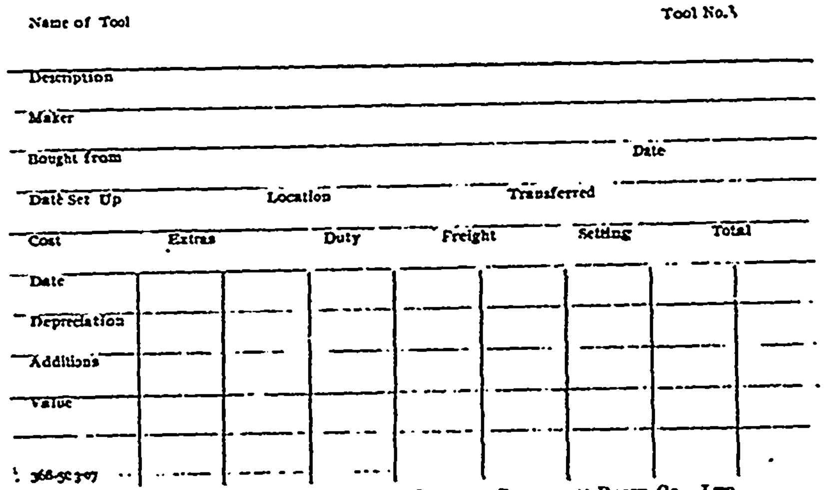


FIG. 11—PLANT EQUIPMENT CARD USED BY CANADIAN RAND CO., LTD.

Daily service cards are turned in by all employees at the end of each day, one order only on a card. The time keeper receives all these cards and they are sorted by clock numbers and checked with time register slips. Six W. A. Wood time registers are employed in the works. The pay roll is then entered from these slips, after which the cards are rated and extended with the amount for the workmen's time. They are then further sorted by shop order numbers and totalled which shows daily the actual amount of wages expended on each shop order. These amounts are entered on card forms showing the amount charged against each shop order for that date. These cards are totalled at the end of each week and the total must balance with the amount of the pay roll.

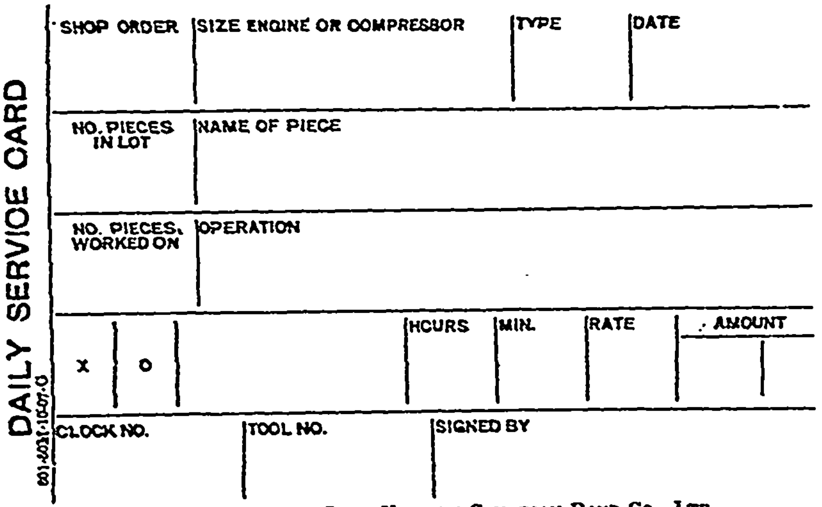


FIG. 12—DAILY SERVICE CARD USED BY CANADIAN RAND CO., LTD.

The pay roll form used is a loose leaf system composed of two forms, one containing the names of the workmen over which is placed a smaller form leaving exposed the names. One of these smaller forms is added for each week. These forms are ruled with columns showing the date, hours and rates, total hours, columns for premiums, deductions for late and insurance. Overtime is entered in red ink and totalled separately. The extra amounts allowed for overtime are charged up to expense of each department.

After the order cards have been rated and sorted under their shop order; they are filed in card-board boxes behind guide cards showing name of piece and operation. As the duplicate copy of the foreman's order card has been sent to the cost department when order was issued, a check is made on the entry of the daily service card. When the work's copy of the foreman's order has been returned it shows that work on this operation has been finished and when the final foreman's order card has been received, the shop order is then completed and ready for checking and totalling.

Material order cards are treated in much the same manner only that the parts are checked off on a part list issued by the draughting department. If two material order cards are received for the same piece it calls for investigation. A defective material or workmanship card is then looked for which would show that one piece had been spoiled or that an error had occurred in issuing material to the wrong shop order. When the shop order is completed it is typewritten on a form showing cost by operation on every piece. This is again entered on a comparative cost card, which shows cost of this part with all previous costs of this piece as formerly manufactured. A daily list of shipments is sent to the cost department, each day on which is entered the flat cost plus the burden ratio, which amount is credited to the production account of each department.

COST OF PRODUCTIVE LABOR.

All orders to the different manufacturing departments are accompanied by foreman's order cards, which are made out in cost department, and which show shop order no., size of machine, number of pieces, name of piece, operation on piece, drawing no. There are also spaces showing name of workman, clock no., tool no., date issued, date finished and a place for foreman to sign when work is finished.

A full set of these cards are issued for every shop order, one card for each operation on every piece going to make up any machine or machines covered by a shop order.

When a foreman desires to give out work on a shop order, he will take cards for these operations and issue them to the workman doing such work, filling in name of workman and date issued. Workmen will make out their daily service cards from data shown on foreman's order, and when workman has finished the operation on all the pieces called for on order, he will turn card in at night with his daily service cards.

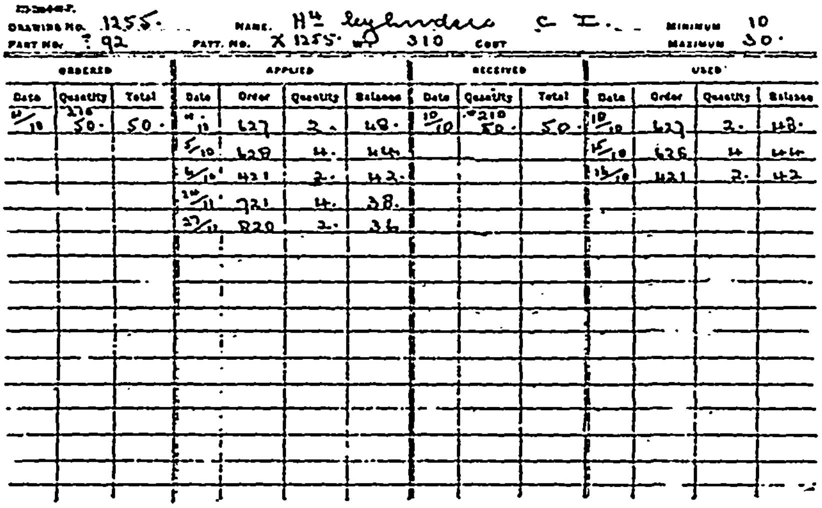
The foreman's order cards are then looked over by the foreman and will show him work finished on previous day and keep him posted on the progress of different shop orders. The date finished is then filled in and card signed by foreman and returned to cost department.

When any pieces are being made up in a lot, and are taken to finish a machine, a transfer memo is made out showing shop order the piece was taken from and the one transferred to, with the name and number of pieces. This is only where such pieces come from a lot, where parts are taken from one machine to finish another, no record will be made as such an exchange would not alter the cost of either machine.

DRILL SHOP SYSTEM.

Material in the shape of rough castings is hoisted by means of an elevator from the store room below to the drill shop. As it is loaded on trucks in the store room it is wheeled directly to the machine on which the first operation takes place. The material order for any number of parts goes to the storeroom before the material is loaded on the truck to go to the drill shop. The man at the machine who is to perform the operation has already received a foreman's order calling for the work to be done. In connection with the workmanship required on the different pieces the machines are so arranged that the piece in question passes in natural sequence from one machine tool to the other according to the work required. After all machining necessary has been completed the piece is passed to the fitting and assembling department and from there to the inspection department, both of which are sub-departments of the drill shop. In the inspection department all parts are inspected to ensure perfect duplication. Each part is properly stamped with a lot number, a record being kept of each operation. This enables every piece to be traced should it in future prove defective as the records will show not only when the work was done, but by whom. From the inspector the parts requiring painting go the painters. Both of these latter departments are situated near the elevator by means of which they are taken to the store room and placed in stock. Thus the material goes through a cycle of operations with the minimum of handling and routing and returned to the storeroom. When orders for one or more finished drills are given the finished parts are brought from the store room, assembled, tested and inspected and returned to the store room whence the complete machine is shipped. Thus every part is practically inspected twice. A noteworthy and highly commendable feature in connection with the system of giving out the individual detail drawings for the workmen is in vogue here. As is mentioned in connection with the draughting office, a set of drawings in book form is in possession of the foreman who issues his work card to the man to do a certain piece of work. The set of drawings prepared in the draughting office and sent as separate drawings to the drill shop is kept in the tool room. When the workman takes his order for tools to the tool room he is handed the drawing for the work he is about to undertake upon which is enumerated the tools required, thus getting the drawing and the tools at the same time. These drawings are kept in small tin tubes to ensure their preservation. This system saves time as it gives every man a drawing showing the work he is to undertake, which he returns to the tool room with the tools when the work is completed.

In a limited write up of this kind it was impossible to follow in detail as far as might have been desirable the various methods of manufacture, as well as the complete internal organization. For instance, the foundry is operated as a department complete within itself and having a separate system of cost keeping. Many other features of interest were likewise omitted. It is intended to describe the foundry system of the plant in the near future.



Drawing No. 1255. Name H4 cylinders C I. Minimum 10
Part No. ? 92 Patt. No. X 1255 W 310 Cost Maximum 50.

Ordered			Applied				Received			Used			
Date	Quantity	Total	Date	Order	Quantity	Balance	Date	Quantity	Total	Date	Order	Quantity	Balance
4/10	276 50.	50.	4/11	627	2.	48.	10/10	210 50.	50.	10/10	627	2.	48.
			5/10	628	4.	44				15/10	628	4	44
			5/10	421	2.	42.				13/10	421	2.	42
			20/11	721	4.	38.							
			27/11	820	2.	36							

FIG. 13—STORE ROOM STOCK CARD WHICH SHOWS NOT ONLY NUMBER OF ARTICLES IN STOCK BUT ACTUAL NUMBER AVAILABLE USED BY CANADIAN RAND CO., LTD.

Talks on Drying

By E. E. PERKINS in the Wood-Worker.

One of the first things in the arrangement of the drying plant at the factory, that demands the careful consideration of the superintendent, is the arrangement for transportation of the lumber from the yard to the kilns and afterward to the factory. In any stock of regular saw mill product, the usual way is by an arrangement of transfer cars, the lumber remaining on the kiln car from the yard to the factory.

Nearly all kilns for factory work using cars within the kiln, where the lumber is nearly of one length, are arranged cross-piling. The reasons for this are several. One is that it allows a saving of one rail throughout the length of the kiln. Another is that the space taken up for platforms is one-half that where four rails are used with end piling; but where lumber is of different lengths, then the usual arrangement is to have four rails, running two cars parallel endwise into the kiln. Also, the end piling kiln is sometimes desired where stock of different dimensions is to be dried in the same kiln, the arrangement allowing it to be left a longer time on one track than on the other, without holding back lumber of smaller dimensions, that is dried much sooner than the larger. This arrangement for drying lumber of different dimensions in the same kiln should only be allowed where the conditions make it imperative. It has been the writer's observation that where different dimensions of stock were dried together in one and the same kiln, the lighter stock was overdried or carbonized, and the other case-hardened; when seemingly dried, it contained more or less moisture, that afterward developed in the manufactured product. For this reason, where the size of the factory demands and the space in the yard allows the construction of more than one kiln, the arrangement is best made in what is known as charge kilns, allowing a separate kiln for each variety and dimension of stock. When arranged in this manner, each variety of stock may be given the exact temperature and condition of moisture necessary to carry the operation of drying forward, with the greatest rapidity and economy allowed. Such an arrangement allows the heating system to be graduated in the number of pipes, instead of, as in a progressive kiln, by the reduction in size of the pipe, then stopping the pipe entirely, leaving a part of the kiln without piping. In one of the improved, patented systems of piping this graduation is carried to the point beginning with one pipe; it then allows, by the use of very few valves, the adding of one each day for any number of days. The pipe is arranged in headers, or manifolds, of multiple number, beginning with a header of three pipes, each pipe valved.

Owing to the chemical composition of some woods they will stand nearly double the temperature at certain stages of drying, without injury, that may be used at another stage of the drying. In progressive drying, unless the kiln is of very great length, the rapid diffusion in the air, upon the car of cold lumber entering the kiln, practically reduces the temperature and absorbs the moisture where entered. While the reduction of temperature is of smaller account, the absorption of the moisture frequently renders the air too dry for the car which preceded it; also, this method is slower in drying, by 24 to 72 hours, than the charge method.

Mineral Productions of Ontario in 1906

A SUMMARY OF THE STATISTICAL FEATURES OF THE ANNUAL REPORT OF THE ONTARIO BUREAU OF MINES.

The Report of the Ontario Bureau of Mines for 1906, which will be ready for distribution in a few days, shows the output of mines and mineral works in Ontario during 1906 to be $22,388,383, computed at the selling price of the products at the mines or works, and not taking into account the additional values induced by subsequent refinement or treatment. This is an increase of $4,534,087 or about 25 per cent., as compared with the production of 1905.

The chief increase is in metallic minerals where the gain is due to two factors, the development of silver and nickel mining and the increased activity in the smelting of pig iron. Among non-metallic minerals, the chief gains are in the production of Portland cement, common building brick and natural gas.

The great diversity of mineral production and the steady expansion of the industry is shown in the following table showing the production during the last three years:

PRODUCT.	1904	1905	1906
Metallic:			
Gold	$40,000	$99,885	$66,193
Silver	111,887	1,372,877	3,689,286
Platinum	10,452 }	28,116	5,652
Palladium	18,564 }		
Cobalt	36,620	100,000	80,704
Copper	297,126	688,993	960,813
Nickel	1,516,747	3,354,934	3,839,419
Iron ore	108,068	227,909	301,032
Pig iron	1,811,664	3,909,527	4,554,247
Steel	1,188,349	3,321,884	....
Lead ore	11,000	....	....
Pig lead	*2,500*	*9,000*	*93,500*
Zinc ore	3,700	....	6,000
	$5,321,677	$13,113,125	$13,596,846
Less value Ontario iron ore smelted into pig iron, and pig iron converted into steel	250,000	2,912,115	(a) 423,766
Net metallic production	$4,906,667	$10,201,010	$13,353,080
Non-Metallic:			
Actinolite	$102	....	....
Arsenic	903	$2,693	$15,858
Brick, common	1,430,000	1,937,500	2,157,000
Brick, paving	55,450	54,000	45,000
Brick, pressed	226,750	234,000	337,795
Building and Crushed Stone	700,000	700,000	660,000
Carbide of calcium	152,295	156,755	162,780
Cement, natural rock	65,250	10,402	6,000
Cement, Portland	1,239,971	1,783,451	2,381,014
Corundum	150,645	152,464	262,448
Feldspar	21,966	29,968	43,849
Graphite	4,700	9,825	15,000
Gypsum	10,674	4,118	6,605
Iron Pyrites	43,716	21,885	40,583
Lime	406,800	424,700	496,785
Mica	37,847	50,446	69,041
Natural gas	253,524	316,476	533,446
Peat fuel	2,400	1,200	900
Petroleum products	904,437	898,545	761,546
Pottery	100,000	60,000	65,000
Quartz	....	....	65,765
Salt	362,621	356,783	367,738
Sewer pipe	283,000	225,835	279,620
Sodalite	....	....	6,000
Talc	2,919	2,240	3,030
Tile, drain	210,000	220,000	252,500
Total non-metallic production	$6,665,970	$7,653,286	$9,035,303
Add metallic production	4,906,677	10,201,010	13,353,080
Total production	$11,572,647	$17,854,296	$22,388,383

PIG IRON AND STEEL.

There were produced in the blast furnaces of Ontario during the year 1906, 275,558 tons of pig iron valued at $4,554,247, as compared with 256,704 tons worth $3,909,527 in 1905. The number of furnaces in operation remained the same, namely, five, situated at Hamilton, Deseronto, Midland and Sault Ste. Marie. The Province's capacity for pig iron production is undergoing enlargement, as the blast furnace at Port Arthur in which it is proposed to smelt the output of the Atikokan mines was nearly completed at the end of the year, and early in 1907 the construction of a new furnace by the Hamilton Steel & Iron Works at Hamilton was well under way. This furnace was being erected by Frank C. Roberts & Co., of Philadelphia. The measurement of the stack was 85 feet high by 22 feet 6 inches in diameter, and the new furnace will enable the company to increase its pig iron product by 110,000 gross tons per annum. In addition the company are erecting a fourth open-hearth steel furnace under the supervision of Alex. Laughlin & Co., of Pittsburg, which when completed will nearly double their production of steel bars. The production of steel in the Province was as shown in the table below. Of the pig iron output 49,907 net tons were used by the Hamilton Steel & Iron Co., in the production of steel ingots and castings, while the whole product of the Algoma Steel Co., at Sault Ste. Marie, was converted into steel rails The latter company are installing a plant for the production of open-heartch steel, their present works being for the Bessemer process.

Following are details of the operation and production of the blast furnaces and steel works in 1906:

Ontario ore smelted	tons	101, 569
Foreign ore smelted	"	396,463
Scale and mill cinder	"	24,282
Limestone for flux	"	153,702
Coke for fuel	"	304,676
Value of do.		$1,589,941
Charcoal for fuel	bush.	811,926
Value of do.		$32,477
Pig iron product	tons	275,558
Value of do.		$4,554,247
Steel product	tons	167,026
Value of do.		$4,202,278
Workmen employed	No.	1,095
Wages paid		$576,206

It will be seen that of the total quantity of ore charged into the blast furnaces last year only 101,569 tons, or some 20 per cent. was of domestic origin, the remainder being imported from the United States. Several reasons have operated in favor of the use of iron ores from south of the line. One is the enormous and constant movement of ore cargoes from lake Superior ports to eastern furnaces, which enables supplies of ore of any desired kind to be easily obtained at current prices, and another is the fact that there are very few iron mines in Ontario in a position to maintain shipments of ore on any considerable scale. The former advantage can be freely availed of by Ontario furnace men because of the absence of any import duty on ore brought from the United States, Canadian fiscal arrangements being such as to impose no such obstacle to the use of foreign ores as the United States tariff, for instance, with its import of 40 cents per gross ton, places on Canadian ores. The Helen mine has for years been the chief source of iron ore within the limits of the Province which could be drawn upon by blast furnaces here, but this paucity of supply is likely to disappear in large degree at an early date, with the opening up of the Moose Mountain and Mineral Range mines. It must be remembered, too, that all ores are not suitable for all purposes. Hence, although a large proportion of the Ontario ore produced, which comes from the Helen mine is exported to the United States, the practical effect is that it is exchanged there for other ores better suited for the manufacture of steel rails by the Bessemer process as carried on by the Algoma Commercial Co., at Sault Ste. Marie.

Particulars with regard to the operations of the pig iron and steel making industry for the last five years are as follows:

PRODUCTION IRON AND STEEL, 1902 TO 1906.

Schedule.	1902	1903	1904	1905	1906
Ontario ore smelted..........tons	92,883	48,092	50,423	61,960	101,569
Foreign ore smelted.......... "	94,079	103,137	173,182	383,459	396,463
Limestone for flux........... "	58,885	49,426	61,566	121,052	153,702
Coke.................... ... "	111,390	96,540	135,108	262,415	304,676
Charcoal..................bush.	968,623	932,630	1,821,270	3,387,869	811,926
Pig iron....... ....tons	112,687	87,004	127,845	256,704	275,558
Value of pig iron.................	$1,683,051	$1,491,696	$1,811,664	$3,909,527	$4,554,247
Steel.......................tons	68,802	15,229	51,002	138,387	167,026
alue of steel....................	$1,610,031	$304,580	$1,188,349	$3,321,884	$4,202,278

NICKEL PRODUCTION.

The output of the nickel mines of the province, 10,936 tons, was the largest yet recorded, being 1,433 tons in excess of the production of 1905, which was the greatest up to that time. Of this 160 tons was derived from the silver-cobalt mines of the Cobalt district, in which nickel occurs in the mineral niccolite, or nickelite, the remainder being from the nickeliferous pyrrhotite mines of Sudbury.

The producing companies in Sudbury district are the Canadian Copper Co., and the Mond Nickel Co. The former raised 219,220 tons of ore from the Creighton mine, and 70,515 tons from Copper Cliff No. 2. The ore extracted by the Mond Co. came entirely from Victoria mine No. 1.

The works of both of these companies are thoroughly well equipped, and furnish excellent examples both of mining and smelting practice. The ore is first roasted in open-air heaps to expel the sulphur and then smelted into matte, which is treated in Bessemer converters and raised in metallic contents of nickel and copper to about 80 per cent. In this form it is shipped for final separation of the metals by the Canadian Copper Co., to Constable Hook, New Jersey, and by the Mond Nickel Co., to Clydach, Wales. The number of workmen employed in the nickel-copper mines and works in 1906 was 1,417, and the amount of money paid out in wages was the large sum of $1,117,420. The nickel mining industry continues to play, as it has long played a highly effective part in the development of that part of northern Ontario in which it has its seat.

Following are particulars of the nickel-copper industry for 1906 and the four preceding years:

NICKEL-COPPER MINING 1902 TO 1906.

Schedule.	1902	1903	1904	1905	1906
Ore raised..................tons	269,538	152,940	203,388	284,090	343,814
Ore smelted................. "	233,388	220,937	102,844	257,745	340,059
Ordinary matte produced..... "	24,691	30,416	19,123	....	....
High grade matte produced... "	13,332	14.419	6,926	*17,388	*20,364
Nickel contents............. "	5,945	6,998	4,743	9,503	10,776
Copper contents............. "	4,066	4,005	2,163	4,525	5,260
Value of nickel.....	$2,210,961	$2,499,068	$1.516,747	$3,354,934	$3,839,419
Value of copper.................	$616,763	$583,646	$297,126	$688,993	$806,413
Wages paid......................	$835,050	$746,147	$570,901	$833,822	$1,117,420
Men employed...............No.	1,445	1,277	1,063	1,176	1,417

* Bessemer matte.

In 1906, 26,741 cords of wood, valued at $61,571, were used, principally in roasting the green ore, and 59,868 tons of coke, worth $380,732 for smelting the ore. The nickel contents of the ore smelted last year, as estimated on the quantity of Bessemer matte produced, and making no allowance for loss in roasting or smelting, were 3.16 per cent., and copper 1.54 per cent.

SILVER.

The Bureau of Mines report gives in detail the history of the remarkable Cobalt discoveries and the subsequent development of silver and silver mining, as shown in the first statistical table herewith.

PORTLAND CEMENT.

In the non-metallic class the record for expansion is held by Portland cement. Beginning in 1891 the production has increased from 2,033 barrels valued at $5,082 to 1,598,815 barrels in 1906, valued at $2,381,014 and the number of cement works increased from one to twelve. The raw materials, marl and clay, are abundant and the demand for cement has been, and still is, very active. In consequence of this demand the increase in production has been accompanied by an advance in price, the average cost per barrel at the factory having risen from $1.42 in 1905 to $1.48 in 1906. It seems in every way likely that the production and sale of cement will show a corresponding increase in 1907.

Nearly all of the Portland cement manufactories hitherto established in *Ontario* have made use of marl as one of the ingredients, but there is a tendey towards substitution of solid limestone, where this can be obtained of suitable composition, as it is believed the cost of production can in this way be lessened. The limestone beds at Point Ann on the Bay of Quinte are utilized by the Belleville Portland Cement Co., but all the other plants in the list given above use marl.

The Portland cement plants which were in operation during 1906 were the following;

Imperial Cement Co., Owen Sound.

Belleville Portland Cement Co., Point Ann.

Lakefield Portland Cement Co., Lakefield.

Canadian Portland Cement Co., Marlbank.

National Portland Cement Co., Durham.

Grey & Bruce Portland Cement Co.' Brookholm.

Owen Sound Portland Cement Co., Shallow Lake.

Ontario Portland Cement Co., Blue Lake.

Sun Portland Cement Co., Owen Sound.

Western Ontario Portland Cement Co., Atwood.

Raven Lake Port'd. Cement Co., Raven Lake.

Hanover Portland Cement Co., Hanover.

Two plants, those of the Colonial Portland Cement Co., Wiarton and the Superior Portland Cement Co., Orangeville, had not been completed at the close of 1906. The production since 1891 has been as follows:

PRODUCTION OF PORTLAND CEMENT, 1891 TO 1906.

Year.	Bbl.	Value.
1891........ ...	2,033	$5,082
1892........ ...	20,247	47,417
1893........... .	31,924	63,848
1894............	30,580	61,060
1895.... . . .	58,699	114,332
1896.... .	77,760	138,230
1897....	96,825	170,302
1898....	153,348	302,096
1899............	222,550	444,228
1900..........	306,726	598,021
1901...: . .	350,660	563,255
1902...... .	522,899	916,221
1903........ . .	695,260	1,182,799
1904....	880,871	1,239,971
1905.......... .	1,254,360	1,783,451
1906....... ...	1,598,815	2,381,014

BRICK, TILE AND SEWER PIPE.

The output of common brick, according to returns to the Bureau, was 300 million worth $2,157,000, as compared with 250 million valued at $1,937,500 in 1905. Pressed brick rose from 26,000,000 worth $234,000 in 1905 to 39,860,000 worth $337,795 in 1906. The brick yards in and around Toronto have for several years had difficulty in meeting the demand, and prices in that market have increased in consequence. Taking the province as a whole, however, there has been a slight fall in the average price of bricks as compared with 1905, the value having gone back practically to the level of 1904. The tendency to higher prices for bricks has been manifest for a series of years, as the following figures show, 1906 being the first year in which this tendency has been suspended.

Year.	Price per M.
1901.........................	$5 73
1902...	6 41
1903.........	6 78
1904........	7 15
1905....	7 75
1906.........................	7 19

The advancing prices have beyond doubt been due to the increasing cost of labor, fuel and plant, as the raw material is of comparatively little monetary value, and the supply is practically inexhaustible and distributed throughout the whole province.

There are three factories for the production of sewer pipe, namely those of the Toronto and Hamilton Sewer Pipe Co., at Hamilton, the Ontario Sewer Pipe Co., at Mimico, and the Dominion Sewer Pipe Co., at Swansea. The first named plant was burned down in April, 1906, but new buildings were erected and the works again put in operation about the beginning of December.

SALT.

From the salt wells of the province, 50,414 tons of salt were raised in 1906, having value of $367,738. The bulk of the salt made in Ontario comes from the wells of the Canadian Salt Co., Windsor; the other producers being the Exeter Salt Co., Exeter; Gray, Young & Sparling, Limited, Wingham; R. & J. Ransford, Clinton and Stapleton; Ontario People's Salt & Soda Co., Kincardine, and the Parkhill Salt Co., Parkhill. The number of hands employed were 213 to whom $94,768 was paid in wages.

NATURAL GAS.

The output from the natural gas wells of the province in 1906 showed a marked increase over that for 1905, the value of the product being $533,446, as against $316,476. This result is largely due to the development of the Haldimand county field, in which the Dominion Natural Gas Co. is the largest producer. In the Welland county field the Provincial Natural Gas & Fuel Co., and the Mutual Natural Gas Co. are the chief operators. From its wells in Welland the Provincial Co. pipes a large part of the product to Buffalo, N.Y., and supplies as well several towns and villages in Ontario. The Dominion Co. in the Haldimand field sends gas to Hamilton, Dundas, Brantford, Galt, Paris, and a number of other places. In the county of Essex, the Leamington Oil Co. obtains a sufficient supply for the wants of the inhabitants of that town. Some of the oil wells sunk in the new Tilbury and Romney fields yield a good deal of gas.

Of the producing wells 225 were in the Welland county field, and 104 in the Haldimand county field.

NATURAL GAS PRODUCTION, 1902 TO 1906.

Schedule.	1902	1903	1904	1905	1906
Value gas produced..............	$199,238	$196,535	$253,324	$316,476	$533,446
Producing wells..............No.	169	210	176	273	339
Producing wells sunk......... "	18	20	36	58	77
Non-producing wells sunk..... "	13	12	13	5	14
Delivery pipe..............miles.	369	312	231	461	550
Workmen employed..........No.	107	138	98	130	108
Wages paid.....................	$55,618	$79,945	$53,674	$88,865	$64,968

Montreal Builders' Exchange Banquet

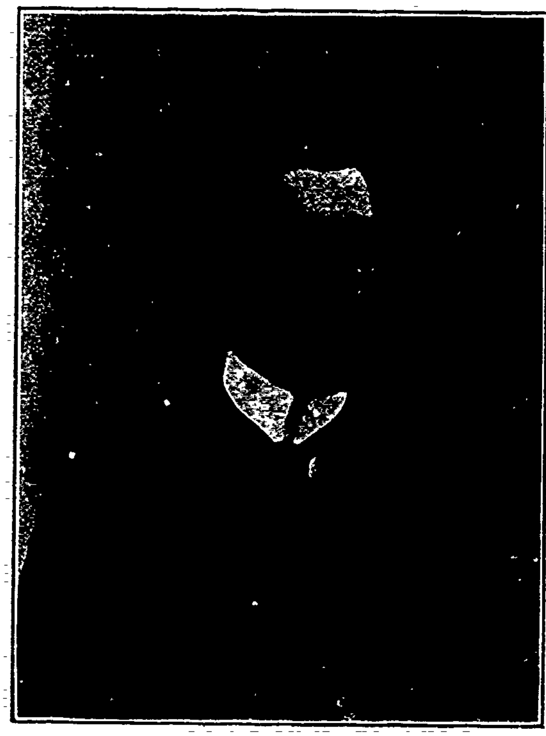
TENTH ANNUAL DINNER IS LARGELY ATTENDED AND IS AN ENJOYABLE FUNCTION.

"ON THIS twelfth day of December, in the year One Thousand Nine Hundred and Seven,

"AT THE SPECIAL INSTANCE AND REQUEST of the past presidents: Messrs. James Simpson, J. H. Hutchison, N. T. Gagnon, R. Geo. Hood and J. O. Deslauriers, of the City and District of Montreal, and during their tenure of office with the Right Honorable Body of the Builders' Exchange of the same place, together with the Executive of the Builders' Exchange in their quailties of Executors and Trustees of this dinner and under their Last Will and Testament, duly probated in the WORSHIPFUL COUNCIL OF THE BUILDERS' EXCHANGE, PLACE VIGER HOTEL, ON THE 12th of December, 1907, and hereinafter called the "Requirants";

"Whereas you have been charged......"

The above formidable Notification and Protest was served on nearly 200 members and friends of the Montreal Builders' Exchange at their annual banquet. It was a decided novelty in the menu line, covering four sheets of legal paper, and was a masterpiece of wit and legal phrasing.



MR. J. O. DESLAURIERS, Past-President of Montreal Builder's Exchange.

The chairman for the evening was Mr. James Simpson, the first president of the original Builders' Exchange in 1897. To

CHAIRMAN JAMES SIMPSON, First President of Original Exchange.

his right at the head table were Hon. R. Dandurand, Speaker of the Senate, Ald. De Seires, acting-Mayor; Mr. L. A. Rivet, M.P.; Mr. C. H. Catelli, president of the Chambre de Commerce. On the left of chairman were Hon. W. A. Weir, Provincial Treasurer; Hon. J. D. Rolland, President of the Canadian Manufacturers' Association; Mr. A. Chausse, Building Inspector of Montreal, and A. Brossard, Provincial Architect.

After the demands of the "inner man" had been fully met, the meeting was called to order, and the toast, "The King," was drunk, the whole assembly responding with the National Anthem.

The second toast, "Our Country—The Dominion," was proposed by Mr. W. E. Ramsay (Pedlar Roofing Co.), in a brief speech, in the course of which he suggested that appreciation should be shown the Government for the passing of the Lemieux Bill, and he expressed the hope that its provisions would soon be extended to all industries including the building trades.

Responding in English, Senator Dandurand said that as Speaker of the Senate he was outside of politics, so he should not mention them. He alluded briefly to some of his early political experiences, then passing to the growth of the country, he recalled the building of the first sky-scraper in Montreal, the New York Life Building. The growth of Montreal, he said, was indissolubly connected with the growth of the Dominion. He emphasized the necessity for all to maintain a watchful interest in public questions, and to take an active part, as far as might be, in public life. Legislators were by no means always ahead of the public opinion of the day. To foster healthy public opinion was to find it, sooner or later, expressed in the statute books. With the assistance of eminent and disinterested men, and of associations such as the Builders' Exchange, the future of Montreal and of this country was assured.

Responding in French, M. Rivet, M.P., for Hochelaga, expressed pleasure at being present at this public and solemn affirmation of professional organization. The freedom of organization was one of the dearest of our liberties. In viewing those countries that claim to have reached the pinnacle of civilization, one finds liberty restricted by all kinds of ordinances, and that made him feel still more proud to be a Canadian and a British subject. Referring to the Lemieux Act he said it was destined to render great service in preserving harmony between employers and employees. He believed the present financial crisis would be of short duration.

Letters of regret at non-attendance were read by the secretary, Mr. Lauer, from Sir Wilfrid Laurier, Earl Grey, the Hon. Lomer Gouin, the Hon. W. Pugsley, the Hon. L. A. Tachereau, Maurice Perrault, M.P.P., Mayor Ekers, Mr. Godfrey Langlois, M.P.P., Mr. G. W. Stephens, M.P.P., Mr. C. C. Ballantyne, Mr. J. Perrault, Mr. Geo. Caverhill, Mr. Geo. Hadrill, Mr. A. F. Dunlop (Canadian Institute of Architects), Mr. N. Turcot (President Plumbers' Association), and the secretaries and presidents of the Builders' Exchanges of Quebec, Ottawa, Toronto, London, Hamilton, Chatham, Winnipeg, Vancouver and Victoria.

Mr. John H. Lauer, Secretary Montreal Builders' Exchange.

The toast, "Our Province—Quebec," coupled with the name of the Provincial Treasurer, Hon. W. A. Weir, was proposed by Mr. N. T. Gagnon, Past-President, and drunk with musical honors.

After expressing his regrets at the absence of the Premier, who at the moment was engaged in the contest at Chateauguay, Mr. Weir turned to matters legislative. The Government, he declared, had the confidence of the people, and had worked hard to merit that confidence. The recent factory legislation, by which no children under fourteen years of age were allowed to work in factories nor under sixteen years, unless they could both read and write, was in advance of anything of the kind in the United States. Technical schools had been established, which would fill a long felt want in the province. The Lemieux Act went a long way in the right direction, appealing, as it did to common sense or public opinion in the settlement of disputes. He believed that before long we should have compulsory arbitration, as they have in New Zealand, not only in public utilities, but in every branch of industry. While defending the right of unions to organize, he considered that a fatal defect of trade unionism was the principle that all workmen, whether skilled or not, must receive the same wage. This defect, he believed the workers themselves would remedy. Mr. Weir spoke strongly on the need of a thorough system of education, which, he said, Canada must have before she can take her place among the great industrial factors of the world. Thought power must be developed. Another need was community of sentiment. Each province, section, and individual should learn to appreciate the needs and the sentiments of others. To rise superior to sectionalism was to create the factors of future national greatness.

The toast, "Our City, and Technical Schools," was proposed by Mr. J. W. Hughes, the father of the technical school movement in Montreal. He reviewed the disappearance of the old apprenticeship system, and showed the need of a system of technical education for the training of skilled workmen. Mr. Hughes was thoroughly at home in his subject, and outlined the growth of technical schools from personal knowledge. Much had been accomplished, but much remained to be done.

The toast was responded to by Hon. J. D. Rolland, who pointed out the close relationship existing between the manufacturing and building industries, and technical education, and also by Mr. C. H. Catelli, president of the Chambre de Commerce.

"Our Architects, Dominion and Provincial," was proposed by Mr. W. T. Castle and responded to by Mr. Alcide Chausse, secretary Canadian Institute of Architects and by Ad. Brossard, Provincial Architect.

The programme of toasts was enlivened by the interspersion of songs and recitations. Much credit is due to the energetic secretary, Mr. J. H. Lauer, and to the chairman of the evening, Mr. James Simpson, for the excellent way in which the whole programme was carried out.

The Schebler Carburetor.

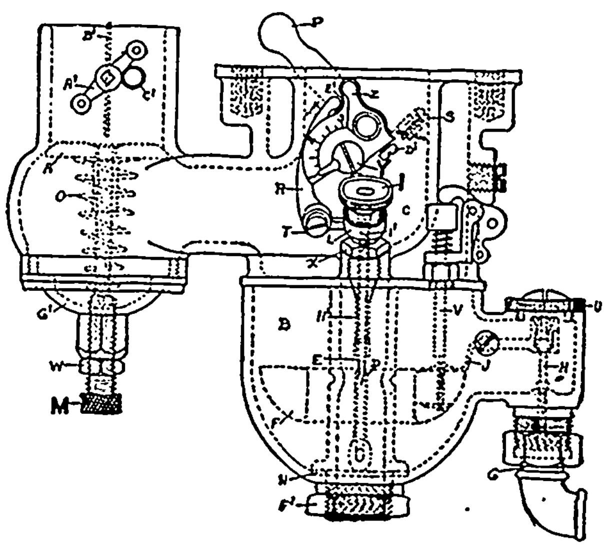
John Millen & Son, 321 St. James St., Montreal, have just acquired a new agency, being that of Wheeler & Schebler, Indianapolis, Ind. Manufacturers of special carburetors. A sectional view is shown herewith of model F.

The bowl design combines compactness with practicability, it serving for reservoir, as well as having mixing chamber embodied therein. The float is made of cork, heavily shellaced and hinged as shown in sectional view, letter J. Attention is called to the size of gasoline valve, it being much larger than ordinarily used. Gasoline is supplied through a reversible union which permits the feed pipe to run in any direction desired. The throttle is made interchangeable with automatic air valve so that they can be used on either top or side of bowl as occasion may require. A drain cock is placed in bottom of bowl for cleansing purposes.

The air valve can be adjusted and locked without aid of tools. Attention is called to the location of spray nozzle. Its being in the centre of the chamber eliminates the changes in quality of mixture when ascending and descending hills, such as occurs in carburetors where nozzle is located to one side of oil reservoirs. Neither does the mixture change while making turns. For boat work the Schebler has been found highly satisfactory, especially on speed boats in which multiple cylinder engines are used. Owing to the design of these carburetors, they occupy very little space and can usually be mounted where other makes can not find room. One of the great disadvantages of many carburetors used heretofore has been the lack of a satisfactory method of securing a uniform mixture of gas and air at different engine speeds. The regulation of the composition of this mixture either had to be effected by hand or was accomplished by more or less automatic devices that were far from satisfactory. The Schebler perfectly performs this function, it being based on the following principles: When the motor is running at its minimum speed, the air is drawn through an aperture of fixed dimensions. As the speed is increased and consequently the flow of gasoline becomes greater, more air is required, and this additional supply is furnished by the compensating air valve which opens more and more as the speed of the engine increases. Compensating air valve, when once adjusted, admits a regulated supply of air in accordance with the degree of vacuum produced by the piston of the motor.

In the type F the throttle is water-jacketed with a butterfly valve in place of the sliding disc type used on the other models. There are two adjustments of the gasoline needle valve. The first acts through a knurled button, marked "I," which is turned to the right or left until a proper mixture is obtained with a low throttle. The second adjustment acting through an eccentric cam marked "Y," causes the lever "Q" to move the needle valve up and down in the spraying nozzle until the proper mixture for high speed and without black smoke in exhaust. Then try controlling engine speeds by throttle If the engine runs at low speed and fires regularly, but will not do the same at high speed, tighten the tension on the spring behind automatic air valve. This may be done by loosening the winged thumb nut and turning the milled screw head to the right a couple of turns at a time, the locking in place by tightening the thumb nut until a trial of engine speed is made to determine whether mixture is right or not. If not correct, make adjustments little at a time on the air valve until the engine will run at all speeds without showing black smoke. Then lock the thumb nut tight, after which there are no further adjusting to be done.

When properly adjusted the Schebler



is obtained. The compensating air valve marked "AOM" with its sensitive spring "O," keeps the mixture uniform between those two regulations and allows air to pass through freely, thus preventing a vacuum in the cylinder. The constant air opening "9" through the center of the body allows the engine to be throttled down very low and still receive enough air to supply a good mixture.

Instructions for Connecting and Adjusting.

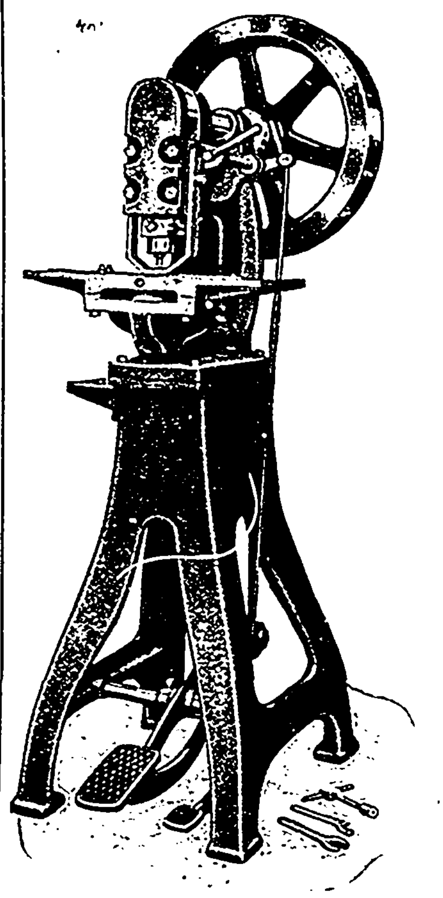
Place Carburetor about 6 inches below the bottom of gasoline tank, connecting a pipe or tube to union G. Pipe to be brass or copper and not less than ¼ inch hole. (N.B.—Don't use rubber tubes, as float chamber will not fill properly and rubber makes a sediment in the gasoline). Be sure the tube or pipe is thoroughly free of dirt or corrosion. After all connections are properly made, turn on the gasoline and wait a few moments for float chamber to fill. Set throttle valve so it stands a trifle open. Turn needle valve about one half turn open. Flush carburetor and your engine is ready to start. The proper mixture is obtained by adjusting the needle valve as the case may require. If black smoke and red flame is observed, then the mixture is too rich. If a yellow flame is shown, mixture is not rich enough. After a deep blue flame has been obtained, open the throttle lever gradually. If motor misses explosions and there is no black smoke or red flame shown from exhaust, it is evident that mixture is not quite rich enough. Open needle valve slightly until firing is regular

Carburetor actually economizes in the use of fuel.

A Compensating air valve.
B Float chamber.
C Mixing chamber.
D Spraying nozzle.
E Needle valve.
F Float
G Reversible union.
H Float valve.
I Needle valve and adjusting screw.
J Float lever.
K Throttle.
L Needle valve retainer.
M Air valve adjusting screw.
N Cork Gasket.
O Air valve spring.
P Throttle lever.
Q Needle Valve lift lever.
R Throttle stop.
S Pivot screw.
T Float cap.
U Flushing pin.
V Lock nut.
W Needle valve hex connection.
X Spring cam casting.
Y Eccentric high speed adjustment.
Z Air valve lever.
1 Air valve butter-fly disk.
2 Spring.
3 Lock screw.
4 Cam spring.
5 Lock nut for bowl.
6 Air valve cap.
7 Needle valve retaining spring.
8 Needle valve spring.
9 Constant air opening.

New Punch and Die Press

The Automatic Specialty Co., Cincinnati, Ohio, have recently developed and placed on the market a combination foot and power press shown in illustration herewith. It was designed with a view of supplying the demand for a small press to be used where power is available or otherwise where manufacturing of light sheet metal and brass



Combination Punch and Die Press Made by Automatic Specialty Co.

goods is carried on. This adapts it to the use of tinners, stove and cornice workers, and other similar lines of manufacture, where foot power only is available.

The ram is fitted up with an adjustable gib to take up the wear, though this would be reduced to a minimum owing to the large area of bearing surface provided. The automatic clutch may be operated either by the hand lever shown at the right of the spindle, or by the right-hand foot lever. The fly-wheel is bronze bushed, and can readily be replaced at small cost. When being used as a foot press, the treadle beneath the machine is connected with a crank-pin on the fly-wheel which is revolved by the foot of the operator in this way. For light work, a working stroke can be made at every revolution of the fly-wheel by this method. For heavy work, beyond the range of the usual foot press, the fly-wheel may be speeded up for several revolutions and the automatic clutch thrown in, as when working with power, when the stored momentum will punch a hole well up to the full capacity of the machine.

The machine is regularly provided with a front and side gauge on the bolster plate for guiding the stock to the punch when duplicate pieces are wanted. A stripper, as shown, is fastened to the sides of the column. The equipment includes a set of three wrenches and a choice of three punches of standard sizes ranging from ⅛ to ¾ inch. The full capacity of the machine is for holes up to ⅞ inch in diameter, through ⅛ inch brass or soft iron. The distance from the center of the slide to the back of the throat is 5¾ inches; from the bed to the bottom of the slide when up, 4½ inches. The fly-wheel, which is 19 inches in diameter, weighs 105 pounds and should run from 175 to 200 revolutions per minute. The weight of the machine is 500 pounds.

Enormous Rope Drive Pulleys

The second of a pair of rope drive pulleys, the largest ever built in Canada, and second largest in America, was recently completed by the Laurie Engine & Machine Co., Montreal, and set up in the new plant of the Canada Tin Plate & Sheet Steel Co., Morrisburg.

In the accompanying illustrations is shown the pulley in the lathe at the Laurie Engine Works. It measures 30 feet pitch diameter, 30 feet 3 inches over all. The face is 4 feet 8½ inches wide, and is grooved for twenty-two 1¾ inch ropes.

Each pulley is built of 12 rim segments, 12 arms, 2 hubs, and shaft. About 200 bolts are used. Finished weight of each pulley with shaft is 180,000 pounds.

The rims, arms and hubs were cast in the foundries of the Laurie Engine Co. The hubs were pressed on to the shaft under hydraulic pressure of from 250 to 500 tons and keyed on. The shaft was then put in the lathe between centres, and bearings for the support of the shaft were adjusted to preserve the alignment. The hubs were then forced off on the inside to gauge, and the arms placed in. When all twelve arms were in position, the rim segments, which had been machined to tinplate, were put in place with pins and temporary bolts. Then the bolt holes were reamed out slightly taper, and turn bolts fitted, driven home and screwed up tight. Each bolt being taper and fitted tight, acts as a dowel, preventing any movement between parts and making the whole absolutely rigid, practically one piece.

Up to this point the shaft had remained in position, so that the faces of the wheel were absolutely concentric with the axis of the shaft—important features for steady power and easy running. The wheel now stood complete in the lathe. The rim was then machined, each groove being carefully turned to gauge of correct form for rope drive, and the wheel was finished. It was then taken down and the pieces shipped separately to Morrisburg, where the wheel was re-erected, and is now assisting in the manufacture of Canadian tin plate.

The largest single belt fly wheel in Canada was built by the Laurie Engine Co., a few years ago for the Ogilvie Flour Mills, at Winnipeg. It was 22 feet in diameter, and has a 6 foot 3 inch face. Another large wheel built by the same firm was a balanced fly wheel for the Dominion Iron & Steel Co. This wheel was 24 feet in diameter, and weighed 236,000 pounds.

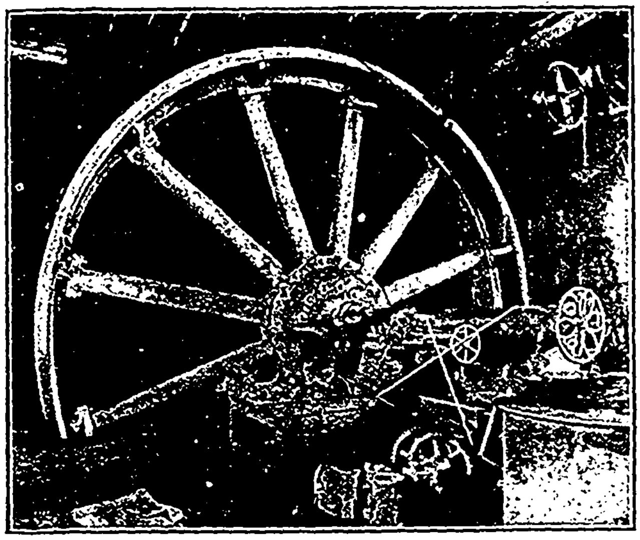


FIG. 2—LAURIE ENGINE & MACHINE CO'S THIRTY FOOT ROPE PULLEY IN LATHE.

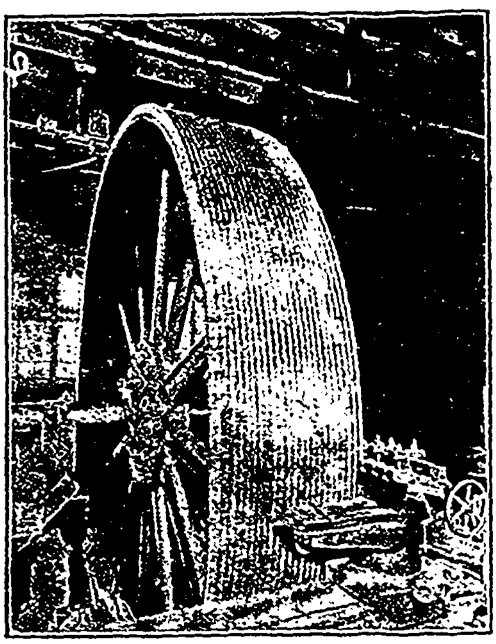


FIG. 1—ENORMOUS ROPE PULLEY SHOWING GROOVES, MADE BY LAURIE ENGINE & MACHINE CO., MONTREAL.

Colors Fast to Perspiration

By C. M. WHITAKER in Dyer and Calico Printer.

With every advance that is made by coal-tar color manufacturers in the way of introducing dye-stuffs superior in point of fastness to those previously in use, a corresponding advance is recorded in the demands made by the merchants in the severity of the tests which the goods ordered by them must withstand. One of the points upon which great stress is laid nowadays is that the dyeings must be fast to perspiration. Fastness to perspiration is naturally of more importance in some classes of goods than others; for instance; it is of first importance in blouse stuffs, shirtings, hosiery, sport flannels, etc. Unfortunately, there is no really satisfactory test for perspiration, and it is therefore a cause of trouble to all concerned in the color trade, both makers and consumers. Unlike ordinary demands, such as fastness to washing, which can easily be determined, fastness to perspiration cannot be so determined, but depends too much on the personal equation for one ever to be certain about it. It is a well known fact that the action of perspiration on colors varies largely with different individuals owing to their different physical conditions, or even with the same individual at different times—that is, whether in good or indifferent health. This factor, it will readily be understood, makes it practically impossible to have a perfect test for perspiration; but it is much to be desired that some one test should be adopted and accepted as a standard, so that a color could be guaranteed fast to the standard test for perspiration.

One point that must not be lost sight of is that perspiration in the first stages has a weakly acid reaction, while in the later stages it is weakly alkaline. This fact alone at once complicates the devising of a satisfactory test.

The action of perspiration on colors may be two-fold in effect, viz., change of shade and causing the color to bleed on to the adjacent clothing or the body itself. It must not be overlooked, however, that faulty dyeing may be the actual cause of the bleeding, due to imperfect fixation of the dyestuff or insufficient washing, in the same way as a fast milling color will bleed under the same circumstances.

Actual personal test. Give a dyed swatch, sewn along with white wool and cotton, to the boiler man, and get him to wear it under the arm-pit during a shift, then notice the effect after washing the swatch. This is probably as satisfactory as any test; but it is not always convenient to carry it out, and it also cannot get over the difficulty that the perspiration of no two individuals reacts on colors in the same way.

Boiling water test. Throw a swatch of the color along with an equal swatch of white wool and white cotton into boiling water, and lift out at the end of one minute. Notice if the water is stained; also dry the swatches, and see if they are stained. If stained, the color is reputed not to be fast to perspiration. This is a very severe test even for acid colors, and still more severe for substantive colors.

Alkali test. Make a solution of 5 ounces Marseilles soap and 3 ounces ammonia in cubic foot. Work the pattern to be tested along with white wool and cotton in some of this solution for ten minutes at 122°F.; then wring out, but do not rinse. Now wrap the pattern in a piece of white calico and iron it dry with a hot iron, then examine the pattern to see how it has stood the test. This can be made still more severe by wrapping the pattern tightly round a glass rod; fasten it on. and dry it slowly at 122°F. This is suggested by Dr. Davidis for the black and white woolen goods, which have been so popular.

Acetic acid test. Make up a solution containing 10 parts acetic acid (30 per cent.) and 1 part common salt per 100 parts water. The salt is added because perspiration contains salt. The pattern, along with white wool and cotton, is soaked in this, and slowly dried at 104°F. This test is varied in that the pattern is kept moist at this temperature with this liquid from an hour to as long as 24 hours before the pattern is dried.

Buying Belting for Planing Mill.

By Uncle Dudley in Wood-Worker, Indianapolis.

The best equipped plants, in purchasing belting, usually get several firms to figure on the entire equipment, and the lowest bidder gets the job, and sometimes the quality of the belting must be cut in order to get the figures low enough to secure the order. The price of leather governs the cost of belting, and the mill man must bear in mind that to get the best belting he must necessarily pay a good price for it.

When a firm agrees to sell you the best belting, or strictly center stock, weighing not less than 16 ounces to the square foot, with short laps, at 70 per cent. off the list, you can just bet you will get soaked, and that in good shape; however, if you do not care for the best, this will no doubt answer and take the place as belting, but in the long run it will be found quite expensive, and there probably will always be a large amount of belting on hand that is damaged or stretched on one side, or stretched at the laps. When your Uncle Dudley purchases belting, he gets the best, regardless of price. Have bought belting that cost as high as 45 per cent. off the list, and it was cheap at that. Why so?. Because, in the first place, it was about 9-32 inches thick, and has been running on planers and matchers for the past seven years, and is still running. It has worn down to about 3-16 inches thick. Had one mill man tell me if he could get belting that would last him two years on heavy planing machines he was perfectly satisfied. That is all right, but if the belting will last six and seven years, would not he be better satisfied? Belting costs money, and if you can make it last twice as long as you did a few years ago, would you be sorry it did not give out sooner? Suppose you should get a new superintendent and he would make your belting last twice as long as your former superintendent; would you give him an advanced salary? Would you thank him for it? Would you tell him he was doing better than the other fellow and see how much he would save the coming year? Would you give him any encouragement for saving you this great expense? I'd bet dollars to doughnuts you wouldn't say a thing to him, not even let on that you appreciated his efforts in the least, but would think he ought to get along on about one-fourth what he had the past year. Let me tell you, Mr. Millman, you are on the wrong road. Go to him and tell him what he has done. He will pay you many times for your extra trouble. Let him know you appreciate his efforts. Give him a good salary. Let him have full swing. Tell him to run the plant just as though he were the owner instead of the superintendent. This will have the desired effect and will bring grand returns.

In concluding this belting question—which is one of the greatest chances for leaks about a factory—there comes up the question of belt-fasteners. You must have them, that is certain, but there are many places where they can be avoided to a good advantage. For instance, there should be but one place in a belt that should be put together with any other method than good cement. Saw a blower belt at one time that had at least twenty pieces of belt put together with whang leather; this belt had to be relaced at least once a day, the mill stopping, with the men standing about waiting, and all this under expense. Let me tell you all that whang leather is the most expensive belt-fastener on the market, for you have to pay at least 30 cents per square foot, and it does not take long to use a foot.

Wire that is soft will last very well if used on an open belt, but not so well if used where both sides of the belt run on pulleys, as on the side that is crossed it will soon wear off. Have used this wire in connection with whang leather, and in every instance the wire was the winner; besides, it is noiseless when it goes over the pulleys. As for fasteners for the spindle belts on matchers and all heavy machines where an endless belt cannot be used, would advocate the use of genuine Blake studs. If properly put in, they will make but little noise, give good service and last a long time. For single belts use the No. 1. That is the only size I use. Wherever it is possible to use an endless belt, do so, by all means. Sometimes a belt will give out during the day and it seems almost impossible to get along without it. The best way out of the difficulty is either to cement it during the noon hour, or put on a new belt and cement the old one, thus saving the laps of the old belt.

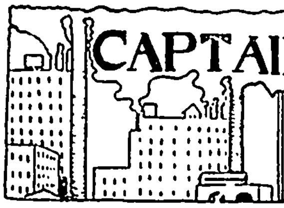
Good belt cement will dry and be ready for use in an hour's time, so one need not be timid about cementing during the noon hour or at any other time. The cost of tools for making cemented joints is small. I have known many to have no other tools than a heel shave and a couple of scrapers, with the edge turned. These will cut the belt down very fast, and one can get a good, even splice. Always try to get the joint the same thickness as the rest of the belt. On high-speed belts, like those for planers and matchers, I always make a 6 inch splice, and find this about the right length. Have the glue or cement hot, apply with a brush, then hammer until it is set, and you have a joint that will stay. It used to be the custom to use rivets or lacing or pegs, and sometimes stitching, but these are entirely done away with except with the few who still insist on this antiquated method.

A SERIOUS DRY GOODS FAILURE.

A despatch from Montreal says: Moses Genser, manager of the Dominion Dry Goods Co., is missing, and there is a list of known creditors whose claims aggregate $51,000. Through an indirect medium Genser has suggested that he may be able to pay 20 cents on the dollar, but the entire stock in the warehouse is valued at only $1,500. The settlement of the estate has been placed in the hands of Wilks & Michaud.

The following is a list of the more prominent creditors as far as known: Auburn Woollen Mills, Peterboro', $796; Universal Knitting Co., Toronto, $756; Slingsby Mfg. Co., Brantford, $2,059.90; Massey Knitting Co., Montreal, $306; Montreal Suspender Co., $726.05; Dominion Textile Co., Montreal, $756.54; J. B. Perry Knitting Co., Hamilton, $855.95; Jos. Simpson Sons, Toronto, $3,607.67; H. J. Dingman, Toronto Knitting Co., $592.08; Bates & Innes, Carleton Place, $811; J. P. Black & Co., Montreal, $96[illegible].44; Bohan Bros., Toronto, $1,593.86; Penmans, Limited, Paris, Ont., $3,446.69; Alex. Burnett, Montreal, $837.31; A. E. Smith, Montreal, $874.52; A. Caisse, Montreal, $705.81.

The John Deere Plow Co., Winnipeg, Man., have been incorporated with a capital of $500,000, to carry on the business of dealers in agricultural implements, carriages, wagons, machinery, etc. The provisional directors include W. Butterworth, W. L. Velie and G. W. Mixter, Moline, Ill.



CAPTAINS OF INDUSTRY

The following items of information, which are classified under the title "Captains of Industry," relate to matters that are of special interest to every concern in Canada interested in any manufacturing industry whatever, this interest extending to supply houses also.

Among the firms who have bought pumps from the Smart-Turner Machine Co., Limited, Hamilton, Ont., during the last few weeks are: R. J. Loze, Chaudiere Junction, Que.; the Brinton Carpet Co., Peterboro, Ont.; the Canada Wood Specialty Co., Orillia, Ont.; Sheldon's, Limited, Galt, Ont.; the Grand Trunk Terminal Elevator, Midland, Ont.; E. Leonard & Sons, London, Ont.; E. F. Stevens, Halifax, N.S.; Normal School, Hamilton; Hiram Walker & Sons, Walkerville, Ont.; J. E. Rathbun, Trenton, Ont.; the American Locomotive Co., for their works at Montreal.

The American Pants & Overall Co., Ottawa, are offering 50 cents on the dollar.

The Simcoe Coat & Mitt Co., Limited, Simcoe, Ont., are to be wound up. John Jags has been appointed interim liquidator.

Kurtze & McLean, Limited, manufacturers motor vehicles, etc., Stratford, Ont., have assigned to the London & Western Trust Co.

H. D. Lockhart Gordon has been appointed provisional liquidator of the Keystone Sugar Co., Limited, Toronto.

The Canadian Bank of Commerce have issued a writ in the High Court against the McIntosh Brick Machine Co., Limited, Sarnia, Ont.

The Cobalt Shippers, Limited, Cobalt, Ont., have been incorporated with a capital of $40,000, to carry on a milling, mining and reduction business. The provisional directors include J. T. Kelly, S. Pierce and T. H. Jessop, Haileybury, Ont.

The city of London, Ont., have just completed three septic tanks. The tanks are 160x50 feet, with grit chambers 50x10 feet.

The P. L. Robertson Mfg. Co. recently organized in Hamilton, Ont., purpose erecting a large screw factory at once.

The American Furnace Co. are having a plant fitted up in Niagara Falls, Ont., for the manufacture of fine steel by electrical process.

The Green-Robin Gold Mines, Toronto, have been incorporated with a capital of $1,500,000, to carry on a mining, milling and reduction business. The provisional directors include J. K. Lindsay, M. Macnair, and W. Cooke, Toronto.

The Canadian Shipbuilding Co. have increased the capacity of their yards at Midland, Ont.

The city of Kingston, Ont., will spend $22,000 in macadam roads during the coming year.

The ratepayers of London, Ont., will vote on a by-law to raise $17,000, for the construction of a new fire hall.

A by-law will be submitted to the ratepayers of Brantford, Ont., in January, which will provide for the expenditure of $55,000, for a distribution plant for power purposes only.

Tuckett, Limited, Hamilton, Ont., have been incorporated with a capital of $200,000, to manufacture tobacco, cigars, etc. The provisional directors include G. T. Tuckett, H. B. Witton, and G. J. Tuckett, Hamilton.

Messrs. Dixon Bros., Campbellford, Ont., have been awarded the contract for the erection of the bridge across the Spanish River at Espanola, Ont.

The car shop of the Grand Trunk Railway Co., at London, Ont., will be equipped with 17,000 square feet of skylight, which will be supplied by Arthur E. Rendle, of Montreal.

The Algoma Steel Bridge Co., Sault Ste. Marie, Ont., have been awarded the contract for the erection of the bridge at Massey, Ont.

The Brand Electro-Ozone Co., Toronto, have been incorporated with a capital of $100,000, to manufacture electrical appliances, etc. The provisional directors include W. M. Gray, G. Laird and S. Egan, Toronto.

The iron bridge over the Humber River at Lambton Mills, Ont., has been completed.

A hospital will be erected at London, Ont., at a cost of about $70,000.

The Economic Light, Heat & Power Co., Toronto, have moved their headquarters from 40 York Street to 72 York Street.

The new dock being erected at the foot of York Street, Toronto, for the Canadian Northern Railway Co. has been completed.

The Lobo Telephone Co., Coldstream Township, of Lobo, Ont., have been incorporated with a capital of $10,000, to carry on the business of a telephone company. The provisional directors include H. J. Marsh, D. A. Graham, and A. E. McKay, township of Lobo, Ont.

The city council, Port Arthur, Ont., have authorized the purchase of a 250 h.p. motor generator, at a cost of $8,000, for additional street railway power.

The Fleming Aerial Ladder Co. have submitted a proposition to the town of Barrie, Ont., for the erection of a plant at a cost of about $26,000.

The Tighe-Larder-Lake Gold Mines, Toronto, have been incorporated with a capital of $4,000,000, to carry on a mining, milling and reduction business. The provisional directors include R. H. Tighe, J. H. Tighe and D. Drover, Toronto.

The municipality of Kemptville, Ont., are considering the advisability of applying for a charter to construct a railway from Kemptville Junction or Mountain across the country to the Grand Trunk line at or near South Indian, Ont.

The Metropolitan Electrical Co., of Ottawa, have offered to sell their power plant at Britania for $200,000.

The Department of Public Works, Ottawa, will receive tenders up to February 1, 1908, for the works connected with the construction of Section No. 2, Ontario-Rice Lake Division of the Trent Canal.

The Credit Valley Brick Co., Toronto, have been incorporated with a capital of $50,000, to manufacture brick, sewer pipes, tiles, pottery, etc. The provisional directors include W. Schumacher, Glen Williams, Ont., G. A. Turner and W. B. Bentley, Toronto.

A new post office may be erected at Chesley, Ont.

The Government are considering the extension of the Winter Fair Buildings, at Guelph, Ont.

The Silver Spade Mining Co., Toronto, have been incorporated with a capital of $500,000, to carry on a mining, milling and reduction business. The provisional directors include F. H. Potts, A. R. Bickerstaff, and N. Corcoran, Toronto.

The Brandon Shoe Co., Aylmer, Ont., have been incorporated with a capital of $30,000, to manufacture boots, shoes, etc. The provisional directors include A. Brandon, O. E. Peterson and J. C. Bram, St. Louis, Mo.

Wm. Nicholson, Wingham, Ont., has been awarded the contract for the erection of the new post office at Kincardine, Ont. The cost will be about $17,000.

The Gould Consolidated Mines, Limited, Ottawa, have been incorporated with a capital of $2,000,000, to carry on a mining, milling and reduction business. The provisional directors include J. Wilson, D. O'Connor and J. W. Bindon, Ottawa.

Work on the new central fire station, Toronto, will not be started until the spring. An office building for the chief of the fire department, and storehouse for the alarm telegraph system will also be erected by the city at a cost of about $35,000.

Sixteen new buildings are to be erected in connection with the Royal Military College, Kingston, Ont., for servants' quarters, etc. The cost will be about $80,000.

The Nova Scotia Cement & Plaster Co., Toronto, have been incorporated with a capital of $100,000, to manufacture gypsum, cement, plaster, ores, etc. The provisional directors include J. S. Lovell, W. Bain and R. M. Coates, Toronto.

A company to be known as the King Edward Hotel Co. has been organized in London, Ont., to erect a large hotel at a cost of about $500,000. The directors include G. Christie, E. Meredith, T. Beattie and P. Pocock, London.

The coal sheds of the Kingston, Ont., waterworks were destroyed by fire, December 2. Loss about $2,500.

Messrs. Lewis & Smith, Toronto, have been incorporated with a capital of $100,000, to carry on an engineering and contracting business. The provisional directors include H. Lewis, H. W. Wilcox and C. M. Doolittle, Hamilton, Ont.

The Grand Trunk Railway Co. have given orders to various Canadian and American firms for one hundred new locomotives, at a cost of about $1,500,000.

The ratepayers of Deseronto, Ont., voted favorably on a by-law, December 9, granting the Deseronto Furniture Co., a bonus of $20,000.

The Crown Gypsum Co., Cayuga, Ont., have been incorporated with a capital of $100,000, to manufacture gypsum, ores, metals, etc. The provisional directors include

J. A. Murphy, Cayuga, Ont.; S. C. Macdonald, Hamilton, Ont., and J. T. Mullany, Buffalo, N.Y.

Messrs. Steinhoff & Gordon, owners of the electric light plant at Tweed, Ont., have sold the entire plant to J. P. Kissack. Improvements will be made to the plant at once.

The Imperial Glove Co., Dundas, Ont., have been incorporated with a capital of $40,000, to manufacture gloves, mitts, etc. The provisional directors include H. G. Carscallen, C. J. Myles and W. L. Ross, Hamilton.

The Burrow, Stewart & Milne Co., Hamilton, Ont., are rapidly rebuilding that portion of their plant destroyed by fire a few weeks ago.

The Railway Y.M.C.A. are considering proposals for the establishment of branch associations at Hamilton, Ont., and Moncton, N.B.

The Industrial Natural Gas Co., Welland, Ont., have been incorporated with a capital of $40,000, to manufacture gas, oil, etc. The provisional directors include W. A. Gibb, Hamilton, Ont., D. Ross and B. J. McCormick, Welland, Ont.

The Temiskaming & Northern Ontario Railway Commission have recently ordered four new vans, two baggage and express cars and two baggage and mail cars.

The Renfrew Roller Mills Co. have purchased the elevator owned by A. A. Wright, Kingston, Ont.

Lastner & Porter, Wiarton, Ont., have been awarded the contract for the construction of the dock at Port Colborne, Ont.

The Thomas A. Norris Co., Toronto, have been incorporated with a capital of $40,000, to carry on a plumbing, gas fitting and tinsmithing business. The provisional directors include R. J. McGowan, C. Winfield and C. F. Brookes, Toronto.

The Evans Rotary Engine Co., Toronto, have secured the contract for installing one of their 40 h.p. engines in the Rossin House, Toronto.

The new plant of the Delaware Seamless Tube Co., of Auburn, Pa., which is to be erected at Sarnia, Ont., will cost $200,000.

A. & C. Boehmer, Limited, Berlin, Ont., have been incorporated with a capital of $40,000, to manufacture paper boxes, cardboard, etc. The provisional directors include A. Boehmer, C. S. Boehmer and G. Boehmer, Berlin, Ont.

Work on the 2,000,000 bushel elevator, which is being erected for the Dominion Government at Port Colborne, Ont., is being pushed, and it is hoped to have one wing with a capacity of 850,000 bushels, completed for this season's crop. When entirely completed the elevator will stand 170 feet above the wharf, occupying a ground space of 210x75 feet.

F. W. Bird & Son, Hamilton, Ont., are considering the erection of a factory at Hastings, Ont.

The Automatic Vending Co., London, Ont., have been incorporated with a capital of $50,000, to manufacture automatic and other Vending machines. The provisional directors include G. H. Townsend, Smithville, Ont., and W. L. Trusler, Toronto.

Messrs. Boyer & Swartz, of Indiana, manufacturers of garden swings, step ladders, etc., have completed arrangements with the city council, Stratford, Ont., for the erection of a factory there.

The ratepayers of Ingersoll, Ont., will be asked to vote on a by-law to raise $50,000, for the purpose of acquiring the plant of the Ingersoll Electric Power & Light Co. The aldermen emphasized the importance of cheap power, and pointed out that it was necessary for the town to acquire the present plant before entering into a contract with the Hydro-Electric Power Commission.

The city council, London, Ont., will submit money by-laws to the amount of $653,000 at the next municipal elections. The most important are: Water works extension, Komoka scheme, $393,500; Niagara power distribution plant, $235,000; fire halls in north and east end, $19,000; debentures for land and tubercular hospital, $6,000.

The Collingwood Shipbuilding Co., Collingwood, Ont., have prepared preliminary plans for a palace passenger and freight steamer for the Northern Navigation Co. The cost will be in the neighborhood of half a million dollars. The steamer will have accommodation for 360 passengers, and the dining room will seat 180. The interior finishing will be in quarter cut oak and mahogany, and furnishings of the most luxurious character. The specifications provide for 6 Scotch boilers and triple expansion engines. Her average speed will be 20 knots, which may be increased if required.

Dr. Sheard, Medical Health Officer, Toronto, reported against the application of Dr. J. E. Wilkinson, president of the British-Canadian Smelters, Limited, for 20 acres free on Ashbridge's Bay, for the purpose of a smelter of cobalt ores.

The Metal Shingle & Siding Co., Limited, of Preston, have shipped six carloads of corrugated galvanized sheets for the new plant of the Great Lakes Portland Cement Co., at Port Colborne, Ont. They have also secured the contract for supplying the same material to be used in constructing the Vulcan Portland Cement Co.'s new works at Longue Point, near Montreal.

Order to wind up the Upper Ontario Steamboat Co., Limited, New Liskeard, Latchford and Charleton, Ont., has been applied for.

The assets of Andrew Parker & Sons, manufacturers furniture, Elora, Ont., are advertised for sale.

The Giant Mfg. Co., Limited, manufacturers paints, varnishes, etc., purpose discontinuing business.

The Stratford Clothing Co., Limited, manufacturers, Stratford, Ont., are asking extension.

P. Gies, Berlin, Ont., has issued a writ against the Canadian McVicker Engine Co., Limited, Galt, Ont., for $891.

The Dodge Mfg. Co., Toronto Junction, Ont., have issued a writ against the Canadian Westinghouse Co., Limited, for $953.

The Phillip Carey Mfg. Co., Toronto, have issued a writ against the Canadian Shipbuilding Co., for $394.

John Knox Co., Limited, have secured judgment against Boehmer, Erb Co., Limited, for $1,095.

The box factory of the Elliott Mfg. Co., St. Andrew's Institute, and several adjoining buildings, Richmond St. West, Toronto, were destroyed by fire, December 16. Loss about $190,000.

The premises of the Woodbine Planing Mill, Toronto, were damaged by fire, December 16, to the extent of about $18,000.

The Weber Gas Engine Co., Kansas City, Mo., have sold through Mr. R. J. Goudy, Canadian representative, a producer gas plant to the City Dairy Farms, Limited, New Lowell, Ont.

The Galt Reformer has published a description of the Parkin Elevator Works, in which it states that this firm have an ideal manufacturing plant and employ between forty and fifty hands.

The new building of St. Jerome College, Berlin, is now almost completed. A feature of the building is the metal cornice, 6 feet high, which was manufactured and erected by the Metal Shingle & Siding Co., Limited, Preston, Ont. This cornice runs around the entire building 356 feet, and adds greatly to its general attractiveness.

The name of the Dominion Dump Car Co., Limited, Montreal, has been changed to that of the Hart-Otis Car Co., Limited.

The O. M. Edwards Co., manufacturers of window fixtures, shade rollers, trap doors, etc., of Syracuse, N.Y., are considering removing their Canadian factory from St. Catharines, Ont., to Montreal.

A steel lighthouse is being erected on the breakwater at Quebec, Que.

F. H. Coarson, of Colebrooke, N.H., has acquired a mill site at Lynds Cove, Que., at the mouth of the Grand Cascapedia River. It is his intention to build a large log lumber mill with shingle and rossing mills attached. Additional wharves will also be built. The estimated output of these mills is expected to be from five to six million feet a year.

The Shawinigan Water & Power Co., Montreal, are installing two sets 1,500 k.w. 30 to 60 cycle three-phase 600 r.p.m. Crocker Wheeler generators.

The Dynamic Machine Works, Limited, Montreal, are putting up a hanging steel floor, 76x16 feet, in the new Engineering Building of McGill University.

L. H. Gaudry & Co., Montreal, shipped a consignment of cast iron pipe for the waterworks at Summerside, P.E.I., from Quebec, December 1. It arrived safely on the 9th. The shipment was valued at $10,000.

The Dynamic Machine Works, Limited, Montreal, are supplying 100 worm gears for use on lock gate openers for government canals.

The Montreal Light, Heat & Power Co., Montreal, recently added a 3,000 h.p., Westinghouse-Parsons steam turbine engine to their plant on Prince Street, at a cost of about $80,000.

The large block of Messrs. Clement & Marchand, Quebec City, was destroyed by fire, December 3. Loss about $14,000.

The premises of Bureau's Hotel, Montmorency Falls, Que., were destroyed by fire, December 1.

The Grand Trunk Railway Co. will build an extensive terminal at St. Lambert, Que.

The new plant of the Lakefield Portland Cement Co., Pointe Aux Trembles, Que., will commence operations in a few days. The output at the start will be about 2,000

barrels per day and will be increased to 3,000 barrels in the near future.

Maison Jean Paquette, Limited, Montreal, have been incorporated with a capital of $300,000, to manufacture hot water heaters, plumbers' supplies, etc. The charter members include O. Paquette, St. Louis, Que., J. H. L. Pelletier, and F. J. Bisaillon, Montreal.

The Canada Tag & Label Co., Montreal, have been incorporated with a capital of $49,000, to manufacture tags, tickets, labels, etc. The charter members include E. F. Surveyer, J. W. Weldon and E. M. McDougall, Montreal.

The Walbridge Mfg. Co., Mystic, Que., have been incorporated with a capital of $20,000, to manufacture tools, wood and iron working machinery, engines, boilers, water wheels, shafting, hangers, pulleys, stoves, furnaces, etc. The charter members include A. S. Walbridge, B. W. Guthrie, Mystic, Que., and L. A. Knight, Manchester, N.H.

Lymburner, Limited, Montreal, have been incorporated with a capital of $75,000, to manufacture machinery, tools, engines, boilers, electrical apparatus, etc. The charter members include L. M. Lymburner, H. N. Lymburner and J. Rivet, Montreal.

The Dominion Petroleum Co., Montreal, have been incorporated with a capital of $150,000, to manufacture petroleum, ores, minerals, etc. The charter members include Z. Perreault, E. Donahue and D. McLellan, Montreal.

The Utica Shale Pipe Co., St. Lambert, Que., have been incorporated with a capital of $20,000, to manufacture brick, sewer pipes, earthenware, glassware, etc. The charter members include W. K. Lowden, St. Lambert, Que.; J. Rodger and W. M. Laurie, Montreal.

A vein of copper was recently discovered at Maletta, Que. Surveys are being made, and drilling is under way to determine the extent of the deposit.

Asbestos has been discovered near Eastman, Que.

The National Licorice Co., of Brooklyn, N.Y., are building a factory in Maisonneuve, Montreal. The building, now almost completed, is a two story brick structure, 100x96 feet. Machinery is being installed.

The Canadian Westinghouse Co., Limited, have been registered in Montreal by Henry D. Bayne, manager.

A despatch from Montreal states that when the tenders for lighting the streets were opened, it was found that a new syndicate, who are prepared to supply power from the Beauharnois Canal and to give arc lights for $55.00 and $57.50, and to put their wires underground. These figures are much below the prices prevailing in Montreal, where the Montreal Light Heat & Power Co. have had the contracts.

The Eason Brick Co., Vermillion, Alta., have been organized.

The premises of the Alberta Hotel and several adjoining buildings, Vegreville, Alta., were destroyed by fire December 9. Loss about $50,000.

The premises of D. Ashkins & Co., St. John, N.B., were damaged by fire, December 4. Loss about $2,000.

Elias Horner & Sons are erecting a large feed mill at Norton, N.B.

The city of St. John, N.B., propose to issue debentures for $500,000, for public improvements.

The Dominion Iron & Steel Co. have leased the property of the New Brunswick Iron Co., at Lepreau, N.B., and will proceed at once to open up the property on a large scale.

The Dorchester Woodworking Co., Dorchester, N.B., have been incorporated with a capital of $12,000, to manufacture carriages, sleighs, vehicles, etc.. The provisional directors include W. F. Tait, G. F. Anderson and C. L. Hanington, Dorchester, N.B.

The Department of Public Works, Ottawa, have under consideration the erection of a large pier at Halifax, N.S., on the Cunard property.

The Yarmouth Electric Co. are being formed in Yarmouth, N.S., to take over the stock and plant of the Street Railway Co. This is for the purpose of extending the line and for the installment of commercial lighting. Work will be begun at once on the lighting system.

The Silliker Car Co., Halifax, N.S., will erect new buildings at a cost of about $25,000.

Rhodes, Curry & Co., Amherst, N.S., have been awarded the contract for the construction of the power house of the Sydney & Glace Bay Railway Co. The cost of plant and machinery is estimated at $25,000.

The plants of the Jackson Engraving Co. and the Dolson Printing Co., Winnipeg, Man., were damaged by fire, December 3. Loss about $30,000.

The Railway Commission have passed an order for the building of a bridge over the Canadian Pacific Railway in Winnipeg, Man., to be used as a public highway, connecting Brown and Brant Streets.

The Board of Control, Winnipeg, Man., invite tenders up to January 15 for furnishing fifteen miles of assorted water pipe.

The ratepayers of Brandon, Man., will vote on a by-law to raise $10,000, for the purpose of the erection of necessary buildings in the public cemetery.

The Board of Control, Winnipeg, Man., invite tenders up to January 2, for supply and installation of pumping and air compressing machinery for Well No. 7.

Winnipeg, Man., will erect a new theatre at a cost of about $100,000.

The town of Morden, Man., have purchased the electric light plant from Mr. F. Schneider, for the sum of $5,000.

The capital of the Brandon Electric Light Co., Brandon, Man., has been increased from $125,000 to $400,000.

The Central Electric Light Co., Portage la Prairie, Man., are preparing to extend their power plant at a cost of about $35,000.

The Souris Hardware Co., Souris, Man., have been incorporated with a capital of $25,000, to manufacture hardware, tinware, paints, oils, glass, sashes, doors, brick, stone, cement, etc. The provisional directors include A. L. Young, J. W. Breakey and J. A. Sterling, Souris, Man.

The Northern Iron Works, Limited, Winnipeg, Man., have been incorporated with a capital of $75,000, to manufacture iron, steel, copper, tools, tubes, boilers, wire-drawers, etc. The provisional directors include R. C. McPherson, T. B. Monk and W. W. Kennedy, Winnipeg, Man.

The steel shed of Messrs. Kelly Bros. & Mitchell, Winnipeg, Man., was destroyed by fire, December 3. Loss about $11,000.

The elevator at Wood Bay, near Pilot Mound, Man., belonging to the Smith Grain Co., of Winnipeg, was destroyed by fire, recently. Loss about $7,000

The town of Maple Creek, Sask., are installing a gravity waterworks system.

The ratepayers of Lethbridge, Alta., voted favorably on a by-law to expend $30,000, for gas boring.

Indian Head, Sask., are considering the question of getting railway connection with the Canadian Northern Railway, which is now about fifteen miles from there.

An electric light plant has just been installed in Wolseley, Sask.

Okotoks, Alta., are considering taking over the local electric light plant.

Tenders will shortly be called for laying mains in connection with the $100,000 gas producing plant to be built at Strathcona, Alta., by the International Gas Heating & Lighting Co., of Cleveland, Ohio.

The ratepayers of South Battleford, Sask., voted favorably on a by-law to raise $10,000 towards the erection of an elevator and flour mill. The elevator will be erected immediately and the flour mill is to be built ready for operation by February, 1908.

The new cold storage plant being erected for the Edmonton Produce Co., Edmonton, Alta., will cost about $50,000.

The Taylor Milling & Elevator Co., Lethbridge, Alta., have been organized.

The American-Abell Engine & Thresher Co., Toronto, will erect a warehouse at Calgary, Alta

The following improvements will be made in Vancouver, B.C., during the coming year: concrete sidewalks, $100,000; pavements, $400,000; sewers, $300,000.

The British Columbia Government intend erecting a provincial asylum at Coquitlam, B.C., at a cost of about $200,000.

The British Columbia Electric Railway Co. will erect extensive additions to their car shops in New Westminster, B.C.

Chief Commissioner of Lands & Works, Victoria, B.C., will receive tenders until December 31 for furnishing and delivering fir and cedar piles at the bridge site on the North Arm of the Fraser River.

A unit of 10,000 h.p., almost the total capacity of the present plant, is being installed by the Vancouver Power Co., at their plant at Lake Buntzen on the North Arm of the inlet. The cost will be $300,000. This work will be finished in about a month, and immediately afterward work will be started on the installation of two more 10,000 h.p. units to utilize the full capacity of the power construction at Lakes Buntzen and Coquitlam, B.C. The cost of each of these units ready for operation is estimated at $300,000 each. Mr. Krase, erecting engineer of the Pelton Water Wheel Co., San Francisco, will

superintend the erection of the new wheel for the British Columbia Electric Railway Co., at Lake Buntzen.

C. J. Digby has been awarded the contract for the construction of a quarter mile trestle to connect the Pacific Coal Co.'s incline at Hosmer, B.C., with the tipple, and also the contract for the erection of a new rink for the Fernie Rink Co., Fernie, B.C., which will cost about $18,700.

The Northern Bank of Canada will erect a five story office building in Victoria, B.C.

The Okanagan Flour Mills Co., Armstrong, B.C., have recently installed a 50 h.p. Allis-Chalmers-Bullock induction motor for the operation of their flour mill.

The electric light plant and waterworks system, Kelowna, B.C., will be extended at a cost of about $40,000.

The Electric Light, Power, & Heat Co., Nanaimo, B.C., will increase the capacity of their plant by building a large dam at Westwood's swamp.

A new public school will be erected at Victoria, B.C., at a cost of about $30,000.

The North Western Telephone Co. have taken over the management of the telephone system at Phœnix, B.C.

In connection with the new Howe bridge at Fernie, B.C., the Great Northern Railway Co. have placed a large order with the Royal City Lumber Co., New Westminster, B.C., for several large timber trusses, 75 feet in length, 18 inches deep and 9¼ inches thick. The Royal City Co. have closed their shingle and cedar mills for a short time and the sash and door factory will be put on half-shift, but the operations of the main mill will be extended throughout the winter months.

Application has been made by H. A. Mellon, Vancouver, B.C., for power from the Rainy River or Cates' Creek for the operation of a pulp mill in connection with a pulp and paper industry, which will be established at a cost of $1,000,000. The mills will cover eleven acres of ground. Monroe Ferguson, of the same city, made an application to develop power from Stewart Creek, but this was dismissed owing to the opposition of the Abbotsford Lumber Co., who are planning the erection of a shingle mill at the Creek.

The Fraser River Sawmills, Millside, B.C., will install a complete new mechanical equipment in the engine room, and increase the capacity of the plant to a quarter of a million feet of rough lumber per day. The changes to be carried out will aggregate in value $100,000.

The Boundry Copper Mines in British Columbia, have shipped more than a million tons of ore this year.

The Columbia River Lumber Co., Golden, B.C., are duplicating their present power plant. The new outfit consists of a 75 k.w. 3 phase 60 cycle 2,300 volt generator, 4 k.w. exciter, and two panel white Italian marble switchboard, all of Allis-Chalmers-Bullock manufacture; also a 14x14 inch Robb-Armstrong horizontal engine.

The Dominion Bank are opening a branch in Vancouver, B.C.

Within the last few days the Canadian Concentrating & Smelting Co., who own the Monarch mine at Field, B.C., have closed a contract with a concentrating plant in Toronto, which provides for a shipment of 1,000 tons of ore monthly, beginning on December 20. Mr. A. Wheeler, the newly elected managing director, will construct a sleigh road from the mine to Field, on which to transport the ore to the main line of the Canadian Pacific Railway.

The Otis-Fensom Elevator Co., Toronto, have secured a site in Vancouver, B.C., on which they will erect a four story factory, 90x25 feet, at a cost of about $30,000.

AMMONIA FROM FUEL.

The province of Ontario contains splendid peat deposits and much money has been spent in trying to make a fuel which could be sold at a price to compete with coal. The success in this direction has, however, been so slight that the information that ammonia is being extracted from peat in England is of importance.

United States Consul Halstead, of Birmingham, describes a new English process for obtaining ammonia from peat.

"A great difficulty in the commercial utilization of peat has always been the large amount of water it contains, which averages 90 per cent. To eliminate the existing moisture down to 70 per cent. is a comparatively simple matter, but to reduce the moisture to a degree where the peat can be utilized for fuel is a long and expensive process.

"The Woltereck process has at last overcome this difficulty. By this new method it has been finally determined on a manufacturing scale that a minimum yield of 5 per cent. of sulphate of ammonia is obtained from the peat, calculated as theoretically dry. The chief products of the Woltereck process namely, sulphate of ammonia and paraffin tar, have a practically unlimited market, and the market for acetic acid, acetates, and their derivative—acetone—is continually expanding, especially that of the latter, of which enormous quantities are required by the manufacturers of smokeless powder. In addition, the ash of peat is salable to the farmer as a cheap fertilizer, since it contains potassium salts, lime and phosphorous acid in available form. After the peat has undergone the necessary harvesting it is conveyed to the works and automatically fed into hoppers working with compressed air and quickly dropped into the furnaces. Here it is subjected to moist combustion by means of a blast of air charged with water vapor at a regulated temperature. The resulting gases contain paraffin tars, acetic acid and ammonia. The paraffin tars are removed by the Woltereck scrubber which retains all tarry matter without causing any condensation and consequent loss of ammonia. The acetic acid is next absorbed in the alkali tower, where the gases meet a hot solution of soda or milk of lime and combine with it to form acetate of soda or of lime, which may afterward be treated for the recovery of acetic acid or the production of acetone. The gases pass from the alkali tower to the acid towers, where they meet a stream of hot sulphuric acid, which combines with the ammonia to form sulphate of ammonia, the chief object of the process. After the acid is completely neutralized it is drawn off to crystallizing vats. The solution of the sulphate is there further concentrated and allowed to crystallize, and after centrifugalizing to remove any adherent liquor, is ready for shipment.

"The paraffin tar is drawn off from the scrubber, when a sample of the oil therein solidifies on cooling. It is then subjected to distillation to remove the lighter oils, and a crude paraffin wax worth about $19.50 a ton remains without further purification. The acetate solution obtained from the alkali tower is evaporated to dryness and distilled with sulphuric or hydrochloric acid to obtain concentrated acetic acid, or can be subjected to dry distillation to produce acetone."

WELDED A HEAVY ENGINE FRAME.

Quite a number of persons were present at the Round House on Tuesday night to see a very interesting job done—the welding of the heavy steel frame of an engine now in the shop for repairs. This is the first job of the kind done in Inverness, or even on this side of the Island, though the process has been in use in Glace Bay by the Dominion Coal Co. in repairing machinery. Daniel Bell, foreman of the Dominion Coal Co.'s foundry at Glace Bay, came over to do the job—Inverness News.

The composition used in welding of this class is known as Thermit.

Publications Worth Reading.

Any Manufacturer or Dealer in Supplies for this Column is invited to send Books on Business Topics for Review or Booklets, Pamphlets, etc., for Reference.

CALENDARS: The B. Greening Wire Co., Hamilton, Ont., have sent their attractive calendar containing views of the head office and works at Hamilton, and half tone of the founder and the present head of the firm. The figures are of fair size and may be seen at some considerable distance.

Canadian Fairbanks Co., of Montreal, have issued a splendid calendar, being composed of a separate sheet the full size of the calendar for each month. The figures are large. The space reserved above the figures is devoted to enumerating and illustrating many of the lines handled by the Canadian Fairbanks Co.

Winnipeg, Man., is being further advertised by the Winnipeg Development & Industrial Bureau by means of a hanger, containing besides a calendar, maps showing Winnipeg as a railway centre and a large amount of statistical information concerning the city of Winnipeg, its growth, development and possibilities.

ELECTRICAL INSTRUMENTS: The Bristol Co., of Waterbury, Conn., are issuing three new bulletins covering their electrical instruments: Bulletin No. 61, describing Recording Voltmeters, which is in 12 pages, illustrated, and is very complete; Bulletin No. 62, describing recording ammeters lists new form of portable instrument, which is now being manufactured and is very attractive in its make-up. Bulletin No. 63 covers a line of recording wattmeters and is somewhat larger than the others, having 19 pages. This bulletin, besides illustrating the new portable form of wattmeter also shows a very complete list of single two phase and balanced three-phase alternating current instruments, something that was absent from former bulletins. These catalogues will be appreciated by engineers, who are usually in a quandary as to the best type of instrument applicable to the loads for which they intend to design, and will be found very helpful in locating the proper instrument manufactured.

"REDSTONE"

HIGH PRESSURE SHEET PACKING

MAKES PERFECT JOINTS.

Does not blow out and requires no following up.

Try a sample lot and be convinced of its merits.

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1906

The Thirty-Third Year
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TYPEWRITER

Shows an increase in Output of

31%

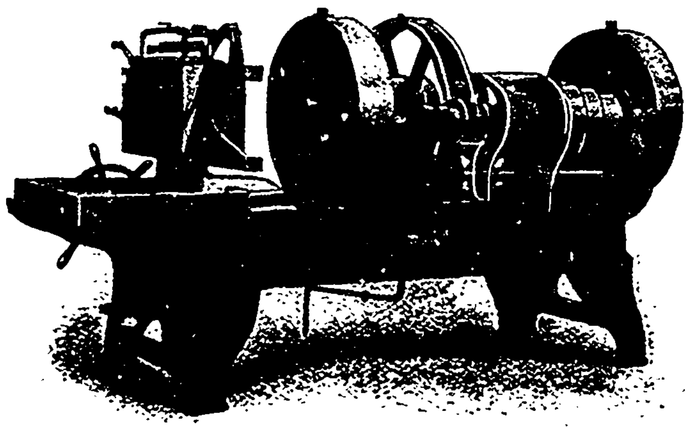
Over the Previous Year.

Typewriters come and typewriters go,
But the Remington runs on forever.

Remington Typewriter Co.,
NEW YORK AND EVERYWHERE.

REMINGTON TYPEWRITER CO., LIMITED
Adelaide Street East, Toronto, Ont.

Pipe Cutting and Threading Machine



A "Made in Canada" Machine.
The Latest in Design.
Most Thorough in Construction; Simplest in Operation and Most Efficient in Service.

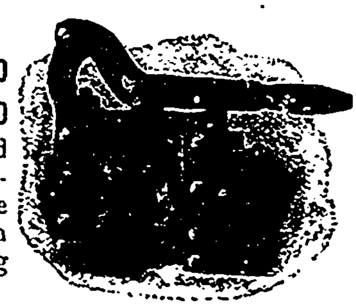
Cuts an absolutely perfect thread on any pipe from 1½ in. to 6 in. It does the work with one cut and does it quicker and cleaner than any other machine in America.

Weighs 4,300 lbs. and is so rigid that a wavy thread is an impossibility.

This machine will save its price for you by doing more work every day and doing it better than the old machine you now have in stock.

It is fitted with the

BORDEN PATENT SOLID ADJUSTABLE DIE HEAD



Everywhere recognized to be the most easily operated as well as the most perfect mechanism on any pipe threading machine in the world.

By this head any degree of accuracy may be obtained simply by the adjustment of an adjusting screw upon which the operating lever rests. Any variation may be obtained to suit any make of fitting, whether standard or not.

Write for Circular with full details.

I. E. SHANTZ & CO.,

BERLIN, ONT.

Practical Hints for the Factory or Mill Superintendent.

There are so many excellent technical publications issued throughout the world that even the most ambitious superintendent could not afford to read them all to get the cream of their articles. We propose in these pages to give some of the most practical hints and suggestions which appear in the technical press in all countries.

Dyeing with Sulphur Colors

Kuhlow's German Trade Review. Berlin.

A recent patent of Bayer's refers to a process of dyeing with the sulphur colors from alkaline baths with the addition of salts of ammonium. Such dyeings are said to be perfectly even, and often deeper and more fast to washing than those obtainable by methods known previously. This surprising observation secures a scientific explanation. The interesting results seem to depend upon the fact that the ammoniacal salts combine with the free alkali existing in such dyebaths containing alkaline sulphides. But it is now found that the same end is reached by the employment of other salts than those of ammonium salts, which are equally capable of combining with the free alkali. In point of fact, acids may be used. This observation is all the more surprising when remembering the opinion holding hitherto that the alkalinity of the dyebath is indispensable for the fixation of sulphur colors.

By the new process the salt or acid is added to the dyebath in such proportion as to give a distinct odor of sulpheretted hydrogen, while not precipitating the sulphur-color or its leucoderivative.

Example 1.—100 kilos. cotton hanks: 2,000 litres boiling water, 10 kilos. katigen R L Ex., 10 kilos, sulphide of soda (crys.) 20 kilos. Glauber's salts; add to this 5 kilos. bicarbonate of soda. Enter the yarn, dye for three-quarters of an hour at about 50 deg. Cen., wring, expose to the air, and wash.

Example 2.—100 kilos. cotton hanks: 2,000 litres boiling water, 10 kilos. katigen B Ex., 20 kilos. sulphide of soda (crys.), 20 kilos. Glauber's salts, 5 kilos. carbonate of soda; add to this 3 kilos. sulphuric acid. Dye at 50 deg. Cen. for three-quarters of an hour, wring, expose to the air, and wash.

Besides using other sulphur colors than those named, other salts are also available for combining with the free alkali; these are acetate of aluminium, alum, bisulphate of soda, tartar, and other acids such as acetic, etc.

Case-Hardening

By G. Shaw Scott, M. Sc. in Technical Literature.

Generally speaking, comparatively little is known of the theory of the process by those who practice the operation of case-hardening, and up to quite recent years crude rule-of-thumb methods were almost universally applied. The production of satisfactory case-hardened material is a matter of supreme importance to many engineering undertakings, and especially to cycle and motor-car making, in which there is often required very hard, yet tough, material in order to obtain satisfactory results in everyday use.

Case-hardening is fundamentally the same as the older process of cementation, the chief points of difference being that in case-hardening a different carbon-conveying material is used from that employed in cementation, whilst in the latter process the carbon is allowed to penetrate nearly through the bars and to form merely a surface or "case" of carburized metal.

Case-hardening is somewhat allied to the Harveyizing and Krupp processes, both of which are employed for the hardening of armor-plate. In the former process a solid carbonaceous cementing material is employed—usually charcoal; and in the latter a gaseous hydrocarbon is stated to replace the charcoal.

Materials Used in Experiments.

For the purposes of this research a variety of steel was selected which has been found by experience in the trade to be especially suitable for case-hardening.

On analysis this steel was found to have the following composition:

Combined carbon	0.14	per cent.
Silicon	0.01	"
Sulphur	0.08	"
Phosphorus	0.03	"
Manganese	0.58	"
(Iron by difference)	99.16	"
	100.00	"

The 3-foot bars of ¼ inch rolled steel were cut up into 4 inch lengths and marked for reference.

Many case-hardening mixtures were tried, among them such materials as burnt leather (several varieties), wood charcoal, anthracite, sugar charcoal, mixtures of barium carbonate and wood charcoal, etc. Owing to its almost universal use in trade circles in England, burnt leather was employed as the standard case-hardening material throughout the research. Two samples of this material in particular were tested, both of which have a considerable sale; they are subsequently referred to as mixtures "A" and "B."

Since preliminary experiments showed that there was a difference in the case-hardening effect due to the relative fineness of the carbonizing material, samples "A" and "B" were sieved and the results are given below:

	"A" Per cent.	"B" Per cent.
Does not pass 10 sieve	68.0	72.6
" " 20 "	9.0	9.6
" " 30 "	4.2	5.8
" " 60 "	4.4	5.4
" " 90 "	4.0	3.8
Does pass 90 "	9.4	2.6
	99.0	99.8

Practically 75 per cent. of the material was comparatively coarse; and there was rather a high proportion of very fine material in "A" as compared with "B". Sample "B" was found to contain a considerable amount of unburnt, or only partially burnt, material, and this is a feature in a case-hardening material that does not tend to reliable work.

Estimations of moisture and ash were made of these mixtures with the following results:

	Moisture Per cent.	Ash Per cent
"A"	13.44	5.56
"B"	24.68	3.60

The mixture "A" was decided on as standard, and an estimation of the amount of nitrogen present was made by Kjeldahl's method.

The composition of our standard case-hardening material "A" is as follows:

	Per cent.
Carbon (by difference)	77.80
Nitrogen	3.20
Moisture	13.44
Ash	5.56
	100.00

For heating the experimental bars in contact with the case-hardening mixtures cast-iron boxes 4 inches by 2 inches by 1 inch by ¼ inch thick were used.

The muffles used were Morgan type, heated by Mond gas, and capable of giving a temperature of 1,000° C. The temperature of the muffles was recorded by means of a direct-reading Baird & Tatlock thermo-couple pyro-meter.

Influence of Temperature on Case-Hardening.

The first experiments dealt with the influence of time and temperature upon carbon absorption, employing the standard mixture "A." In connection with case-hardening temperatures, it may be pointed out that Mr. Osmond's work has shown that the lowest practicable temperature, using pure iron and pure carbon, will be not muh below 900°C., a statement which was checked as follows: Bars were heated for four hours at 700°C. in "A," and subsequent microscopic examination showed that absolutely no carbon penetration had taken place. A penetration—to the depth of 0.13 mm.—was observed after similar treatment at 800°C., while at 900°C. the depth of carbon impregnation had increased to 1.58 mm.

At 1,000°C. the depth of penetration was found to be more than twice that obtained by case-hardening at 900°C. for an equal length of time. At temperatures higher than 900°C. the danger of overheating the metal was evidenced, and the carbon absorption become both "harsh" and irregular. For normal case-hardening a "case" should be obtained which contains a percentage of carbon equal to that of the pearlite eutectoid—namely 0.89 per cent. With more carbon the "case" in its "normal" or unhardened condition shows cementite as white rivers surrounding the larger masses of pearlite.

The specimen represented having been heated in mixture "B" for eight hours at 1,000°C. showed the presence of much cemen-

tite, which is generally regarded as unsatisfactory in case-hardened articles.

INFLUENCE OF TIME AND CEMENTING MATERIAL ON CASE-HARDENING.

Having briefly considered the effect of various temperatures upon the depth of carbon penetration when using a standard case-hardening mixture, the author proceeds to consider the effects of the use of various mixtures for differing periods of time, the uniform temperature of 900°C. being employed throughout the series.

Using specimens 3 inches long and 6.5 mms. square section, the following figures were obtained:

Time of Heating	Burnt Leather "A"	Wood Charcoal	Barium Carbonate and Wood Charcoal
2 hours...	1.15 mm.	0.72 mm.	0.36 mm.
4 "	1.58 mm.	1.07 mm.	2.20 mm.
8 "	2 30 mm.	1 58 mm.	2.84 mm.
12 "	2.80 mm.	1.80 mm.	3.17 mm.
16 "	Right across specimen.		

From these results it will be seen that the most rapid penetration took place when using the mixture of barium carbonate and wood charcoal, while the least penetration resulted from the use of wood charcoal. However, when the heat was sufficiently prolonged, the several mixtures gave approximately the same results.

CASE-HARDENING MATERIALS.

These are very varied in character, and include wood charcoal, potassium, ferro-cyanide, potassium cyanide, petroleum, gas, bone, horn, graphite, burnt leather, bone black, acetylene, barium carbonate and charcoal, coal gas, sugar charcoal, etc. What is most noteworthy in connection with this list is that of all the materials mentioned those that give the most rapid case-hardening effect are those which either contain nitrogen in some form or other, or else have the power of utilizing atmospheric nitrogen.

NITROGEN AND CASE-HARDENING.

The case-hardening materials in common commercial use contain nitrogen. It is obvious that unless practical experience had shown that nitrogen aided the process in some way, no one would think of using a costly nitrogenous material in place of charcoal or anthracite, these being well-known possible substitutes which cost only as much per ton as burnt leather costs per cwt.

To prove how slight was the effect (measured by carbon penetration) of heating the standard steel bar with materials other than those which contain, or supply, nitrogen, experiments were made with anthracite, and also hard coke. The carbonaceous material in each case, together with the bar to be treated, was packed gently in one of the special iron boxes, carefully luted down, and heated in a muffle for four hours at 900°C. After this heating it was found that there was penetration to the following extent:

a Anthracite.....0.15 mm. on 6.5-mm. bar.
b Best hard coke.0.16 mm. on 6.5-mm. bar.

With a bar under exactly similar conditions, but using as a carbonizing material burnt leather "A" instead of the above, a penetration of 1.58 mm. was obtained. From this it will be seen that the effect of the nitrogenous mixture was to increase the depth of penetration during the initial stage of case-hardening in the ratio of about ten to one. Hence it will be recognized that nitrogen must play a very important part in the process of case-hardening. Experiments were undertaken to test this, and resulted as follows:

Two exactly similar bars of standard steel were selected. One was heated in an atmosphere of ammonia for four hours at 550°C. The other received no treatment. Afterwards, both were heated in separate cast-iron boxes in a non-nitrogenous carbonaceous material (sugar carbon) for eight hours at 1,000° C. The mean figures of a series of these experiments showed that the "ammonia bar," as compared with the untreated bar, had received greater proportionate penetration in the ratio of 45 to 32. The high temperature employed was specially favorable to the non-nitrogenous material, and had the heating been conducted at a lower temperature, the difference would, in all probability, have been still greater.

Subsequently an apparatus was made to pass dry ammonia into the case-hardening box during the whole period of heating in the muffle. For this purpose one extremity of a piece of ½ inch gas-pipe was screwed into the end of one of the boxes. The other extremity projected outside the muffle and was connected to an apparatus for giving dry ammonia.

In the same muffle as the above box, and placed side by side with it. was an ordinary box. Both were filled with sugar charcoal as a non-nitrogenous carbonizing medium, and among the charcoal several test-bars were placed.

The muffle containing the two boxes was kept at 900°C. for four hours; a stream of ammonia being passed through the special box, escaping through a minute hole drilled in the lid. Afterwards the boxes were allowed to cool, ammonia still passing into the special box. On subsequent superficial examination the "non-ammonia" specimens were found to be bluish-black in color and quite soft to the saw. On the other hand, all the ammonia-treated bars possessed a distinct whitish luster, and presented a tough outer skin to the saw. Microscopic examination showed that whereas the bars which had received no ammonia treatment gave a penetration figure of 1.44 mm., those which had been treated with the gas had been penetrated by the carbon to the extent of 1.80 mm.

It will be seen that ammonia did cause a slight increase of carbon penetration.

"TWINNING" RESULTING FROM AMMONIA TREATMENT OF BARS.

Mention is made of the peculiar results obtained by heating bars at a certain temperature in ammonia. After treatment with ammonia for four hours at 550°C. the bars showed a bright, silvery luster, and on microscopic examination, a structure at the edge of each specimen was observed which showed very obvious "twinning." Photographs showed these twin-crystal areas, one photo demonstrating the strong resemblance of parts of the structure to that of a bar of worked copper.

That twin crystals were not present in the bars before treatment was proved by repeated and careful microcopic examination at high powers of the original material.

An uniform structure was always observed right through the bar. To show that the "twinning" was not produced by the distortion of the bar by mechanical strain, a bar was held in the vise and bent backwards and forwards several times until fracture occurred. No twin crystals resulted from this treatment, or from other tests. It is therefore evident that these twin crystals were not present in the original steel, nor were they induced by any subsequent mechanical treatment, but that they were produced by heating the bars for a more or less prolonged period at 550°C. in an atmosphere of ammonia.

THEORY OF CASE-HARDENING IN PRESENCE OF NITROGEN.

It appears to be clear that nitrogen in some form is necessary for the practical performance of case-hardening, and the question therefore arises as to the manner in which nitrogen assists the rate of carburization. That the free gas itself has no effect upon steel has been proved both by Guillet and by Braune. Ammonia, on the other hand, is absorbed by iron, and the experiments above recorded prove that it causes an increase in the rate of carburization when carbonaceous material is present. This latter fact suggests that ammonia itself, while being the prime agent in any change, may conceivably lead to the formation of cyanogen, and that this cyanogen may act upon the iron thus:

$$2CN + 3Fe_2 = 2Fe_3C + 2N$$

from which it will be seen that the cyanogen may act as a carrier of carbon to the metal to be carburized.

This, however, does not explain why carburization takes place at a lower temperature when nitrogen compounds are present. But it has been shown that after steel has been heated in ammonia "twinning" is observed. Now, since Osmond has shown that twinning can only result when iron or steel is in the v condition, it is reasonable to assume that the metal has been changed from the a to the v state. Under normal conditions, metal at 550°C. would certainly be in the a condition. Nitrogen, we may conclude, should therefore be added to the list of elements which cause iron to take or retain the v form. And, since v-iron combines more readily with carbon than does a-iron, this action of nitrogen, on the iron would appear to explain sufficiently its beneficial effect during the early stages of the process of case-hardening.

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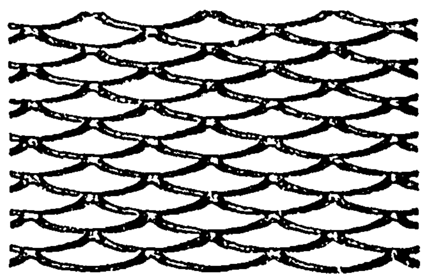

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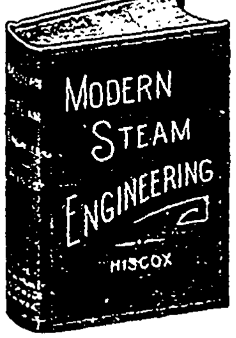

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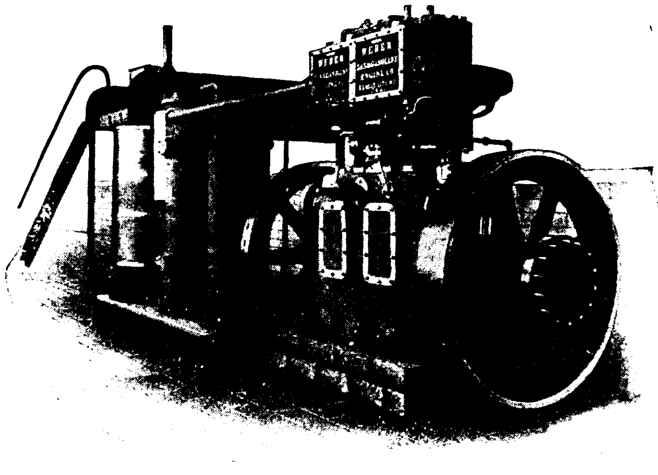

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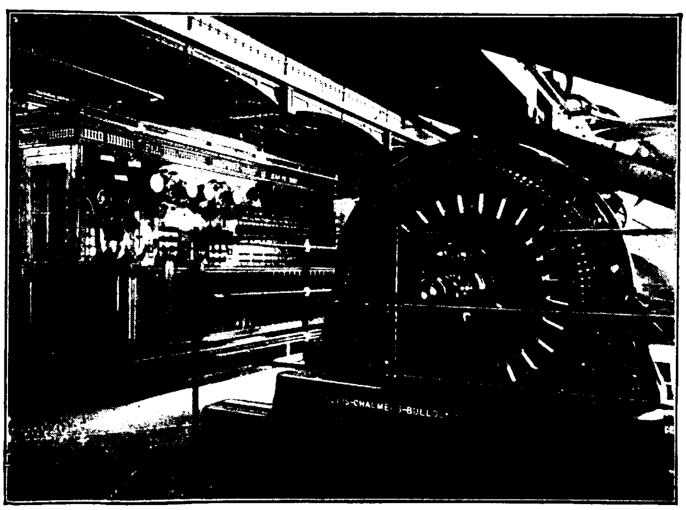

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