PAGES

MISSING

The Canadian Engineer

ESTABLISHED 1893.

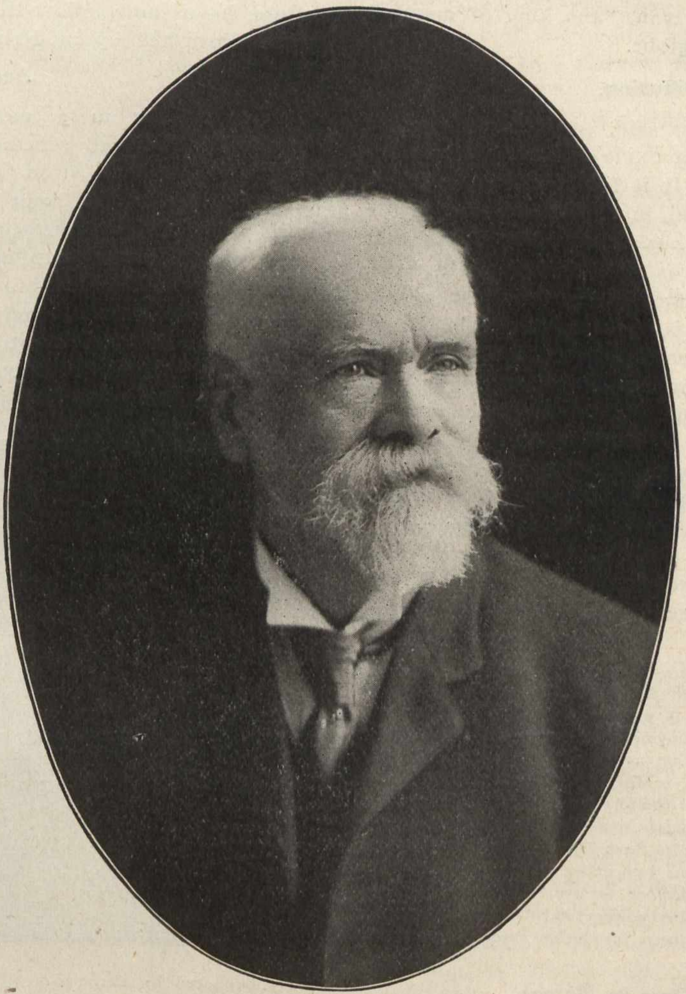
WITH WHICH IS INCORPORATED

THE CANADIAN MACHINE SHOP.

VOL. XII.—No. 9. TORONTO, SEPTEMBER, 1905. PRICE 10 CENTS $1.00 PER YEAR.

"We judge ourselves by what we feel capable of doing; but the world judges us by what we have already done."

Longfellow.



THOMAS ROBERTSON.

Huxley is responsible for the following formula, by which to estimate life and its meaning:—

> Practical life is a rule-of-three sum, in which your duty multiplied by your circumstances gives a fourth term in the proportion—which is your deserts.

It is a common platitude that in the business affairs of life, the men who succeed are not always the most deserving of success. Tried by the above formula, the subject of our biographical sketch this month—in our gallery of men who have "done things" in Engineering—has undoubtedly won for himself by deep thought, hard work, and upright dealing, the proud position of affluence, and goodwill of his fellowmen, which crowns his days in the autumn years of life.

Civilization has been defined as, "the predominance of humanity over animality." Anything which contributes to the refinement and pure sensuous pleasures of life displaces the gratification of coarse and brutal instincts, and hence makes for civilization. This is precisely what Mr. Robertson has done by his valuable inventions of machinery, now extensively used in almost every part of the world in the making of pure confectionery; one of the innocent delights of taste which lingers with us from childhood to old age and helps to drive away monotony, which is the bane of existence.

Thos. Robertson was born in the south of Scotland in 1838. He comes of good old Scottish-Lowland, and English-Cumberland stock; out of that historic borderland famed in the ancient ballad of "Chevy Chase." He left Scotland at the age of sixteen, for Durham, Eng.; subsequently crossed the Atlantic into the United States; sojourned for a while in New York; then in the blue grass State of Kentucky, finally settling in Toronto in 1865—forty years ago. Had we space, an interesting story could be told, worthy of a place in Smiles' "Lives of the Engineers." The early dawn of mechanical instinct, developed on the turning lathe and other machines in his father's workshop—who was a Master Builder of repute; his thorough training and career as a cabinet maker; his inventions of labor-saving devices and machines for the manufacture of confectionery on a large scale—altogether unique in this line of business; his enterprise in founding, together with his brother, a retail provision and confectionery business, which in 1893 was re-organized into the widely known firm of Robertson Bros., Limited, Toronto: (of which he is President), capitalized at $400,000, and employing 300 hands—constitutes a business record of which any Canadian citizen may justly be proud.

Although Mr. Robertson has reached the stage when—

> The leaves are paling yellow, or turning into red.

the fires of intellect and physical vigor are unabated. His retiring disposition, zest for travel, love of books, quiet unparaded habits of philanthropy, and command of the means of leisure, must have been great temptations to retire to the land of the Lotus Eaters. But the call of duty conquered, and he has recently added to the above-mentioned presidency, that of President of The Monetary Times Printing Co., Ltd.; and within the last three months, has been elected President of Biggar-Samuel Co., Ltd., owners and publishers of THE CANADIAN ENGINEER; "The Canadian Machine Shop;" "Pulp and Paper;" and "The Canadian Journal of Fabrics;" responsibilities needing executive ability and business insight of no mean order.

With business men of this type, it is no wonder that Canada is making such rapid strides in commerce, and taking a high place among the nations of the world.

DESCRIPTIVE METALLURGY OF IRON AND STEEL.

BY THE EDITOR.

II.

Registered in accordance with the Copyright Act.

ORES IN NATURE.

It is a remarkable fact, that in nature, things which are of vital importance to the existence and evolution of man are universal—either in adaptability or diffusion. For example, wheat, "the staff of life," is the only cereal which can be grown in every clime. Iron, "the king of metals," is found in every part of the globe.

Universal Diffusion.

As W. Mattieu Williams has said, we cannot dig up a spadeful of earth without finding oxide of iron. No geological formation is free from it. It is found in the ocean, in mineral springs, in the red blood, in the atmosphere, in the very heavens above. So rarely is it absent from the soil that a bed of sand free from it is as valuable as a gold mine. Glass-workers have no little difficulty in getting such supplies. Clay free from iron oxide is of great value to the potter. The prevailing reddish brown color of the earth is due to iron. Snow is looked upon as an emblem of purity, and yet within the Arctic Circle one cannot evaporate a handful of snow without leaving behind a sediment containing darkish particles which jump to a magnet.

It does not need high powers of inductive reasoning to perceive in this phenomenon of the universal diffusion of iron, a wonderful example of design in nature. Without metals man would have remained a savage. Louis Figuier has luminously enforced this view in his "Primitive Man:"—

There can be no doubt that the free use of or privation from metals is a question of life and death for any nation. When we take into account the important part that is played by metals in all modern communities, we cannot fail to be convinced that without metals civilization would have been impossible. That astonishing scientific and industrial movement which this nineteenth century (1876) presents to us in its most remarkable form—the material comfort which existing generations are enjoying—all our mechanical appliances, manufactures of such diverse kinds, books and arts—not one of all these benefits for man, in the absence of metals, could ever have come into existence. Without the help of metal, man would have been condemned to live in great discomfort; but, aided by this irresistible lever, his powers have been increased a hundredfold, and man's empire has been gradually extended over the whole of nature.

Origin of Iron Ores in Nature.

The popular scientific theory is, that in the beginning the matter which constitutes the round globe upon which we live, existed as a fiery mist floating in space. In some way—we call it *gravitation*—the particles of incandescent gaseous star dust (by mutual attraction) ran together, and condensed into a globular mass, which gradually cooled, forming a solid crust, enveloped by dense seething metallic vapors, holding in suspension carbonic acid, oxide of iron, siliceous sand, aluminous clay, magnesia, phosphates, sulphate of lime, etc. At first, the metallic rain which poured down boiled off again on approaching the heated surface. After a time, however, this metallic rain ceased to rise again, and remained part of the solidifying earth. Then came the birth of vegetable life, colossal palms and immense ferns. It is well-known that plants, under the action of light on their green cells, decompose carbonic acid, and liberate oxygen. Now the earth's atmosphere at this stage—known as the Carboniferous Period of Geology, was densely laden with carbonic acid; but in time this was abstracted and absorbed by the great forests and swamps with their rank vegetable growths, thus clearing the atmosphere and making the earth's surface habitable for animal life. As the broad forests and widespread swamps became submerged, either by the action of glaciers or subsidence of the earth, the buried organic matter, consisting largely of carbon, taken from the atmosphere, was petrified into *coal*; while the immense areas exposed to the oxygenated atmosphere gradually died, decomposed and decayed, evolving in the process carbonic acid, which attracted to itself the surrounding oxide of iron, silica, alumina, magnesia, sulphates, phosphates, etc., and gradually solidified into beds of iron ore, even 100 feet thick, as in Lake Superior, U. S. A. (Fig. 3), and in India. The various depths and angles at which these layers or strata are found being mainly due to volcanic eruption and upheaval of the earth's crust.

Having glanced at the Nebular Hypothesis of La Place, as the best scientific explanation of the origin of iron ore in nature, let us now follow this up by one or two illustrative proofs furnished by modern research.

Aerolites.

Native iron in a metallic state is very rare. It is one of the pet schemes of the metallurgical chemist to form pure iron in the laboratory; but even then it has to be kept hermetically sealed, otherwise it is attacked by the oxygen in the atmosphere and quickly transformed into oxide of iron. If exposed long enough it will crumble into dust. Nearly all iron found in a metallic condition is of terrestrial origin, and is never pure, for in the aërolitic form it is invariably alloyed with other metals, such as nickel, cobalt, manganese, etc. The use of aërolites in iron working is as old as history. Amerigo

Reproduced by Permission from St. Nicholas Magazine, March, 1905.

Fig. 1.—Largest Aerolite Known to be in Existence.

Vespucci, after whom the North American continent is named, tells us that in the fifteenth century the Indians at the mouth of the La Plata River made their arrow heads of iron extracted from aërolites. Certain Siberian tribes are known to make their knives from this source, and a like practice exists among the Laplanders. Indeed some writers have set up the fanciful theory that the working of iron began with the use of these metallic stones dropped from the skies. It is true these stones of terrestrial origin are found in all parts of the earth, varying in size from mere dust grains to masses weighing tons.

Fig. 1 is a photographic picture of "Ahnighito," the largest meteoric mass of native iron ore known to be in existence in the world. It was discovered by Com. Robt. E. Peary, U. S. navy, at Cape York, Greenland, in 1894, and is now in the American Museum of Natural History, New York. It is 11 feet long, 7½ feet thick, and weighs 37 tons. The mass of metallic iron is alloyed with 8 per cent. nickel and a little cobalt.

In Fig. 2 is shown a diagramatic section of the Egremont Mine on the north-west coast of England, illustrating the remarkable manner in which strata of red haematite ore are sometimes found imbedded in thick layers of limestone. As the waters, heavily laden with vegetable matter in process of decomposition and hence highly carbonized, flowed through the limestone, it dissolved out large quantities of the rock, thus forming great cavities and caverns. Now the Old Red Sandstone is rich in iron. In fact its reddish color is due to oxide of iron, just as the red color of the blood is due to iron. When, therefore, either by grinding glacier or raging torrent, denudation of the sandstone rocks took place, the oxide in the finely divided particles of sand was dissolved by the vegetable acids into carbonate of protoxide of iron. As this solution of iron floated along in the drift it was acted upon by the oxygenated atmosphere, iridescent films would appear on the surface of the flood, indicating that the protoxide had been transformed into peroxide of iron. These insoluble films of iron oxide being of higher

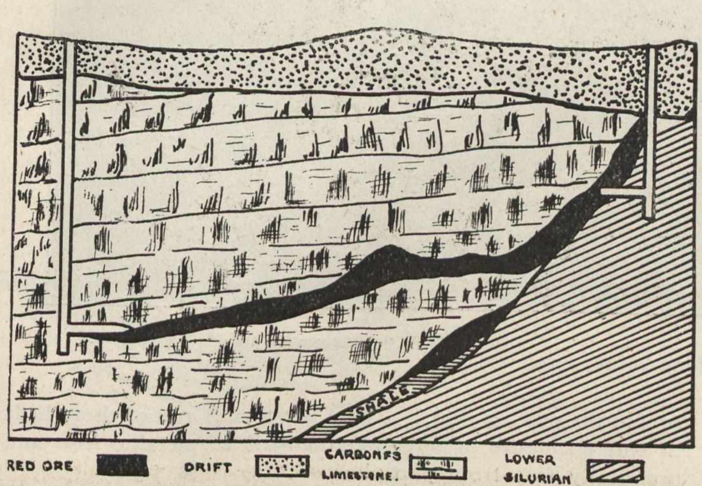


Fig. 2.—Egremont Mine, England.

specific gravity than the rest of the drifting material, and becoming heavy masses by the addition of new particles, sank to the bottom, filling up the cavities and deep fissures, and gradually solidified into solid beds of red haematite iron ore as illustrated in Fig. 2.

To a like origin may be traced the formation of the famous bed of haematite ore in the Chapin Mine, near Iron Mountain, Michigan, U. S. A. (Fig. 3.)

This is the greatest deep mine deposit of ore being worked in the world to-day, and was opened in 1880. It consists of four lenticular deposits 2,500 feet long, 130 feet wide, depth unknown. The ore contains 63% of metallic iron, 0.07% phosphorus.

Phosphorus.

Mention of the phosphoric contents of the Chapin Mine ore opens the way for an explanation of the reason why the extensive beds of carbonate iron ores which abound in the Eston hills of Yorkshire, England, and in the broad seams running from New Jersey, through Pennsylvania, down to Alabama in the United States, contain as high as 2.75% of phosphorus; while the 1,000,000,000 tons of haematite iron ores buried in the Mesabi range, and Lake Superior district, U S. A., are practically free from this mortal enemy of the steelmaker.

Popularly stated, there are three periods in geological time:—(1) Silurian: age of Invertebrates; (2) Devonian: age of Vertebrate fishes; (3) Carboniferous: age of coal plants, vertebrate, amphibians and reptiles. It is a well established induction of science that the existence of phosphorus in iron ores is due to the remains of decayed fishes and animals. It is also a fact that the solid frame work of the invertebrate animals which existed in the Silurian period consisted of carbonate of lime; whereas the bony structure of the vertebrates, which existed in the later Devonian and Carboniferous periods, was made up of phosphate of lime. Now the high phosphorous ores of the Cleveland district of England, and Pennsylvania, U.S.A., are all found in beds of the Carboniferous age, in close proximity to the great coal measures, when fishes, amphibians and reptiles abounded; and it is from the decayed bones of these extinct vertebrates that the excessive phosphorus is derived. On the other hand, the Lake Superior haematite ores, are all found in the levels of the Silurian age when vertebrates did not exist; only shells of mollusks, corals, crinoids, trilobites and other invertebrates; and as already stated. The solid frame work of these creatures consisted not of phosphate but carbonate of lime, hence the comparative freedom of these iron ores from phosphorus.

Modern Ore Making.

If proof is needed of the foregoing theory of the origin of iron ores, the reader can have actual demonstration before his eyes in Canada to-day. About midway between Montreal and Quebec in the valley of the St. Maurice, where the river flows from the north into the St. Lawrence, is Lac à la Tortue (Turtle Lake), a body of water four miles long, by one and one-quarter miles in average width, situated in the middle of a swampy morass. The environing land consists largely of sand, doubtless carried down from the archæan rocks in the vicinage, by the erosive and grinding action of glaciers.

Standing on the western shore, the traveler gazes in imagination upon a primeval scene. Innumerable streams and rivulets may be seen winding and percolating their way down to the lake, through the sand rich in oxide of iron. These running waters are laden with the decaying vegetable matter which grows rank in the marshy lands; carrying with it quantities of the sand, saturated with iron oxide. The organic acids evolved by the decomposition of the vegetable stuff dissolve the oxide of iron, which is carried to the lake. But as it floats down, this solution of protoxide of iron is acted upon by the atmospheric air, oxidation takes places, and a remarkable phenomenon is perceived. Patches of iridescent film appear on the surface of the lake, looking like petroleum with its rainbow colors, indicating that the soluble protoxide has been transformed into insoluble sesquioxide of iron. The reason this peroxide film appears in patches, is due to concentrationary action; the particles aggregate themselves into batches, which sink to the bottom of the lake in the form of cakes ranging up to ten inches diameter or more; hence the term "cake ore."

This brown haematite lake ore contains 70% of metallic iron, and seems inexhaustible; for with the decay of each year's vegetation, new supplies of iron from the sands are deposited in the lake. These rich lake ores have been used in the St. Maurice Furnace at Radnor since 1752. In 1775 one of the lessees of the Radnor furnace, aided the American colonists, by casting shot and shell—made from the lake ores—to be used against Quebec.

Lac à la Tortue and a neighboring lake, are the only known instances of the kind on the American continent.

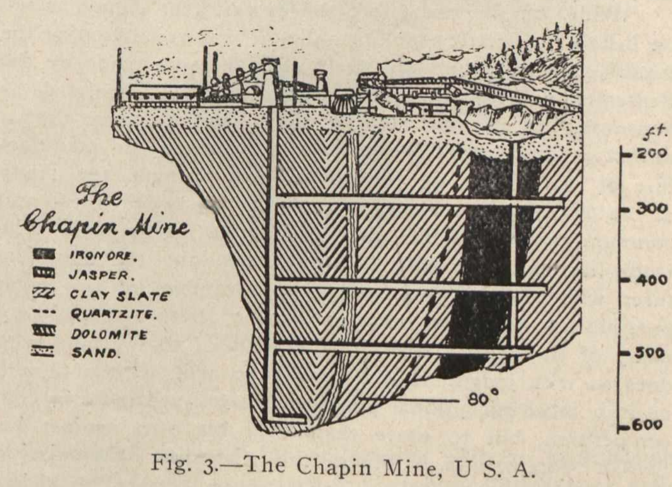


Fig. 3.—The Chapin Mine, U S. A.

Deep mine formations like those of the Chapin Mine and lake bottom deposits similar to that of Lac a la Tortue, are, however, mineralogical curiosities when compared with the magnificent surface deposits of the Mesabi range in Lake Superior country. We are almost bewildered with the marvellous prodigality of nature when we look upon awe inspiring scenes like that pictured in Fig. 4. Gazing upon this stupendous work of man, we are impressed with the

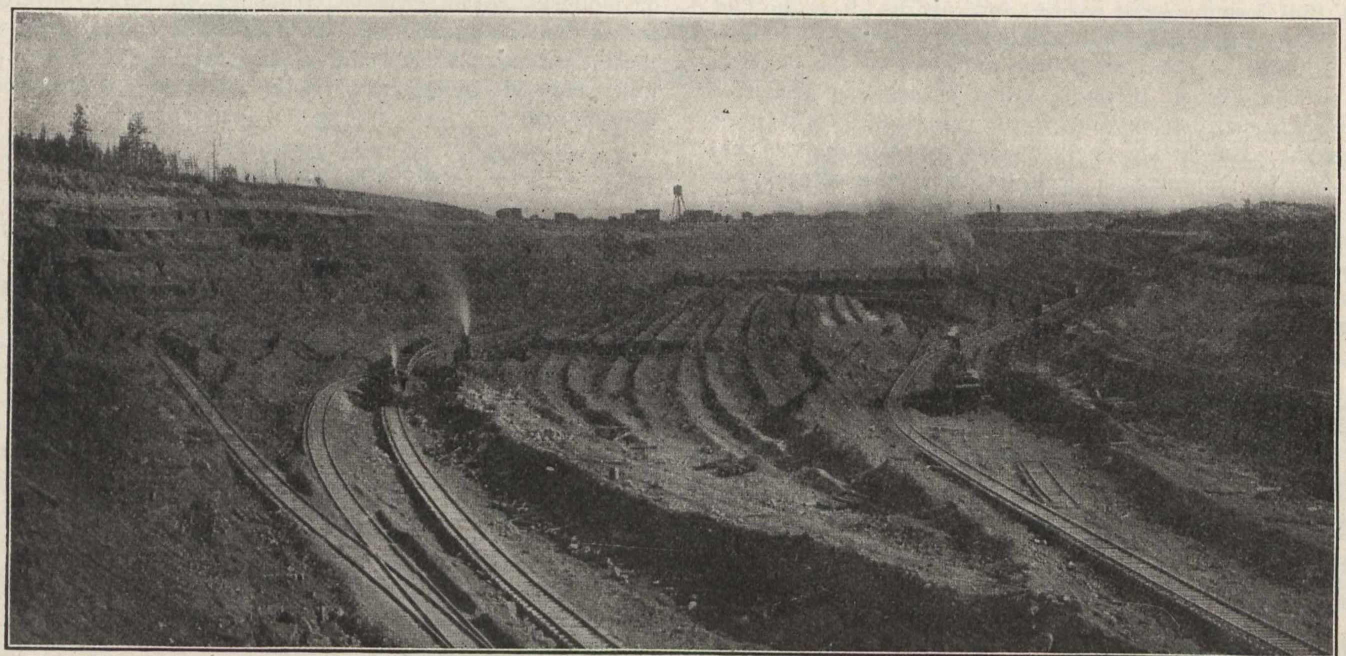


Fig. 4.—Mountain Iron Mine, 1904. From the Engineering and Mining Journal.

same sense of grandeur and majesty as we are upon first beholding Niagara Falls! One caused by the mighty hydraulic forces of nature; the other by the engineering skill and inventive genius of man.

And this is only one of the series of enormous holes made in scooping out with giant shovels, 79,000,000 tons of ore, in the past 12 years. There is 75 miles run of these beds of soft haematite ores, containing 50% of metallic iron and practically free from phosphorus.

Having described the modus operandi in which ores are formed in nature, we now pass on to a consideration of the properties of the ores of Commerce.

ELECTRIC STEEL.

By F. W. Harbord, Expert Metallurgist Engaged By Canadian Government Commission to Investigate Electro-Thermic Processes for Smelting Iron Ores in Italy, France and Sweden.

(From "The Times" Engineering Supplement, August 2, 1905.)

The great interest which the manufacture of steel in the electric furnace has aroused, both amongst manufacturers and engineers in this country, and the fact that there is already one electric furnace in Sheffield, and that it is reported that another Sheffield company have acquired the exclusive patent rights of the well-known Heroult process for the British Isles, make it important that we should consider the possibilities of electric smelting relative to steel manufacture in England.

While, on the one hand, the extravagant claims urged on behalf of electric smelting—that it will revolutionize the manufacture of structural steels as at present made by the Bessemer and open-hearth process—may be dismissed as nonsense, the attempts on the other hand to prove that it cannot compete with the crucible process in the manufacture of tool steels, or the open-hearth furnace for many of the higher class steels intermediate between these and common structural steel, may equally be disregarded. The truth lies between these two extremes; and the manufacturer who realizes this, and takes advantage of the great possibilities which the electric furnace offers to meet very many of the special steel requirements of to-day, and who does so with judgment and knowledge, will, without doubt, be in a most exceptional position, not only to meet foreign competition, but to more than hold his own against his British competitors. Since the Canadian Commission visited Europe last year, rather more than a year has elapsed. During this time very considerable quantities of electric steel have been made both in Sweden and France, and have been used with most satisfactory results for all classes of tools and cutlery, and for various other purposes for which the highest class crucible steel was formerly employed, confirming in every way the conclusions of the Commission that "steel equal in all respects to the best Sheffield crucible steel can be made." Considerable quantities of this steel have been supplied to Sheffield firms, who have thus been able to convince themselves of its exceptionally high quality, and it now only remains for our Sheffield people to make the steel for themselves, rather than import it. The manufacture of crucible steel for tool purposs, important as it is to the country, owing to the world-wide reputation for quality which is has acquired, is, however, only one comparatively small branch of our great steel industry; and perhaps the most important question is, to what extent electric smelting can be employed for the manufacture of the numerous classes of steels between this and ordinary Bessemer, or open-hearth steel?

We import annually very large quantities of Swedish Bessemer steel for tube blanks for the solid drawn tube trade, and for other purposes too numerous to mention; again, large quantities of Swedish pig-irons are imported for use in our open-hearth furnaces for the manufacture of special qualities of high-class steel for large forgings, axles, tires, special wire and other purposes, and in many cases steel of the required composition can only be made by using, either entirely or in part, these very high-priced pig-irons. Another very important branch of the steel trade is the production of dynamo steel of exceptional purity and low hysteresis, and in this direction the electric furnace promises great things, as steel of the greatest purity, low in carbon and manganese can readily be produced. If we add to these the manufacture of all kinds of ordnance, armour plate, projectiles, rifle, bayonet, and other high-class steel, we see that without attempting to compete with Bessemer or ordinary open-hearth structural steel, there is an immense field open to the electric furnace. Numerous experiments have shown that electric steel is not only extremely pure, but it is also exceptionally homogeneous, and this is a most important point in the manufacture of large steel castings. When it is remembered that, for special purposes, castings, sometimes of 50 to 60 tons, have to be made by mixing the contents of a number of crucibles not containing more than 1 cwt. each, the advantages of being able to make steel equal in all respects as to quality, in quantities of 15 tons and possibly more, will readily be apparent.

If steel, to satisfy the exacting requirements of the highest class of tool steel, can be produced, there can be no question as to the production of steel of a quality suitable for what we may term medium-class steels, and it then becomes simply a question of cost, and whether the electric furnace can compete in this respect with Swedish Bessemer steel, or steel made from Swedish pig-iron, or steel of specially selected English brands.

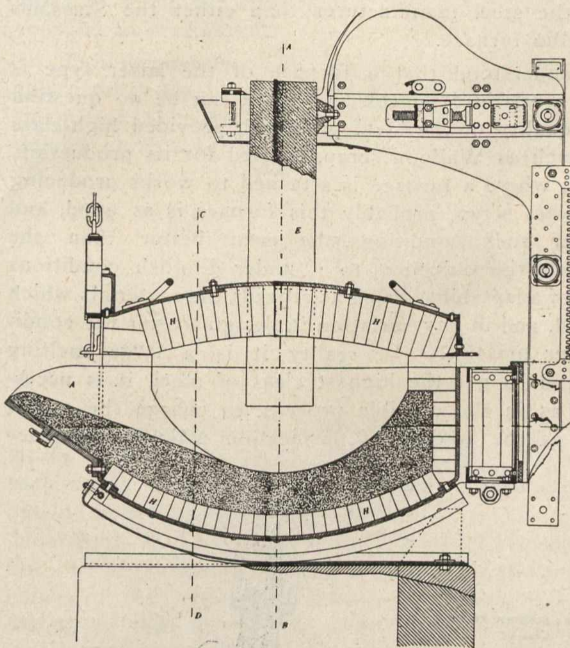


FIG. 1. TRANSVERSE SECTION.

Heroult Resistance Type Electric Furnace.

In the electric furnace of the resistance type, which may be said to be represented by the Heroult (Figs. 1 and 2) and Keller (Figs. 3 and 4) furnaces, the highest-class steel can be made from ordinary English scrap, such as rail ends, but against the saving effected in this direction, has to be set the cost of the electric energy required. The electric furnace, even under the best conditions, is not a cheap melter, but as a refining furnace towards the end of the operation, when a very high temperature is required, it is far more efficient; it therefore seems probable that the future development of the electric furnace will be in combination with some form of continuous open-hearth process, in which molten pig-iron is first converted into what we may term "molten scrap steel" in a gas-fired furnace, and then transferred in the molten state to the electric furnace for final purification. By this means the additional cost over ordinary open-hearth steel would be comparatively small, the melting and preliminary refining have been done in the gas-fire surface, and the electric furnace being employed only to do the final refining at such high temperatures as those at which it alone is able to work most efficiently and economically.

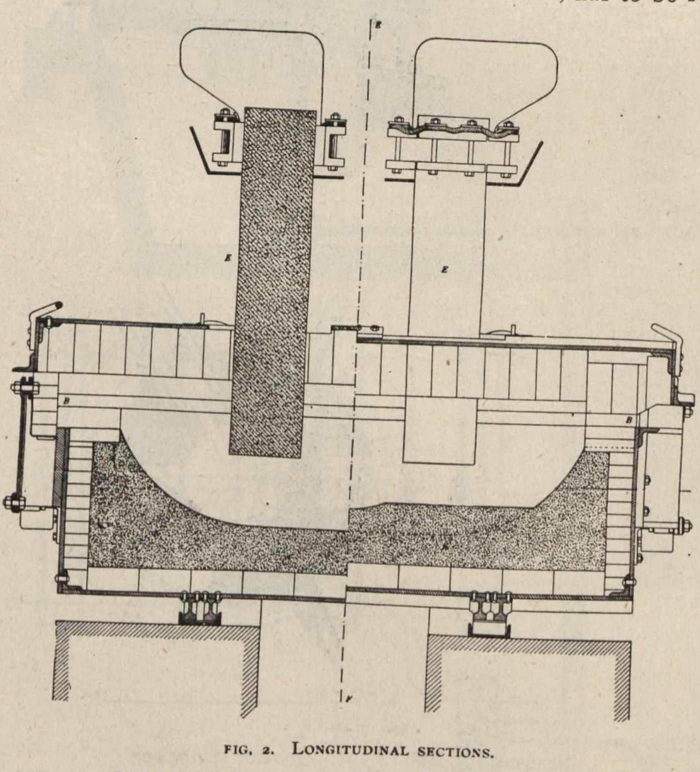


FIG. 2. LONGITUDINAL SECTIONS.

Heroult's Resistance Type Electric Furnace.

The design of the Heroult furnace (Figs. 1 and 2), so far as the general construction is concerned, is particularly well adapted to work in combination with an open-hearth tilting furnace, and if, instead of charging cold scrap, or even molten pig iron, converted metal were charged on some such lines as suggested, a steel superior to best Swedish steel, or steel made from Swedish pig iron, should be obtained at a less cost. Given a large output, so that labor costs are reduced to a minimum, the price at which such a steel could be produced would no doubt induce many manufacturers to employ it for purposes for which at present they are content to use inferior steel, and thus it will soon create a demand for high-class material, apart from

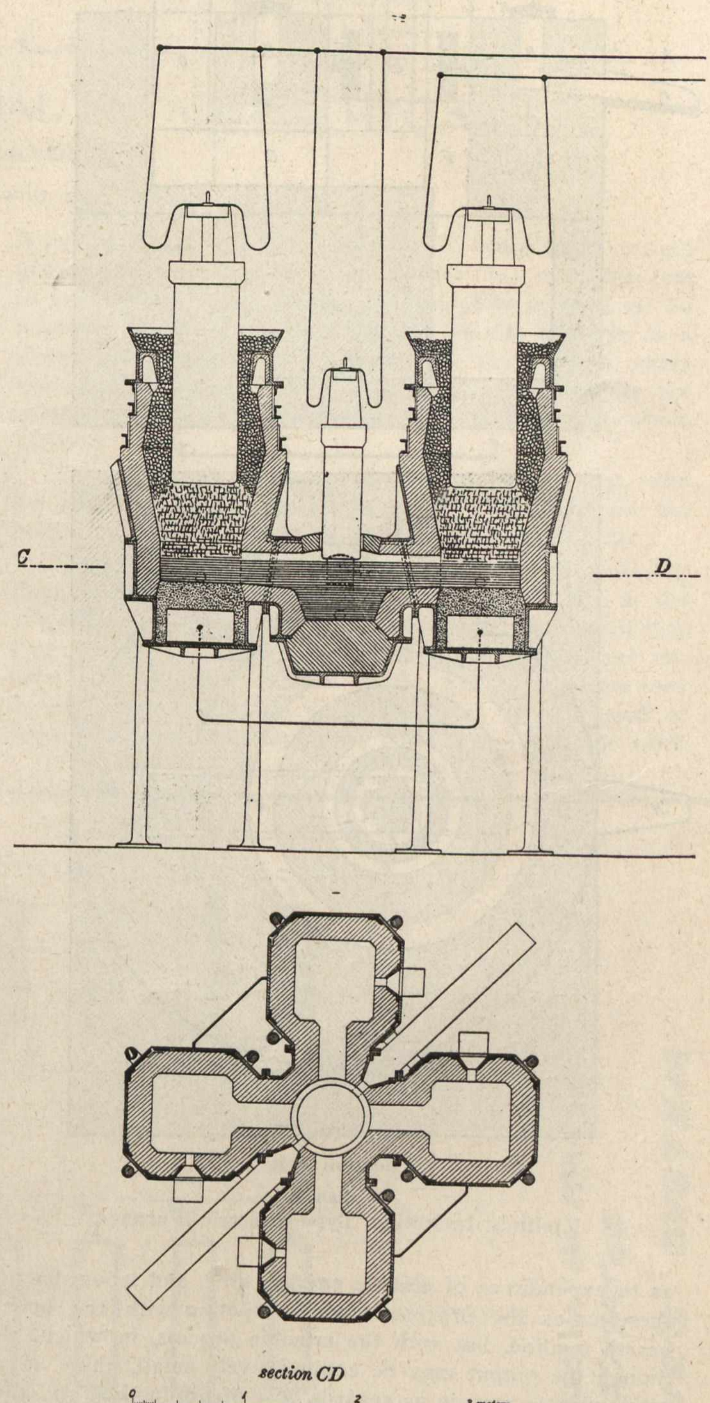
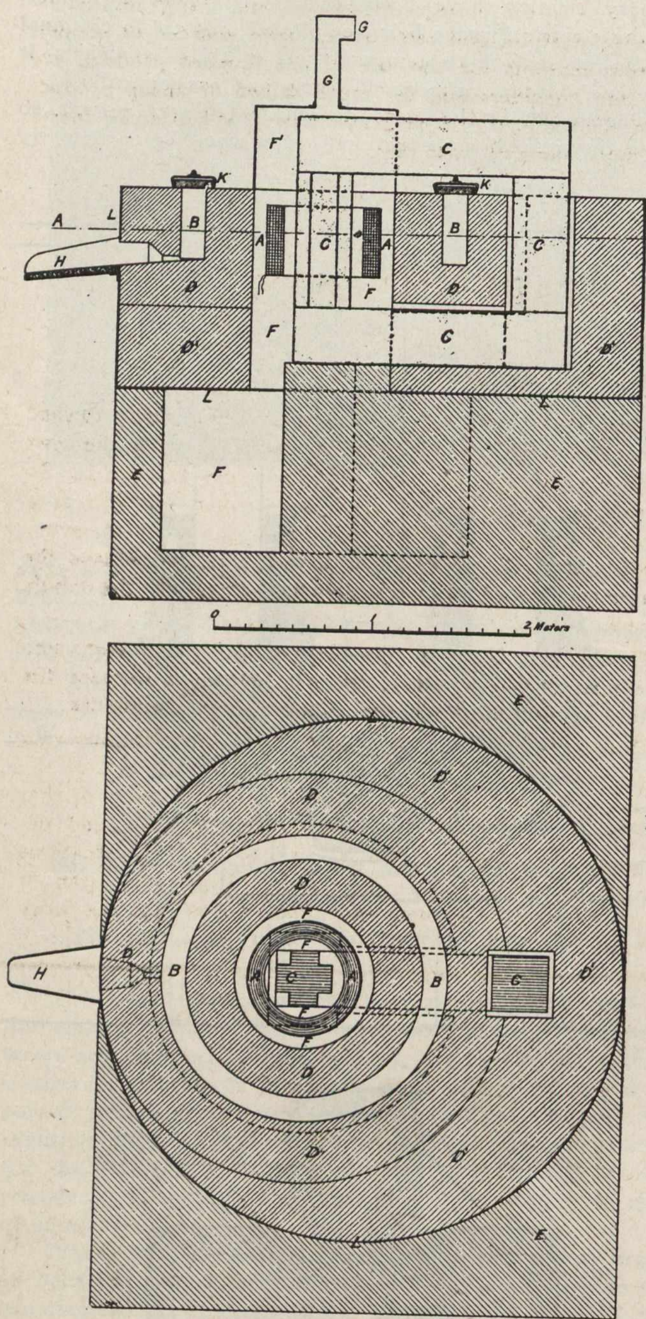


FIG. 3 and 4.

Keller's Resistance Type Electric Furnace.

that already existing. It is not suggested that a simple refining of ordinary steel in this way would be sufficient for the production of the highest class of tool steels, For the production of these, it would no doubt be necessary to carry on the operation in the electric furnace in a way similar to that employed at La Praz, at a considerably greater cost



Section A B

FIG. 5. and 6.

Kjellin's Induction Type Electric Furnace.

as to expenditure of electric energy, time, and labor; but in these cases the process is not competing with the open-hearth method, but with the crucible process, in which, although the output may be comparatively small, there is a much greater margin as regards cost of production, and the question of a pound or so a ton is of no great consequence.

There are two other types of furnaces, known as (1) the induction furnace (Figs. 5 and 6) and (2) the arc furnace (Figs. 7 and 8), which are now competing with the resistance furnace for the favor of the English steelmaker. The former is represented by the Kjellin furnace (Figs. 5 and 6), which has been at work for several years in Sweden, and the latter by the Stassano furnace (Figs. 7 and 8), which has been at work for a considerable time in Italy. The Kjellin furnace is quite distinct both in principle and construction from the Heroult furnace, whilst the difference between the principle of the latter and arc furnaces generally is not so clearly marked, and they merge one into the other. But this classification will be sufficient for practical purposes. In general arrangement, and also as regards electrical and other details, the Stassano furnace is totally distinct from the Heroult, and it was primarily designed for the direct smelting of iron ore rather than for steel making, although it has been producing steel most satisfactorily for some time. From a practical engineering and metallurgical standpoint, however, there can be no doubt that the Heroult furnace is far better designed to meet the general requirements of the steel manufacturer than either the Stassano or the Kjellin furnace.

It is understood that a furnace of the latter type is already at work in Sheffield, and there can be no question as to the quality of the steel produced, provided high-class material, such as Walloon scrap, is used for its production. In Sweden, where a furnace is attached to works producing this high-class scrap, probably this furnace is as good, and may, under such conditions, be even better than the Heroult; but the objection to it under English conditions is its lack of adaptability, both as regards the materials which can be used, and in any variation in design to suit the conditions of our practice. In reality it is a large melting crucible, and to get the highest class of steel, it is necessary, just as in the crucible process, to charge the purest materials, as the amount of purification which takes place

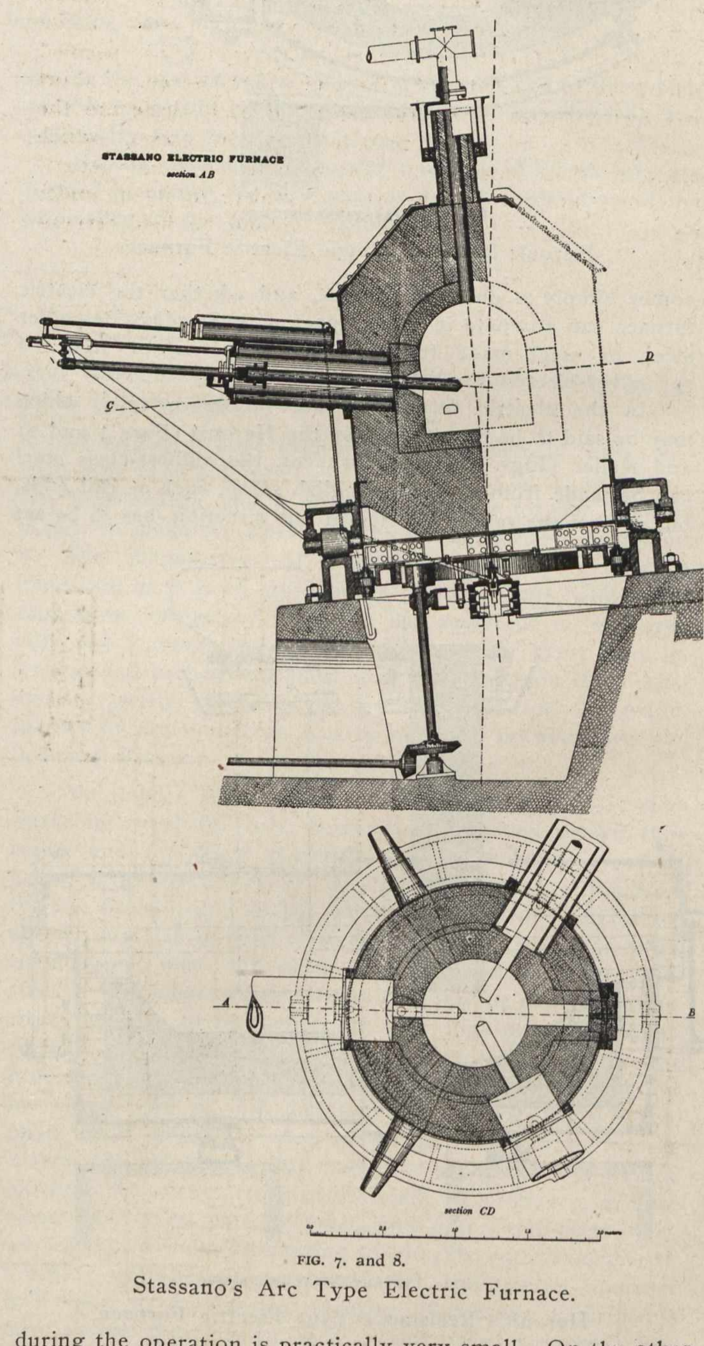


FIG. 7. and 8.

Stassano's Arc Type Electric Furnace.

during the operation is practically very small. On the other hand, the Heroult process can deal with ordinary English scrap or pig iron, and by the repeated addition of suitable fluxes to form new slags, the impurities can be removed, so that a final product is obtained quite equal, if not superior, to much that is made from Swedish materials in a crucible.

That steel made in an electric furnace should possess superior properties to steel of similar composition produced either in a Swedish Bessemer converter, or in an open-hearth steel furnace, may seem at first to be claiming a great deal, but such appears to be undoubtedly the fact, and this is due probably to its production in what may be regarded as a practically neutral atmosphere, under conditions in which the occlusion of gases and over-oxidation is reduced to a minimum.

It is frequently urged that the cost of electric energy in this country makes the production of steel in anything like quantities, a commercial impossibility; but with electric energy at £10 per kilowatt year, at which price it can be produced under favorable conditions from coal, and by using the gas furnace for the melting, and the electric furnace only for the final operation, the difference in cost, as regards electric energy, will probably be more than met by the lower price of our raw material, and our proximity to markets for the sale of the finished product. **When the irregularity in supply, due to the change of seasons, and the generally inaccessible position and remoteness from sources of supply, and from markets for the sale of the finished product, are taken into consideration, the much talked of cheap production of electric energy from water power will often be found to be more apparent that real.**

SYSTEM FOR INDUSTRIAL ESTABLISHMENTS.

BY A. J. LAVOIE.

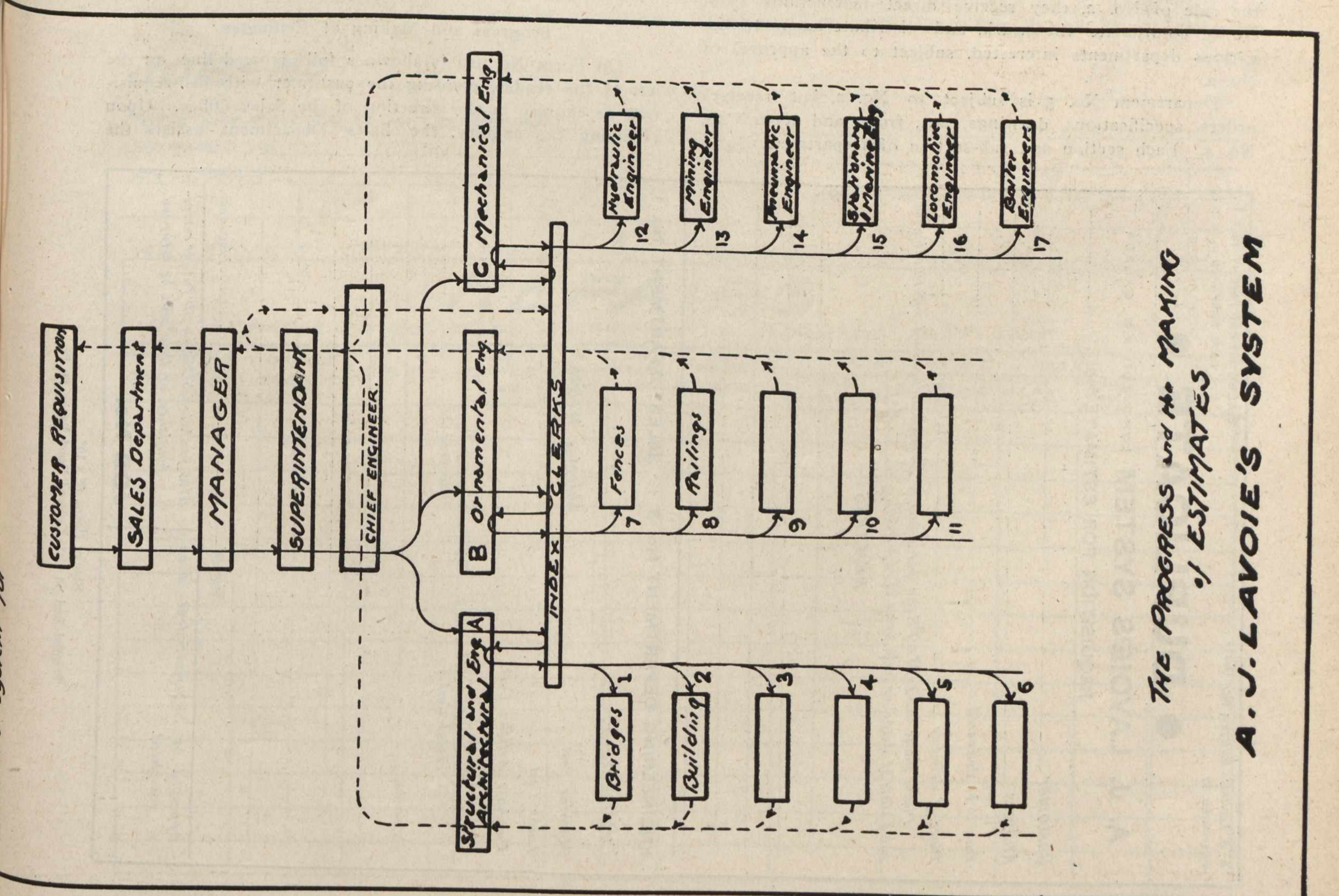
II.

In the first place, it is necessary to describe briefly the works organization chart (Form No. 59). Printed within each circle is the respective departmental number, while outside is the departmental name, with color tint specified underneath in brackets. At the ends of the series of short lines which radiate from the centre of each circle are the names of the sub-departments, offices, or shops, which belong to that department. In dividing up these departments the aim is to make each complete in itself, under one head, who will have full control and be held responsible for its good management and efficient operation.

Department No. 1 is the Managing Director, who has absolute control of both Works and Sales. His position in the system is such that by touching a button he can have placed before him a card showing how the entire business of both divisions (Works and Sales) is being handled: (1) If the Sales division is getting orders; (2) what work is in the shops; (3) what progress is being made toward getting the work out on specified time; (4) what the cost of every job is; (5) what the profit or loss account is. So minutely are these details kept that he can perceive at a glance the weight of every part, and the cost of every operation while the work is in progress. This enables the management to get a comprehensive grasp of the whole business.

Department No. 2 is the General Superintendent, who has entire control of the works, and is responsible for the efficient operation of all the subordinate departments.

Department No. 3 is classed as the "Engineering Department," and, while nominally subject to No. 2, the five officers embraced in this section are the advisers of that department. To them is relegated the designing and detailing of the work for the shops: (1) by specifications issued to the Production department; (2) by their staff of inspectors, who keep their eyes open to see that the work



is done in accordance with specification, but cannot give orders in the works, their function being simply to accept work if properly made, or to reject same if not done as per instructions, or if the material is defective.

Department No. 4 is composed of the clerical staff throughout the works, with the exception of those in Departments Nos. 1, 2 and 3. Although No. 4 is under the rule of No. 2, they receive direct instructions from No. 3, co-ordinate the work, and distribute same to the various departments interested, subject to the approval of No. 2.

Department No. 5 is subject to No. 2, but receives orders, specifications, drawings, etc., from, and reports to, No. 4. Each section and sub-section of Department No. 5 receives orders from, and reports to, the head of their department. All work done in this department, must, after inspection and acceptation, be delivered straightway to the Stores before being handled by any other department. The subordinate departments or sections indicated may be increased or the number decreased without interfering with the legitimate working of the others.

A. J. LAVOIE'S SYSTEM No. 93 — SALES DEPARTMENT No. 1
PREPARED BY — DATE PREPARED

● ORIGINAL ●

A. J. LAVOIE'S SYSTEM LONGUEUIL P.Q., CANADA
REQUISITION FOR ESTIMATE No.___

*Customer*___
*Address*___
*Date to be delivered*___
*Place of delivery*___
Please make ESTIMATE as per attached correspondence and information in full (state if detail or bulk price is required).
REMARKS:—

ENGINEERING DEPARTMENT No. 3 TO SALES DEPARTMENT No. 1
*Prepared by*___ *Date*___*190*_
Machine Cost ...... *Shipping Weight*___
Labor Cost ......
Purchase Articles Cost
Material Cost ......
Total Cost...... *Delivered at*___
*Remarks*___
*Signed*___*Engineer.*
Approved by Superintendent when completed. | *Always state job No. on all future correspondence, or they will be returned.*
JOB No.

Size of Form, 6" x 10"
Printed Black on Café Colored Bond Paper, 20 lbs.

A. J. LAVOIE'S SYSTEM No. 94 — SALES DEPARTMENT No. 1
PREPARED BY — DATE PREPARED

● DUPLICATE ●

A. J. LAVOIE'S SYSTEM LONGUEUIL P.Q., CANADA
REQUISITION FOR ESTIMATE No.___

*Customer*___
*Address*___
*Date to be delivered*___
*Place of delivery*___
Please make ESTIMATE as per attached correspondence and information in full (state if detail or bulk price is required).
REMARKS:—

ENGINEERING DEPARTMENT No. 3 TO SALES DEPARTMENT No. 1
*Prepared by*___ *Date*___*190*_
Machine Cost ...... *Shipping Weight*___
Labor Cost ......
Purchase Articles Cost
Material Cost ......
Total Cost...... *Delivered at*___
*Remarks*___
*Signed*___*Engineer.*
Approved by Superintendent when completed. | *Always state job No. on all future correspondence, or they will be returned.*
JOB No.

Size of Form, 6" x 10"
Printed Red on Café Colored Bond Paper, 20 lbs.

Form 101.

Progress and Making of Estimates.

On Form No. 101 is shown a full arrowed line on the left of the reader, pointing the customer with his requisition or enquiry in the direction of the Sales Office. Upon receiving the enquiry, the Sales Department assists the customer, if necessary, in making it out as complete as possible with a view of enabling the Engineering Department (No. 3) to clearly understand the technical requirements. Regular forms (6 x 10) for this purpose are provided, namely, original form No. 93; duplicate form No. 94; and triplicate form No. 95, which are all filled in at one operation of the typewriter by means of transfer carbon papers. The triplicate is filed in the Sales Office; the duplicate copy and original are passed on to the Works, where they are first handled by the Managing Director (No. 1) for verification, and from thence to the Superintendent (No. 2), who has the right to accept or reject any enquiry. Rejected enquiries must be accompanied by full explanatory reasons, together with all the connected data, and be returned at once through the channels they came. If No. 2 accepts the enquiry, the aforesaid two copies are delivered to the Chief Engineer (No. 3), whose duty it is to carefully examine Forms No. 93 and No. 94, and place

A. J. LAVOIE'S SYSTEM No. 95 SALES DEPARTMENT No. 1
PREPARED BY DATE PREPARED

• TRIPLICATE •

A. J. LAVOIE'S SYSTEM LONGUEUIL P.Q., CANADA

REQUISITION FOR ESTIMATE No.

Customer

Address

Date to be delivered

Place of delivery

Please make ESTIMATE as per attached correspondence and information in full (state if detail or bulk price is required).

REMARKS:—

ENGINEERING DEPARTMENT No. 3 TO SALES DEPARTMENT No. 1

Prepared by *Date* *190*

Machine Cost ..... *Shipping Weight*

Labor Cost .....

Purchase Articles Cost

Material Cost .....

Total Cost ..... *Delivered at*

Remarks

Signed *Engineer.*

Approved by Superintendent when completed.

Always state job No. on all future correspondence, or they will be returned.

JOB No.

Size of Form, 6" x 10"
Printed Green on Café Colored Bond Paper, 20 lbs.

JOB-No

NAME and ADDRESS of CUSTOMER

SHIPPED TO

REMARKS —

A.J. LAVOIE'S SYSTEM form #90 ENGINEERING DEP'T #3 FILING ENVELOPE

REPAIRS.

ALL REPAIRS TO BE MADE ACCORDING TO INSPECTOR PART LIST

CUSTOMER ORDER No	SALES ORDER No	JOB No	IN OFFICE No	IN CABINET No	ON SHELF No	DATE SHIPPED	PERMANENT FILED DATE TRANSFERRED	IN BUILDING No	ON FLAT No	IN VAULT No	ON SHELF No

them, together with all the connected data accompanying same, in the filing envelope (Form No. 90), and pass on to the Engineering Office Clerk, whose duty it is to straightway index Form No. 90: (1) under job number numerically, using Forms No. 64 and No. 15; (2) alphabetically, under name of article, using Forms No. 65 and No. 66; (3) alphabetically, under name of customer, using Forms No. 64 and No. 15; (4) numerically, under Sales order, Forms No. 65 and No. 66.

Customer's Order No.	*Customer's Name*	*Job No.*
Record Shelf No.	*Address*	*On Shelf No.*
Building No.	*Size and Symbol of Machine*	*In Cabinet No.*
Vault No.	*Type of Machine*	*Sales Order No.*

Remarks

A. J. Lavoie's System, No. 64, Dept. No. 3, Job No. Index.

Front
Printed Red on 120 lbs. Amber Color Cards.
Use Parchment Card Board for these Cards.
Size of Form 3 x 5.

Name of Article	*Job No.*
Size of Machine	*Sales Order No.*
Symbol of Machine	
Type of Machine	
Remarks	

A. J. Lavoie's System, No. 65, Dept. No. 3. Index to Machine Built

Front.
Printed Red on 120 lbs. Amber Color Cards.
Use Parchment Cardboard for these Cards.
Size of Form 3 x 5.

Remarks

FORM NO. 15.

Back of Form No. 64.

NAME OF PARTS	BUILT TO PART LIST DRAWING NO'S

A. J. Lavoie's System No. 66.

Back of Form No. 65.

Drawing No.	*Name of Article*	*Job No.*
Date	*Size of Machine*	
	Type of Machine	

DATE ALTERED	ORIGINAL COST AND CHARGES *(See over)*	COST	CHARGES

A. J. LAVOIE'S System, No. 5, Department No. 3 (Drawing Estimate Cost Card).

Front
Printed Red on 100 lbs. Amber Color Cards. Use good quality of Stock.
Size of Form 3 x 5.

	TIME	MAN NO.	COST $ C.	CHARGES $ C.
Sketch				
Search				
Information				
Checked				
Office Cost or Burden				
Pencil Drawing				
" " *Ink Over*				
" " *Traced on Tracing Cloth*				
Size of Paper	*yd.*			
" *Tracing Cloth*	*yd.*			
Blue Print Cost (each)				
		Total Cost =		

Signed, *Amount Charge*

Date

FORM NO. 16.

Back of Form No. 5.

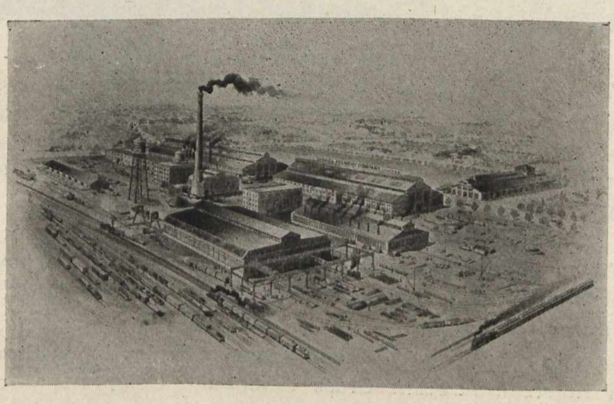
An estimate cost card (No. 5 and 16) is then issued, on which is to be entered the time and material required to do the job. When this particular estimate is completed, Form No. 5 and 16 is transferred to the Cost Department (No. 4) to be indexed in numerical order under its respective job number. Having taken out the estimate card, the Engineering Office Clerk consults his alphabetical index under name of article with a view to finding a previous estimate on a similar job. If the search is in vain, the envelope (Form No. 90) is returned to the Chief Engineer, accompanied by a written report, indicating that there is no estimate on a like job in the files of the Office. Seeing, however, that an estimate is necessary, and as there is no approximate data at hand, the Chief Engineer instructs the clerk to hand the enquiry, with all attached data, to the section of the Engineering Office concerned with the class of work specified. But before doing so, the clerk takes his job number numerical index (Form No. 64 and 65), and enters shelf number and cabinet number in the spaces reserved. This will keep track of Envelope Form No. 90 wherever it may be, whether unfinished or completed.

CANADA FOUNDRY COMPANY'S DAVENPORT WORKS, TORONTO

II.

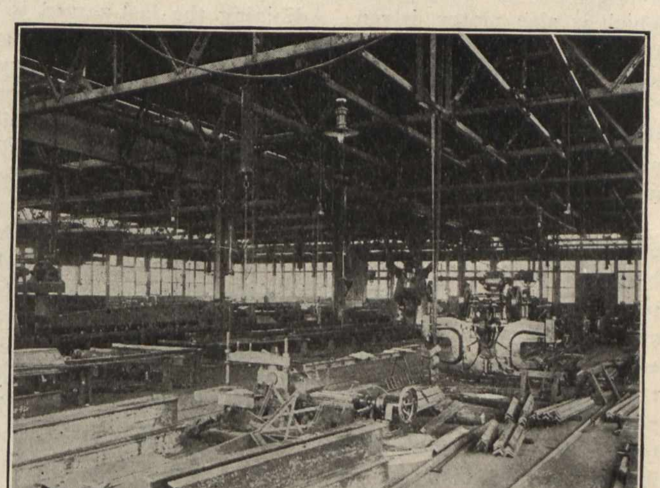
(Continued.)

The Structural or Bridge Shop located at the south-west corner of the plant is designed and equipped for the making of bridges, roofs, buildings, and steel structures of all description. The wide span roof is of the composite louvre type, supported on a series of longitudinal steel columns, between which travel twenty air hoists of 3 to 5 tons' capacity. Two standard railway tracks divide the shop floor into three parts; the eastern section dotted with machines for detail work—shearing, punching, etc.; the western wing used for fixed and portable machine riveting; while the middle bay is reserved for general assembling; an altogether admirably planned arrangement. Entering the well-lighted building at the north-east corner, we found 160 men actively engaged in the handling of tools and appliances involved in the various processes of steel construction. The first object of interest was the elevated foreman's office, reared against the eastern wall of the building—about midway, from which a comprehensive view of the entire operations going on in the shop can be obtained. Along the side on the right of the office were observed a lathe, shaper, two drill presses, and a small punch; while in front is a double punch, upon which was being holed an angle bar 60 feet long. Left of the office we perceived a large horizontal punch; "Bertram" angle shear; and a 24-in. cold saw. On the floor facing the last-mentioned set, are a double punch, and a shear, by Hilles and Jones, of Wilmington, Delaware, U.S.A.; while on the other side of the track, running tandem northward is a powerful double shear by the Cleveland Punch and Shear Co., U.S.A.; then a horizontal punch built by the same firm; and near the doorway a large double shear made by Smith Bros. Co., of Glasgow, Scotland. From thence we passed over to the western side, and in the north-west corner the first thing which attracted our attention was a portable bull riveter made by John E. Allen, New York. About halfway down this bay we came across two more bull riveters—but in this case fixed; both engaged in active service. Overhead, a long section of diagonally-braced structure work,—probably 60 feet long, was being carried down the wing, by three 5-ton air hoists; connected respectively at the ends and middle, demonstrating the wisdom of the multiple air hoist system (in place of one or two heavy electric cranes) for this class of work. At the south end we saw single and double headed drills made by Baker Bros., of Toledo, U.S.A.; also a large horizontal boring machine for eye bars, bridge chords, etc.; and adjoining this a pneumatic riveter actively fixing up a frame. Stepping across the western track into the middle bay, we beheld a massive set of rolls, 4 top, 3 bottom, capable of straightening a plate 60 feet long, and out of line 6 inches—made by Smith Bros., of Glasgow. Starting from this tool is a special rail track, upon which is a portable steel derrick (made by the Canada Foundry Company) with connecting frame, supporting four crane arms—two in front the other pair in rear; each having a portable drill, all operated by two electric motors fixed upon the intermediate bridge frame. Then last, but not least, is the large Plate Planer, also built by Smith Bros.; on which, a series of plates 26 feet long can be planed effectively. In enumerating with some minutia the various tools and appliances with which the shop is equipped, we have not mentioned the excellent overhead system of warming the building in cold weather—as installed by the Sturtevant Company; nor have we described the heating furnaces, smiths' forges, rivet heaters, and other minor but important adjuncts of a modern steel construction plant; we have, however, said enough to show that this comparatively new shop, in which was constructed the dome crowned roof of the Manufacturers' Building in the Toronto Exhibition grounds, near the blue waters of Lake Ontario; and the fine swing bridge for the James Bay Railway in the frozen north, is well fitted to meet the demands of the "good time coming."



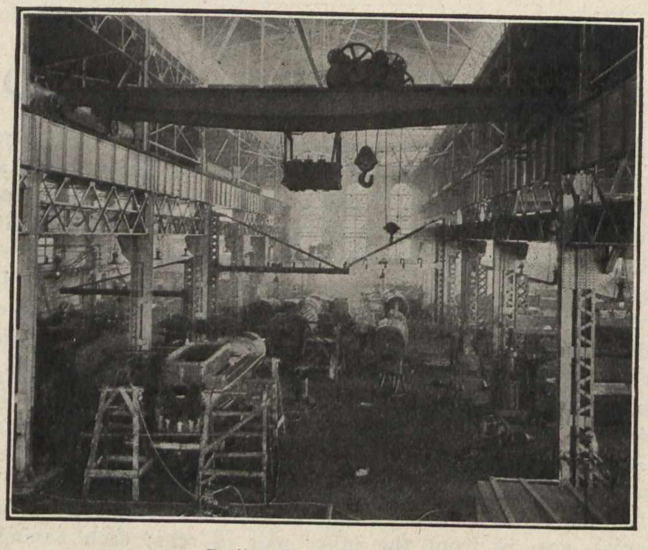
Bird's-eye View.

Fig. I.



Bridge Shop.—Fig. 2.

As the visitor approaches the works (Fig. 1), by way of Lansdowne Avenue from the lake, the first object to the right on crossing the C.P.R. tracks, is the new general office; built in concrete, then comes the stock yard, exhibiting a fine array of tubular boilers on the gauntries. At the end of this yard, looms the most imposing building of the whole plant—the Boiler Shop. It is solidly built of brick and steel. The high altitude of the roof eaves, and the lofty riveting tower give it an impressive appearance. It is 260 feet long, by 150 feet wide, and is adequately provided with lifting facilities. In the middle bay on overhead tracks is a 30-ton electric travelling crane; in each of the side wings a traveller of 15 tons capacity; while 6 = 6-ton Jib Cranes are fixed on the columns supporting the main roof. Shipping facilities have been carefully thought out also, for transversely through the shop near the western end is a standard railway track, passing through large openings fitted with steel rolling doors. The foreman's office is located at the western end—almost central. To the right of the office,



Boiler Shop.—Fig. 3.

and occupying the space in the south-west corner up to the track are the stock racks, in which 400 tons of plates, etc., were stacked and tiered at the time of our visit.

A perspective glance down the shop from the stock corner revealed a formidable array of solid looking tools and appliances; nearly all operated by hydro-pneumatic power. Proceeding down the southern wing from this point, we first of all ran up against a massive punch 7 feet, gap = 1¼ holes in 1¼ plates—made by Crow, Harvey & Co., Glasgow, Scotland. Next to this is another punch 42 inch gap, = ⅞ holes in ¾ plates, also built by Crow, Harvey & Co.; while in front of the pair is a Shear, 5 feet gap, capable of shearing plates ⅝ thick. Beyond the last-named, is an adjustable wrangler, rotary, bevel shear, motor driven. Perhaps the finest machine in the building is the 30-foot planer built by London Bros., Glasgow, Scotland, (Fig. 4), which is also motor driven. Adjoining the last-named is a set of motor driven, 10-foot plate rolls, made by "Bertram;" while right in the south-east corner is a belt driven "Bertram" 6-foot swing Radial Drill. Next the wall across the southern end are ranged, a small drill press; a 4-spindle multiple drill by Crosby & Co., Sarnia; and an 8-spindle multiple drill by "Bertram;" both the latter motor driven.

Returning down the middle bay, we first perceived a punch of special design, 6-foot gap, for ⅝ holes in ⅜ plates—built by Haniel & Lueg, Dusseldorf, Germany, (1903). In proximity to this is a 50-ton portable riveter (1-in. rivets) made by Canada Foundry Co. Turning back to the north-east corner we find a colossal vertical riveter 18′ 6″ gap, 1½ rivets—built by W. H. Wood, Media, Pa. Over the last-named tool is the riveting tower, ascending through the roof and provided with 30-ton electric travelling crane, having 35-foot lift—made by the Canada Foundry Co. Another machine of magnitude is a 550 ton flanging press, also made by the W. H. Wood Co. Nearby the latter, is a large heating furnace, designed and built by the Canada Foundry Co., fired with soft coal, which takes in 10-foot plates. Beyond this furnace is a manhole punch, 5-foot gap, made by R. D. Wood & Co., Philadelphia, Pa.; and capable of punching a manhole 12 x 16 through a ⅝ plate. Once more turning to the middle bay, we observed next to the 50-ton portable riveter, a pneumatic, clamping and straightening machine, with upward thrust, which is 12′ 6″ between housings. This exceedingly simple, yet effective appliance, designed by J. J. Fletcher, and built by the Canada Foundry Co., is one of the best things on the plant.

Further along is a 7-foot set of plate straightening rolls, built by Rushworth & Co., Sowerby Bridge, England; and a motor driven, combined punch and shear, provided with automatic spacing device, made by Long & Allstatter Co., Hamilton, Ohio.

A small set of rolls; a 20-in. gap shear by "Bertram;" a 3½ angle shear by John Bush, of London; a cold saw; 2 "acme" design, bolt thread cutting machine, and a six spindle, vertical, stay bolt machine by Edwin Harrington, Son & Co., Philadelphia, practically ends our story of the equipment within the walls of the main building.

The method of warming the boiler shop to the temperature of 48 to 50 degrees in cold weather differs from the

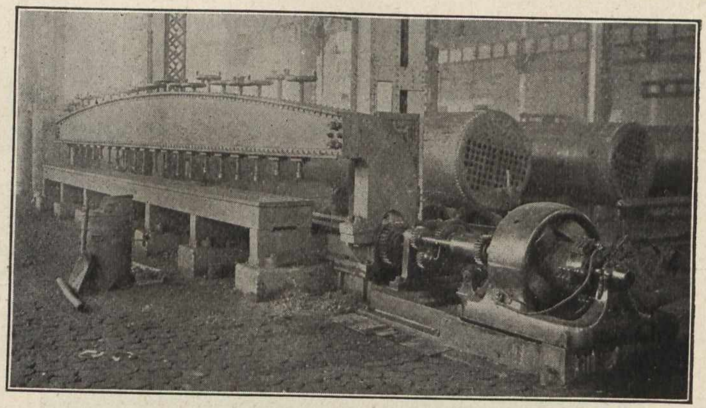


Plate Planer.—Fig. 4.

bridge shop. In the former, the hot air is forced through underground flues, upward into the building, instead of downward from the roof, as in the case of the latter. Both heating systems were installed by B. F. Sturtevant Co.

The power plant consists of two 160-h.p. Babcock & Wilcox boilers, generating a steam pressure of 150 pounds per square inch, for driving air compressor, engines, and injector testing, etc.

The compressed air supply system is developed through an Ingersoll-Sergeant Cross Compound Compressor,—compressing 2,000 feet of free air per minute at 125 pounds pressure to the square inch. In the same house with the Compressor System, is an Auxiliary steam engine, consisting of two Brown engines; originally built for single action, but now coupled, and driving one large fly-wheel, which is belted to two 100-h.p Canadian General Electric generators.

The most interesting part of the plant, however, is the hydro-pneumatic installation, which we hope to describe extensively on some future occasion, as we have reason to believe that it is the only installation of the kind in the Dominion; and will, therefore, be of interest to Canadian Engineers.

To the superficial, our description may have the appearance of a mere inventory, but to those of our many readers interested in the class of work for which this fine shop was designed and equipped, it will serve to show, that for the making of boilers and tanks—from the smallest upright boiler, to the largest locomotive or marine boiler, which can be produced—the resources at Davenport are unsurpassed, and in many respects beyond competition—at any rate in Canada.

Visitors to the Machinery Hall, Canadian National Exhibition, can see a fine exhibit of flanged and pressed steel work, the product of this boiler shop; which is evidence of the phenomenal growth of the iron and steel industry of Canada.

Advertising is the greatest motive power of business to-day. But to-morrow it will be the only power. The manufacturer who does not advertise is, as a class, just as certainly doomed to extinction as the small retailer. The lesson of these things is obvious.

STANDARD FLOOR PLATES.

One of the most effective designs for floor plate checkers is that shown in Fig. 2. When seen in perspective on a large engine house floor, or gallery, it presents a very artistic appearance. It has been adopted as standard by two of the largest engine building concerns on the continent; because not only does it fill aesthetic conditions, but is of utility also; for every other checker having the grooves at right angles to one next to it, gives an effect of alternate light and shade, and at the same time, offers fractional resistance to sliding and slipping. Hence, this form of checkered floor plate may be said to be ideal, since it embodies the ideas of both beauty and utility.

Inasmuch as floor plates for the purpose indicated, are generally large in size, and the cutting of the grooved checkers by hand a very difficult and tedious process, a

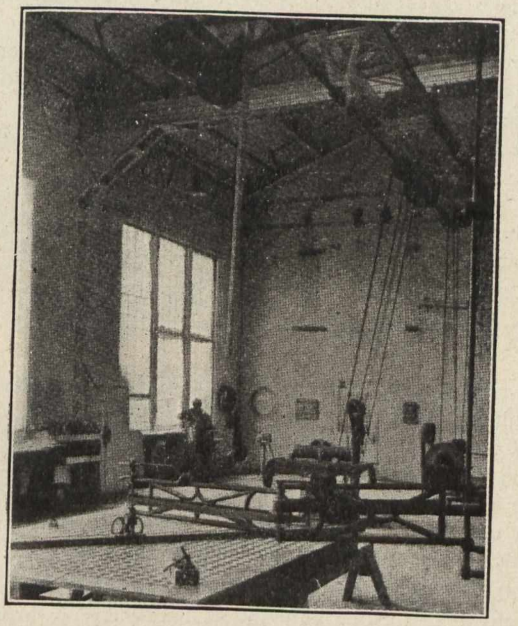


Fig. 1.—Checker Forming Machine.

special machine (Fig. 1) was designed by the Westinghouse Machine Company, of Pittsburg, for cutting the grooves, and has proved a complete success. A brief description thereof, will doubtless be of interest to our readers.

Making Pattern.

A vertical shaft is attached to one of the posts by suitably supporting brackets, and carries a double swinging frame similar to the ordinary "sander." At the end of the

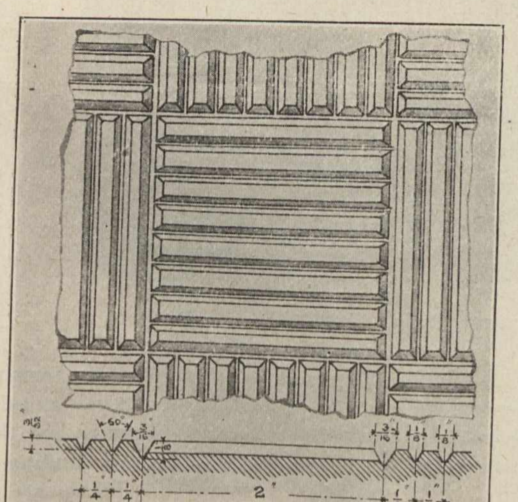


Fig. 2.

frame there is a vertical spindle carrying a small routing cutter. This spindle is guided by bearings attached to the sliding piece gibbed to the heavy metal slide. The slide is laid across the pattern face as shown, and grooves cut by pressing down the routing cutter and passing the slide along the guide bar. The guide being made of steel, is so heavy that clamping is needless. First, the face of pattern is marked out in checkers, say two inches square, with grooves in the alternate checkers running in opposite direction. Lines marking out the grooves which separate the squares are first drawn across the board, then grooves are cut. After this, the grooves in each square or checker are cut by

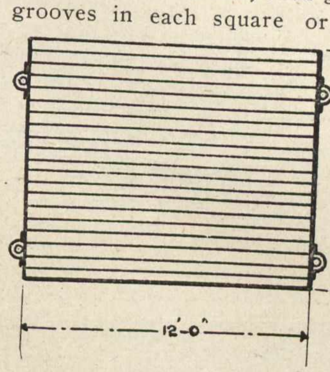


Fig. 3.

Fig. 4.

pressing down the routing cutter when it is desired to have it operate. The routing cutter is ordinarily held in a raised position by means of a powerful flat spring.

Molding Floor Plate.

The pattern should be made larger than any plate is likely to be, (Figs. 3 and 4), having checkers on one side, with ribs and thickness on the other—which is smooth. The ribs should be cast downwards, as shown on Fig. 5.

The checkered face of pattern must be as large as flask, with sides extending outside same, properly guided by pins. After cope is rammed and gated, it is hoisted off, pattern withdrawn, then cope is lowered down on to drag; but instead of the two parts of flask being 2½" apart as when pattern was in place, they now touch, leaving space for thickness and ribs in drag, and grooved recesses of checkers in cope, to be filled with metal. Border and bosses to be put on corrugated side of pattern.

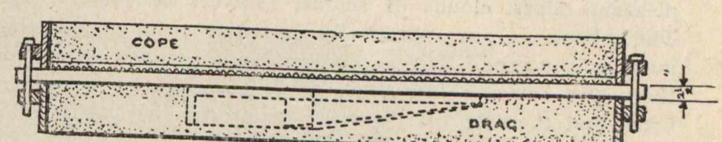


FIG. 5

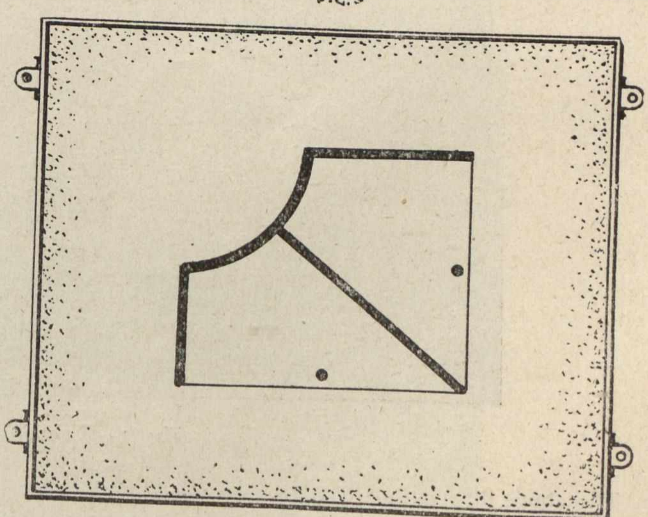
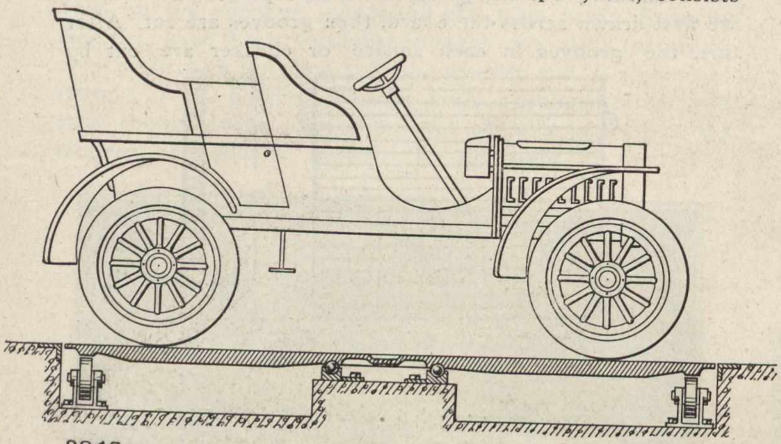


FIG. 6

When these comparatively large floor plates were first molded, it was found to be almost impossible to withdraw the pattern without particles of sand being left in the somewhat delicate grooves, hence these bad "draws" necessitated considerable patching and mending, causing great loss of time and expense. All manner of parting sands, etc., were tried without avail, until an old experienced molder suggested the use of "Lycopodium"—one of the most minute seeds in nature. It was somewhat expensive—costing 58 cents per pound, but from the very first was a complete success.—S. G.

AN AUTOMOBILE TURNTABLE.

An automobile turntable, as illustrated, has been designed to overcome the unsatisfactory method of manoeuvring by hand. This device, manufactured by the Link-Belt Engineering Company, Philadelphia, Pa., consists



2842

of a cast-iron table, fitted at its centre with ball bearings, and supported at the outer edge upon rollers, which are set in the concrete pit. The pit is protected by an iron ring, which prevents the mutilation of the concrete edge. Owing to the shallowness of the pit, which is drained, the cost of excavating and concreting is at a minimum. The turntable is ample for a wheel base of 96 inches, and a brake is furnished, providing a rigid fastening when the table is not in use. Hand-holes, with flush-top lids, are also provided. One of the features of the turntable is that it is a protection against fire, which may result from dropped oil or waste becoming ignited: an element of danger where wooden turntables are used.

KEEPING AT IT.

Advertising campaigns are never finished. The fact that you advertised yesterday does not give you the opportunity to rest to-day. You must keep on advertising to-day in order to receive the full results of your yesterday's advertising.

Advertising is like pushing a heavy weight uphill. The hill is the steepest and the weight the heaviest at the start. The farther up you go the less you have to push in order to make progress, but, if you should stop pushing, after being well up the hill, the weight will bowl you over and roll back to the very bottom of the hill.

The beginner in advertising should not begin unless he has the grit to continue. There is nothing more foolish than to spend a lot of good money making a good start and then stop for fear you will not get your money back, just as the business is about to make good.—Advertising.

ELECTRIC LOCOMOTIVES.

In view of the proposed electrification of Canadian railways, we have pleasure in describing recent applications of electric locomotive traction in England and Sweden.

The electrification of the Metropolitan Railway (London, England) is a scheme which has long been looked forward to by the travelling public, especially that portion whose lot it is to make daily use of the underground section of the line, with its poisonous atmosphere, unpleasant odors, clouds of smoke, showers of cinders, etc. The scheme is now practically complete so far as equipment is concerned, but in the matter of traffic operation there still remains something to be done before all is in order and the last of the old steam-propelled trains has disappeared from view.

In Fig. 3 is shown a photographic picture of a 25-ton single-phase locomotive, also built by the British Westinghouse Company, for the Swedish State railways.

One of the interesting features is the high trolley voltage for which the equipment is designed, viz., 18,000 volts, though connections are supplied for operating at several voltages lower than this, the minimum being 3,000 volts.

This high voltage necessitates the use of an oil-cooled main auto-transformer and an oil break circuit breaker, oil having insulating properties which have been amply demonstrated by service in high tension transmission. The intention is to experiment at various line pressures, with a view to ascertaining the highest working pressure suitable for the conditions prevailing upon the Swedish State railways.

The control system is electro-pneumatic, and consists of

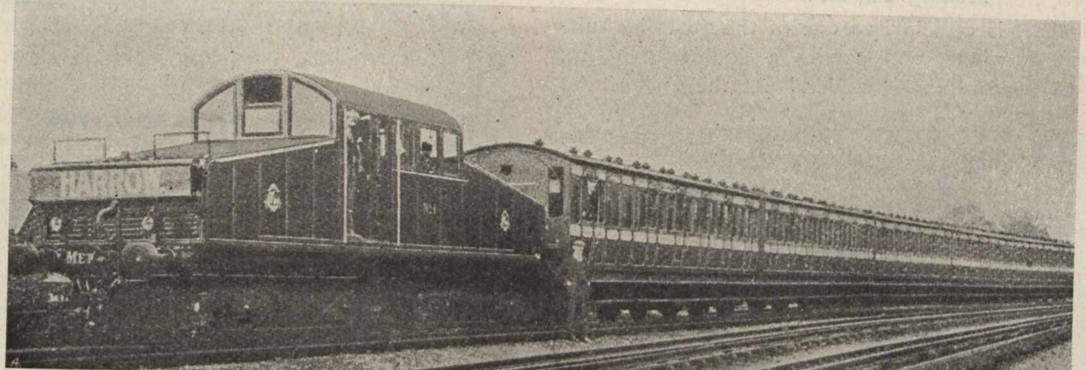


Fig. 1—Electric Locomotive and Train.

The above illustration (Fig. 1) shows one of the 150-ton electric locomotives (1,200 h.p.) attached to six bogie coaches and van, as used on the Baker street to Verney Station service. This locomotive is one of ten weighing 150 tons each now being supplied by the British Westinghouse Company, designed to haul trains approximately 120 tons at a maximum speed of 36 miles per hour on the level.

They are equipped with four motors of 300 h.p. each, and an interesting feature is that, owing to the terminus facilities being somewhat restricted, it has been necessary to use motors of a smaller size than usual, equipped with forced ventilation, so as to keep the over-all length down to convenient limits for handling at the termini.

an air compressor driven by a single-phase alternating current motor, an air motor on the induction regulator, air cylinders on the circuit breaker, and reverser and the necessary magnet valves. The air brake and air sanding gear are also supplied by the above compressor. There are two connectors at each end of the locomotive, so that two locomotives can be coupled together and operated by one motor switch. The master switch is in the middle of the cab, and is so situated that the operator has a clear view in all directions without leaving his seat. Two 150 h.p. twenty-five period single-phase motors are geared, one to each axle, with a gear reduction of 18 to 70, and the locomotive so equipped has shown its ability to handle a 70-ton train at 40 miles per

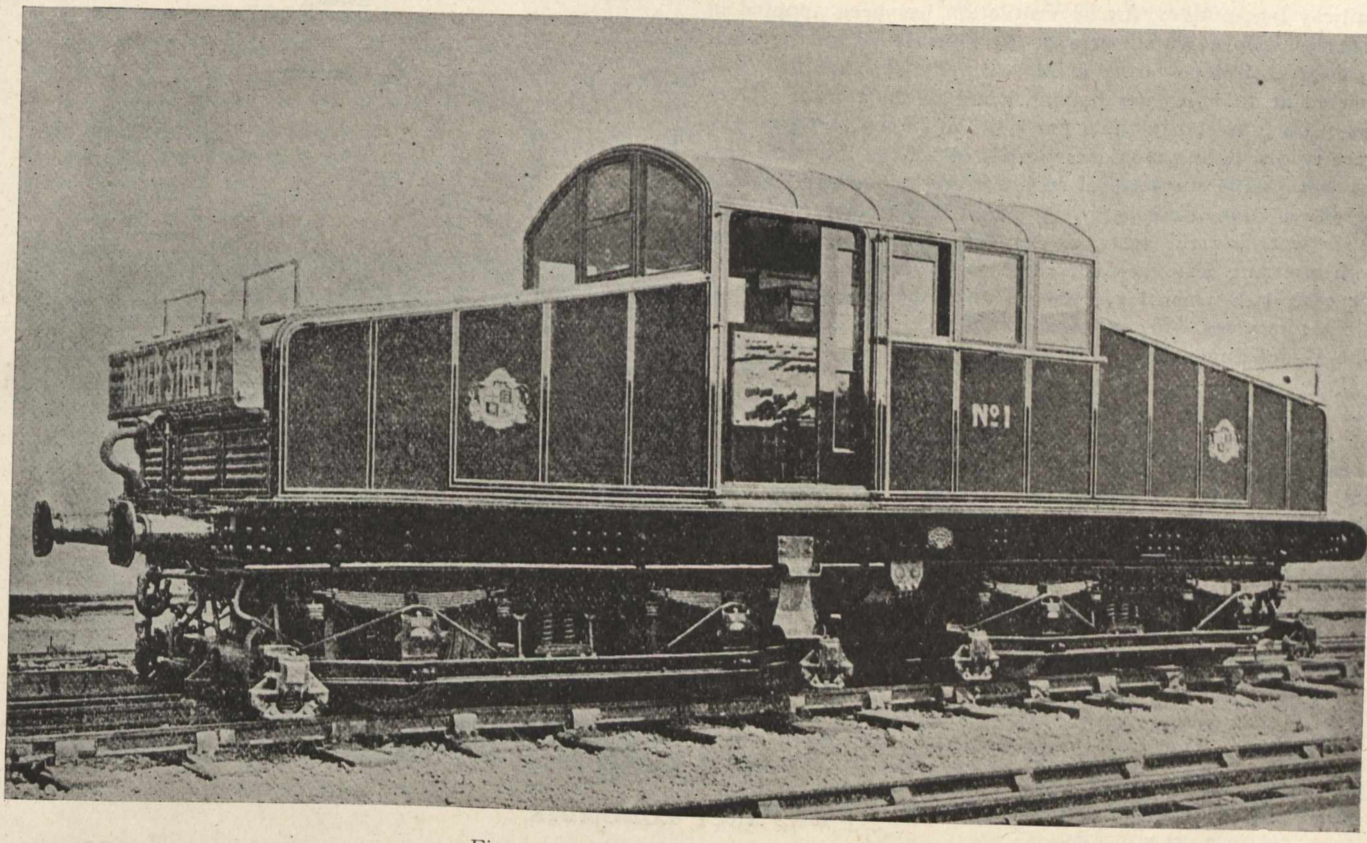


Fig. 2.—150-ton Electric Locomotive.

hour without exceeding the rise of temperature for which the motors were designed.

Ready access to all the parts has been arranged for; only the small operating devices have been placed in the cab, and the lay-out is such as to allow of the greatest convenience in operation with a maximum of safety to the operator. The illustration shows the locomotive as sent out from the builder's works; the buffers, collecting devices, etc., are being fitted at the railway works, Stockholm. The design is that of Mr. Robert Dahlander, director of the Electrical Department of the Swedish State Railways.

Another, more powerful than either of the foregoing, is the 135-ton electric locomotive, recently built at the Baldwin Locomotive Works, Philadelphia, U.S.A., and equipped by the Westinghouse Company, of Pittsburg, U.S.A., for the purpose of hauling heavy freight trains. It differs from Fig. 2, in that the centre cab is carried from end to end, and is built in two halves, either of which can be used independently of the other should necessity arise. It is designed for a trolley voltage of 5,000 to 6,000 volts., which is reduced to 225 at the motors. Each end is carried on two six-wheeled trucks, which have a rigid wheel base. These wheels, all drivers, are 5 ft. in diameter and mounted on 8 in. axles, the difference between centres being 6 ft. 4 in. The side frames are of cast steel and spring supported, the cabs are of sheet steel on angle iron supports, and the entire cab is removable from the truck. Each axle carries a 225 h.p. single-phase series motor (see section Fig. 4), so that the total horse-power is 1,350, but the locomotive can exert considerably more power on emergency. As in the Metropolitan

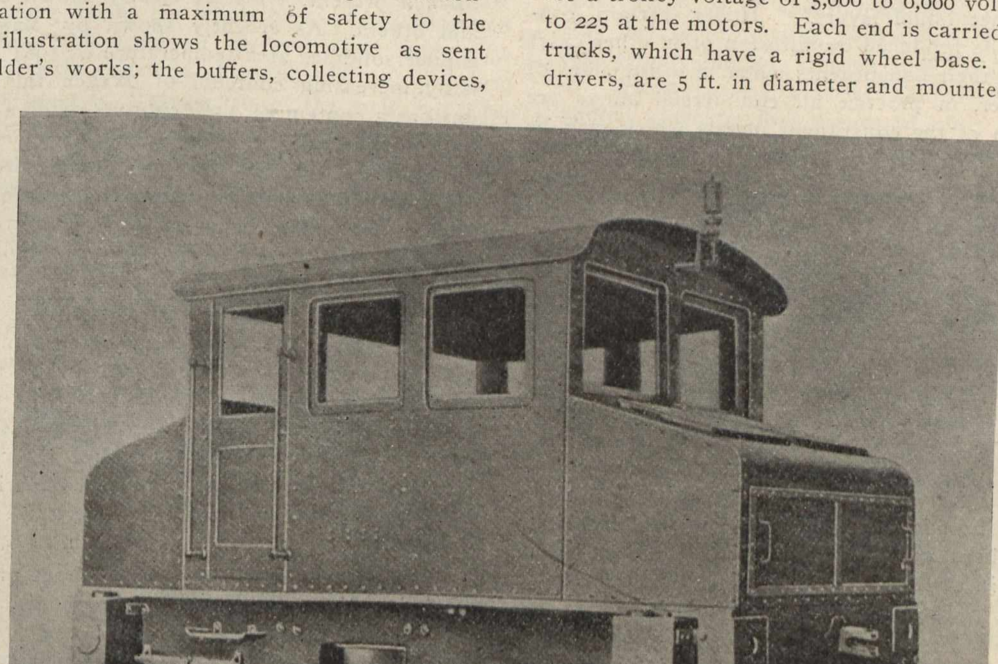


Fig. 3—25-ton Electric Locomotive for Swedish State Railways.

Railway locomotives, forced ventilation has been adopted in order to keep down the size of the motors. With the locomotives at full power, a draw bar pull of 50,000 lbs. was exerted at 10 miles per hour; when hauling a train weighing 1,200 tons steady draw bar pulls of 60,000 to 65,000 lbs. were recorded, and momentary pulls of 100,000 lbs. were also reached. The spectacle of such a large locomotive drawing its power from trolley wire, .40 inches in diameter, interested those watching the tests, as showing the flexibility of the high pressure alternate current system, and demonstrating the ease with which large powers could be supplied to electric locomotives.—From Engineering Review (London) and The Model Engineer and Electrician.

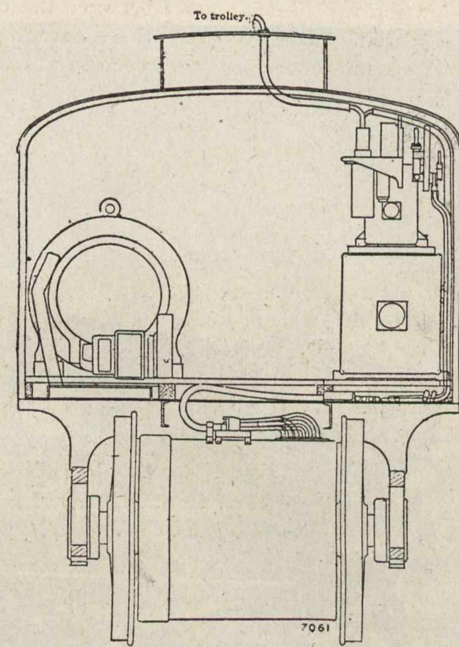


Fig. 4.

—The scale of color-temperatures proposed by Janivier is as follows: Very dull red, 525°C.; dull red, 700°; bright red, 800°; cherry red, 900°; bright cherry red, 1,000°; very deep orange red, 1,050°; deep orange red, 1,100°; orange red, 1,200°; whitish, 1,300°; brilliant white, 1,400°; dazzling white, 1,500°; blue white, 1,600°. These data differ materially from those of White and Taylor, and Howe, who give temperature corresponding to white heat as 1,205° and 1,150°, respectively.

"ALLOYS."

BY PERCY LONGMUIR.

Carnegie Research Medallist.

Introduction.

An alloy may be defined as "an intimate mixture or union of metallic substances, which on melting do not separate into two distinct liquid layers."* Under certain conditions alloys may be produced by diffusion or in other cases by compression of their constituents when in a fine state of division. However, in practice all commercial alloys are produced by fusion of the constituent metals which may be effected in gas, coke, or oil fired crucible furnaces, or in gas or coal fired reverberatory furnaces. As a rule the coke fired crucible furnace is employed for small quantities and the coal fired reverberatory furnace for large quantities. Success in the production of alloys can only be attained by practical experience and personal contact with the difficulties encountered and such guidance cannot be given on paper. Further a distinction must be drawn between the production of laboratory and commercial alloys and determining conditions often ignored in the first case have a very decisive bearing in the second one in which the alloys have to meet competitive and service conditions. In other words a commercial alloy must not only yield its maximum properties but must also be produced under conditions enabling it to compete with others on the market. Therefore, before describing alloys in general a few notes are necessary as to their preparation.

The majority of metals undergo certain changes on melting, familiar examples being found in the case of copper and iron. The latter metal in as pure a form as can be fused will not by simple fusion yield a sound casting, nor yet an ingot capable of forging. The difficulty in producing sound copper castings is very familiar, and perfectly malleable and sound castings of this metal can only be produced by exercising great care. Another aspect is shown in the following quotation:—

"Melted silver exposed to the air gradually absorbs oxygen, which lowers the freezing point, and the latter is not a definite temperature, varying with the rate of cooling mass and surroundings." †

* Nomenclature of Metallography—Journal of the Iron and Steel Institute, No. 1, 1902.

† 1. High temperature measurements, 2nd edition, Le Chatelier & Boudouard. Translated by Burgess.

The influence of oxygen—absorbed during melting—on the solidification point of copper is even more marked, and results obtained will be found to vary with the amount of oxygen present, a feature clearly shown by Heyn, Richards and others. As recently shown by Bauer ‡ oxygen, free copper solidifies at a temperature of 1084° C, but with gradually increasing contents of oxygen this temperature falls until at a content of 3.5% cuprous oxide a solidification temperature of 1065° C is reached. Further increments of oxygen sucessively raise the freezing temperature. This return of the freezing point curve marks the beginning of the appearance of free oxide. Thus up to 3.5% cuprous oxide is soluble in copper, but exceeding this amount the oxide appears structurally free.

The structure of chemically pure copper is shown in Fig. 1, whilst the same copper containing an excess of oxygen is shown in Fig. 2, and it will be noted that the structure is now a composite one built up of two distinct constituents, viz., copper containing dissolved oxide and structurally free oxide. A further example of oxygenated copper is shown in Fig. 3, and a comparison of Figs. 2 and 3, with Fig. 1, will readily show the structural changes induced by the presence of oxygen.

These features have a very direct practical bearing for metals, which have the property of absorbing oxygen when molten are very liable to retain the resulting oxide when cold, and according to the amount present have their malleability impaired.

In the case of copper this is of special moment, and, as already shown, up to 3.5% cuprous oxide can be dissolved by the metal. Under ordinary conditions of melting, oxygen will combine with copper forming an oxide, which is most tenaciously retained by the metal on solidification. Various plans are followed in order to prevent this oxidation, the most usual one being that of melting under a layer of charcoal, which has also the virtue of being most inefficient. In this sense inefficiency is, of course, applied to industrial masses, that is weights exceeding 30 pounds. It is a practical impossibility to melt this or a greater amount of copper protected by a layer of charcoal alone, and produce oxygen free castings. Charcoal is, of course, strongly reducing, but

‡ Giesserei Zeitung.

before reduction can occur contact between the charcoal and oxide is essential. Unfortunately these oxides do not float to the surface and, therefore, the necessary contact is not obtained. It will naturally be stated that a layer of charcoal on the top will prevent the admission of air and thereby maintain a reducing atmosphere. To a certain extent this will be the case, that it is not completely so can be readily proved by simple trial.

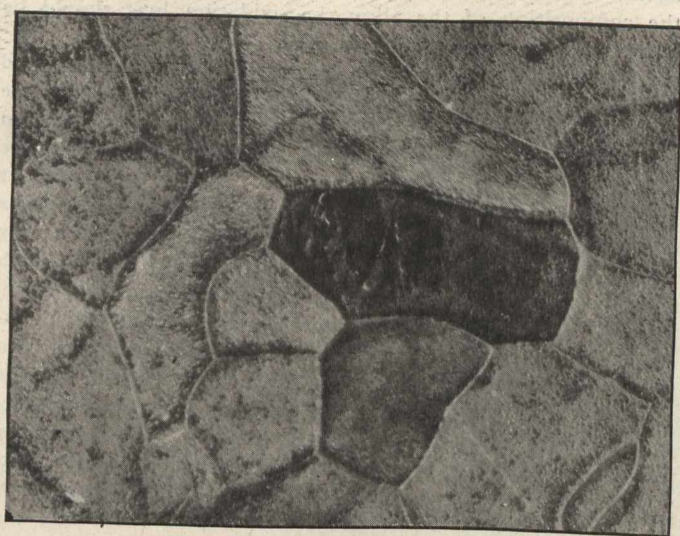


Fig. 1.—Pure Copper.
X. 58.

Commercial copper of the type used in the production of alloys always contains more or less oxygen in the form of oxide; in melting further quantities of oxide are formed before the copper is liquefied, but on liquefaction the amount formed is determined by the melting atmosphere and the effectiveness of the charcoal covering. Given a strongly reducing atmosphere during the whole period of melting and a crucible initially exhausted of oxygen then oxide free copper castings result. Such ideal conditions are, however, not attainable in practice, during parts of the melting period an oxidizing atmosphere will ensue and until the ingots of copper settle down into a liquid mass the covering of charcoal will not be effective.

Unlike charcoal, which only gives superficial contact, deoxidizing agents, such as zinc, phosphorus, silicon, or manganese, when added to molten copper by permeating the whole mass effectually seize oxygen and form oxides which readily float to the surface.

In practice many copper castings are produced by melting under charcoal, and just before drawing the crucible adding some 2% of zinc—the greater portion of which is oxidized and castings of fairly high purity result. The most familar deoxidizing agent is phosphorus added in the form of phosphor-copper. An addition of ½ pound phosphor copper to 50 pounds of copper would give a theoretical phosphorus content of 0.15%. The actual amount of phosphorus remaining will, of course, depend on the oxygen present; a phosphorus loss of 50% is, however, a safe estimate and this would, therefore, yield a phosphorus content in the copper of 0.075%. Manganese and silicon have very similar effects to that of phosphorus, and like phosphorus are more conveniently added in cupro form. In the production of German silver, the nickel, which enters largely into the composition, should always be deoxidized by manganese.

From the foregoing it is evident that with an alloy of copper and zinc, owing to the presence of zinc, copper will not take up or unite with oxygen. Further in the presence of these two metals there is always a preferential oxidation of zinc, which is readily evidenced by the fumes of zinc oxide given off. With a copper tin alloy the case is entirely different. Tin, like copper, will unite with oxygen to form an oxide, which is retained by the metal. A feature of note lies in the fact that metallic tin will reduce copper oxide but the oxide of tin is retained by the alloy. This reduction may be expressed as follows:—

$$2\ Cu_2\ o + Sn = 4\ Cu + Sn\ o_2.$$

Here again charcoal will only reduce the oxide of tin when in contact and owing to the fact that the oxide does not float, that contact does not occur.

Copper tin alloys have comparatively little industrial application, but the triple alloys, copper, tin and zinc are very largely used. As a rule the content of zinc varies from 2 to 6%, and with this metal present, oxidation of copper or tin will not occur.

As the majority of alloys contain zinc the loss of this metal is of some moment. As shown this loss is due to combination with the oxygen present, and further sources of loss are found in the volatile character of zinc at the alloying temperature. The total loss will, therefore, be greater when making an alloy, i.e., adding zinc to molten copper than when remelting an alloy, further it will vary according to conditions of melting, etc. As an example one case may be quoted in yellow brass, 70% copper, and 30% zinc was made over a long period of time by charging the foregoing quantities. As a matter of fact the cold castings contained 76% copper and 24% zinc, the castings thus containing an excess of the costly metal copper and a deficiency of the less costly metal zinc.

The author's experiments clearly show that the zinc loss is determined by the highest temperature reached and is entirely independent of the amount present. The following examples illustrate this point,—

Alloy.	Highest Temperature.	Actual content of zinc in the castings.	Percentage loss of zinc.
Gun Metal	1173° C	1.8%	27.7
Red Brass	1308° C	10.2%	28.6
Yellow Brass	1182° C	26.0%	26.1
Muntz Metal	1038° C	40.5%	19.0

The alloy containing the most zinc gives the least loss, but a glance down the temperature column will explain this. From other experiments evidence is offered to show that had the foregoing alloys been heated to one uniform temperature the loss in each case would have been identical.

Whilst casting a series of moulds from a crucible of yellow brass noxious fumes of zinc oxide are constantly emitted, and from this it would almost appear that the content of metallic zinc would be steadily lessened. In other words the first casting poured would be higher in zinc than the last one. Such is, however, not the case, and a wide series of tests has clearly shown that the loss takes place entirely on heating, and the amount is determined by the highest temperature reached. As the fumes are emitted from the alloy as it stands in a crucible and continue until the temperature is in the vicinity of the freezing point, it necessarily follows that these fumes represent oxide previously formed, that is during the heating stage.

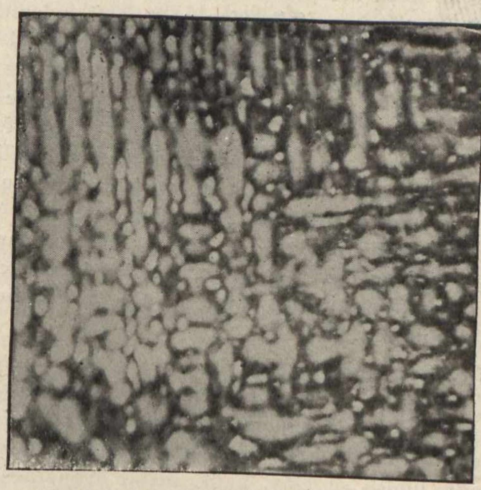


Fig 2.—Oxygenated Copper.
X. 58.

This loss of zinc should be allowed for in all cases, it is of special moment in certain alloys, such as manganese bronze, in which a specified content of zinc is essential in order to obtain the full range of properties from the alloy.

Naturally the loss should be determined for the conditions under which the alloys are made, but when this is impossible an alloy of 25% will not err on the wrong side.

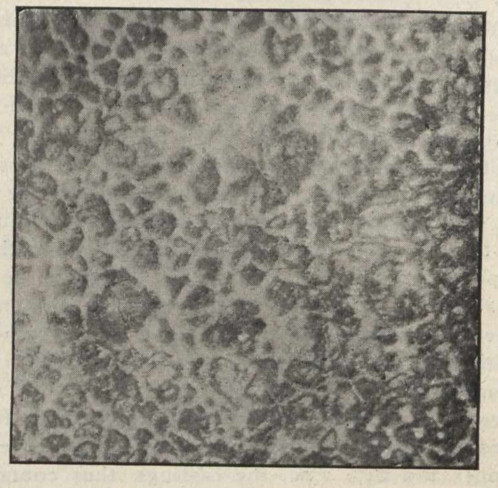


Fig. 3.—Oxygenated Copper. X. 58.

Decisive oxidation losses occur with phosphorus and manganese in alloys containing these elements as special constituents. These losses are far too variable in character to give a probable loss factor. Under ordinary conditions an allowance of from 30 to 50% should be made, and in many cases 50% will not err on the excessive side. Unlike zinc the loss of manganese is of secondary moment for its chief purpose is that of a deoxidizer. If this purpose is served it is immaterial whether the alloy contains a trace or no manganese. A characteristic feature of manganese bronze is found in the fact that they often contain no manganese, but none the less this metal has been used in their production.

Oxidation has been treated at full length because it is of prime importance in the production of any alloy containing copper as a base. Efficient protection is found in melting under a layer of charcoal, and in the use of a deoxidizing agent. When this agent, as in the case of zinc, enters into the composition of the alloy the oxidation loss should be allowed for in making up the alloy.

Further features are found in the speed of melting and in the casting temperature. The quicker the melting the better the result, and as the author has conclusively shown all alloys must be poured at a suitable temperature in order to obtain the full range of properties. In this connection it is well to note that an alloy containing aluminium gives when fluid a peculiar skin, imparting to what is really a very fluid alloy, a dead or pasty appearance, a feature which must be allowed for when judging temperatures by eye.

With certain bronzes, aluminium, manganese and phosphor, fairly large gates or runners are necessary in order to obtain castings free from pin holes or "draws." If the castings are at all massive these runners should be supplemented by feeding heads placed on the heavy portions. With aluminium and manganese bronzes much cleaner castings are obtained by the use of "plug heads," which consists of a dry sand or loam reservoir with a plug fitted into the runner. The head is filled with metal, the plug then withdrawn, and a constant level maintained by the ladle until the mold is filled. By this precaution no dirt enters the mold and extremely clean castings result.

SAND SIFTING MACHINE.

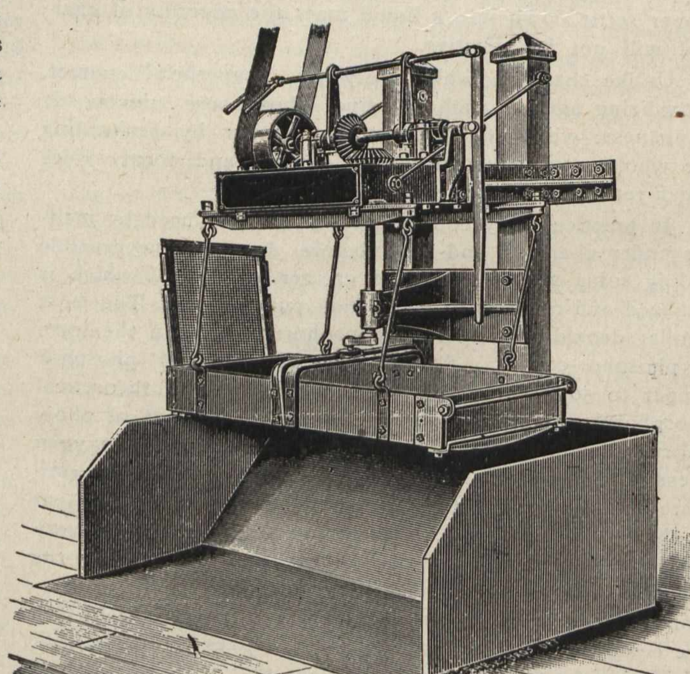
Designed by S. Groves.

The machine illustrated in connection with this article is an adaptation of an "Old World" flour mill device, viz.: a suspended sieve with crank motion, designed strongly and simply, to meet the requirements of a modern foundry. In these days of keen competition, to have each molder mixing his own facing is sheer folly, for no two founders agree as to the right proportions and grading of the sand mixtures to suit different forms and sizes of castings, as many a jobbing shop foreman knows to his sorrow; while the time spent by the skilled molder in riddling is manifestly uneconomical, since a laborer can do it just as well, leaving the molder to utilize his time on work commensurate with his rate of wages. Experience has demonstrated, that with a machine like the above, one laborer can prepare all the facing required by thirty molders, and be done each day by dinner hour, filling in his time in the afternoon helping around the foundry.

It is claimed that for the purposes of a jobbing foundry —where different grades of facing are necessary—a sand sifter is immeasurably superior to the best centrifugal sand mixer, for the latter breaks up and mixes into one grade only, sands, lumps of clay, nails, metal droppings, and, indeed, everything that is shoveled into the throat; while the former not only mixes, but sifts all that is thrown in, leaving behind in the riddle box the lumps of clay, scrap, etc., which are not required in the facing. This sifter is equipped with four sieves of 16, 8, 4, and 2 mesh respectively, which can be interchanged in a few seconds, either for the purpose of sifting the finest facing or cleaning up the floor of the shop, and saving the scrap for the cupola; and is so designed that, when in motion, the riddle box is tilted in all directions, thus embodying the idea of the most perfect hand riddling. Further, the driving mechanism is all above the falling sand, hence the wear of the frictional parts is reduced to a minimum, and when, in operation, is practically noiseless.

The design and construction of this appliance is the result of enforced economy by a foundry subject to keen competition, and has proved a valuable labor and money saving device.

The riddle box is operated at a speed of 130 revolutions per minute, and sifts five cubic yards of moistened sand in a No. 4 mesh riddle in 45 minutes. The whole machine occupies a floor space of about 6 feet 6 inches by 4 feet 6 inches.



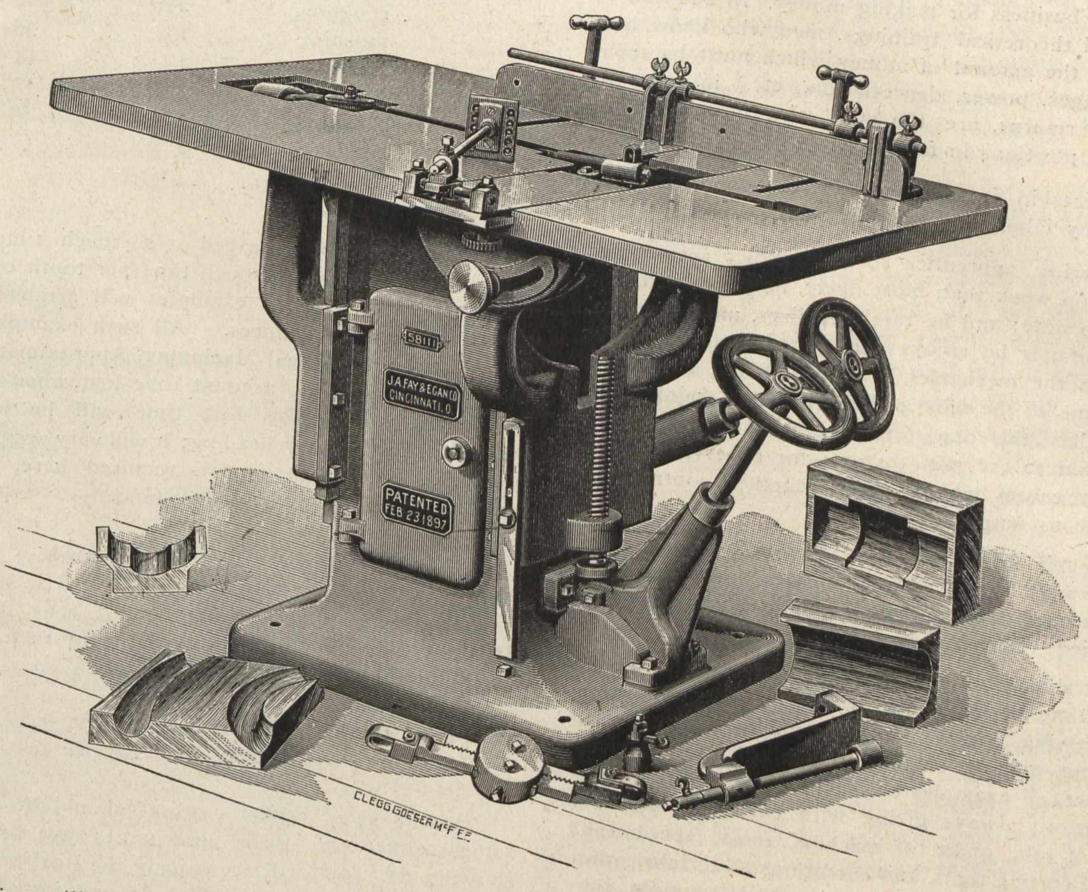
Sand Sifting Machine.

Experimental Tests.

Size of Riddle.	Cubic Yards of Sand Sifted.	Time. H. M.	Number of Stops Made for Cleaning Riddle.
No. 2	5	0—25	..
" 4	"	0—45	..
" 6	"	0—55	2
" 8	"	1—15	3
" 12	"	2—40	6

A NEW CORE BOX MACHINE.

The wood-working machine illustrated below is an entirely new and improved machine for making core boxes, and for work that requires recessing, duplicating, etc. It was patented February 27th, 1897, and the makers are J. A. Fay & Egan Company, Cincinnati, Ohio.



The machine will cut semi-circular core boxes of any length, and from ¾ to 20 inches in diameter. Semi-circular core boxes closed at the ends, with recesses of different diameters, can be made rapidly, and with corners of any desired shape.

On patterns with internal curves, such as the inside of staves, coves, and cutting out the under side of bosses to fit on rounded patterns, the work is done accurately and with great rapidity. For making large fillets on engine and pump frames, and other patterns of that character, it is unsurpassed, and is a great improvement over the old methods of working the curve.

It is not necessary to use clear lumber when making the cuts, for owing to the construction of the cutters, knotty lumber, cutting with or across the grain, a smooth surface is produced.

A radius attachment is furnished with the machine by the use of which circular core boxes are correctly produced, such as elbows, etc. The heads used may be set for different diameters, being so made that the bits are adjustable; by which arrangement fewer heads need be used to accomplish a wide range of work.

BOOKS RECEIVED.

The following books will be reviewed in our October issue:—

American Tool-making and Interchangeable Manufacturing.—By Joseph V. Woodworth. New York: The Norman W. Henley Publishing Co. Size, 9¼ x 6¼ inches. (Price, $4.)

Lives of the Engineers: Bolton and Watt.—By Dr. Samuel Smiles. London: John Murray. (Price, 3s. 6d. net.)

The Honorable Peter White: A recital of the discovery and development of the Lake Superior iron country.—By Ralph D. Williams, editor of the Marine Review. Cleveland: The Penton Publishing Co. Size, 9¼ x 7¼ inches. (Price, $1.50 net, postage 15 cents.)

The Metallographist, now The Iron and Steel Magazine.—Vols. V., VI., VII., VIII., and IX. Edited by Albert Sauveur. Boston, U.S.A.: The Boston Testing Laboratories. Size, 9¼ x 6¼ inches. ($3.50 each.)

Electricians' Handy Book: A Compendium of Useful Data, Covering the Field of Electrical Engineering.—By T. O'Connor Sloane, A.M., E.M., Ph.D. New York: The Norman W. Henley Publishing Co. Size, 4¾ x 6½ inches. (Price, $3.50.)

Mechanics for Engineers: A Text-book of Intermediate Standard.—By Arthur Morley, M.Sc., University Scholar (Vict.). London, New York, and Bombay: Longmans, Green & Co. Size, 7½ x 5¼. (Price, 4s. net.)

Modern Engines and Power Generators: A Practical Work on Prime Movers and the Transmission of Power—Steam, Electric, Water, and Hot Air.—By Rankin Kennedy, C.E. Vols. I., II., III., IV., V. (1904). Toronto: The George M. Morang Co., Limited, publishers. (Price, $15 per set.)

❧ ❧ ❧

The Hamilton Tool & Optical Co., of Hamilton, has perfected plans, we are informed, by which they will place upon the market a line of small tools such as milling cutters, reamers, twist drills, etc., which possess a number of new features.

❧ ❧ ❧

As a lubricant for wire rope Dixon's Hand Graphite Rope Dressing is the ideal. This dressing is put up in packages about the size and shape of an ordinary book, which contain about three pounds of graphite lubricant. The application is made by holding the open edge of the package to the cable, while in motion. Manufactured by the Joseph Dixon Crucible Co., Jersey City, N.J.

EXTRACTS FROM AN ENGINEER'S NOTE BOOK.

R. D. SPINNEY.

The Engineering Shop Pupil's Note Book.

Those students who intend to take up manufacturing branches of engineering cannot begin too early to consider engineering as a business for making money. In addition to having had good theoretical trainings, men who know best how to estimate the amount of money which must be spent (in material, wages, power, depreciation, etc.) in order to bring in certain returns, are the men who nowadays are wanted for high positions in factories.

An apprenticeship in the shops is the opportunity to learn how to buy labor, and what it costs.

The engineering apprentice so soon grows accustomed to every-day shop work that, most likely, he treats it as too commonplace to note; and he rarely realizes, until too late, the great advantages he enjoys during the time he works in overalls with the mechanics. A pupil should look upon this time as some of the most privileged in his training, for it is then he has the opportunity—perhaps never to be experienced again to the same extent—for observing accurately the many causes which, taken together control the relation of time to output.

The shop pupil should never go to work without a note book, which he may label "Time Examples." Another note book, though it need not accompany him to work, should be kept, and labelled "Time Averages."

In the first should be entered, at all opportunities, actual examples of time taken to do work. Full descriptions of turning, screwing, boring, drilling, machine tapping, milling, gear cutting, planing, shaping, punching, machine riveting, etc.; in fact, all examples of machine work which come under observation; always giving with each example, size and material of job, make of machine tools, speeds and feeds, styles of cutting tools, and conditions as to lubrication. In conjunction with, but separate from each example, time spent in "marking off," or what supersedes this, setting up, or taking down work, grinding and regrinding tools, and other remarks (such as, if the operator is a boy or man) should be tabulated, and the date when the note is made must always accompany it.

Examples in fitting should occupy another portion of the book. Descriptions of fitting and erecting are extremely difficult to note concisely; but, with judgment, many valuable examples may be entered. Actual examples of hand-work, however, such as racket-drilling, tapping, studding, rivetting, scraping, etc., should be greedily collected, and full remarks as to general conditions attached to them. Notes on hand work are particularly valuable, because they are not likely to grow useless with age; thus, apart from pneumatic or electric hand drills, a man will take as long now to drill a hole by hand as his grandfather took to drill a similar hole. On the other hand, in machine work, higher powers and faster steels increase output every few years. This remark must not deter a pupil from collecting machinery data.

When a large number of actual examples have been noted the similar ones should be averaged, and reduced to simple form for entry in the "Time Averages" note book.

For instance, under "drilling cast iron" will appear approximate averages somewhat as follows:—

½ in. twist drill,	1 in. deep,	time	½ minute.
1 "	"	"	1 "	"	"	1 "
1½ "	"	"	1 "	"	"	1½ "

Again, turning may be averaged for each diameter and per inch or foot in length, or at such a length per unit of time. Thus, under "mild steel shafting, 20 feet per minute, self-hardening cutters, finishing cutters flatnosed, lubricants, suds," a table may appear as follows:—

1½ in.	shaft,	roughing	1 ft.	in	1¾ mins.	or	32 ft.	per hr.
1½ "	"	finishing	1	"	1	"	59	"
1½ "	"	total	1	"	2¾	"	21	"
2 "	"	roughing	1	"	2¾	"	21	"
2 "	"	finishing	1	"	1¾	"	38	"
2 "	"	total	1	"	4½	"	13	"
2½ "	"	roughing	1	"	3½	"	17	"
2 "	"	finishing	1	"	2	"	30	"
2 "	"	total	1	"	5½	"	11	"

and so on.

Planing may be averaged at so much time per square foot; gear-cutting at so much time per tooth of given pitch one inch wide. Other examples will arrange themselves according to circumstances. All such examples should be under a title of "Actual Machining, Approximate Averages;" they do not take into account time lost when the machines are not at work. This lost time will be averaged, and entered under another heading; it will vary according to class of work. To explain what is required here, the following hypothetical case may be of assistance:—

20 in. A type cylinder, lathe work.

Marking off and setting in lathe..............	50 minutes.
Resetting for piston valve-seats, etc............	25 "
Grinding, altering, fixing tools, lathe at rest..	30 "
Total	1¾ hours.
Lathe running	7 "
Grand total	8¾ "

Therefore unproductive time=20 per cent.

A number of similar castings should be treated in the same manner and their percentages averaged. A sketch showing the work will accompany the final average. Unproductive time averages should be found for as many classes of work as fall under observation, and sketches should explain each.

A book of time averages as suggested above should be carefully guarded by the student. As he advances in his profession it may become one of the most valuable of his assets.

To arrange each book is not so difficult as may at first appear; the collecting of the necessary data will cover the whole time spent in the shops, while the averages may be worked out in odd moments.

In conclusion, let me advise students to affix source of information and data to all notes. An old note, if it does not tell from whence it was obtained, is never convincing, and if dateless, is little better than useless.

"TECHNICS," ENGLAND.

THE METRIC SYSTEM IN THE COLONIES.

The secretary of the Decimal Association has received a letter from the General Council of Chambers of Commerce of the Commonwealth of Australia, stating that at a meeting of that body held in Sydney in June last the following resolution was passed:

"That this General Council of the Chambers of Commerce of the Commonwealth of Australia views with satisfaction the increasing public interest in the metric system of weights and measures, and expresses the hope that it may very shortly be adopted for England and the Empire generally, and recommends that such legislation may now be framed in the Commonwealth as will enable us to at once follow the Home Country in this change."

The Canadian Engineer.

ESTABLISHED 1893.

With which is Incorporated

THE CANADIAN MACHINE SHOP

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, LOCOMOTIVE, STATIONARY, MARINE, MINING, METALLURGICAL, AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

SUBSCRIPTION—Canada, Great Britain and the United States, $1.00 per year, foreign, 6s. Advertising rates on application.

OFFICES—62 Church St., Toronto. TELEPHONE, Main 4310.

BIGGAR-SAMUEL, LIMITED, Publishers.

THOS. ROBERTSON, President. JAS. HEDLEY, Vice-President.

EDGAR A. WILLS, Sec.-Treas.

SAMUEL GROVES, Editor. J. J. SALMOND, Advtg. Representative

Editorial matter, cuts, electros, and drawings should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 10th of the preceding month.

PRINTED AT THE OFFICE OF THE MONETARY TIMES PRINTING CO., LIMITED, TORONTO, CANADA.

TORONTO, CANADA, SEPTEMBER, 1905.

CONTENTS OF THIS ISSUE.

IMPORTANT NOTICE.

With this issue we have incorporated "The Canadian Machine Shop." The reasons are lucidly set forth in the following circular letter, which tells its own tale:

To the Subscribers to THE CANADIAN MACHINE SHOP.

Since sending out the July number of "The Canadian Machine Shop," the proprietors have deemed it wise to reconsider the whole question of the future publication of that journal; and have come to the conclusion that they will be best serving the interests of the intelligent mechanics of Canada who have subscribed to "The Canadian Machine Shop," by incorporating in the columns of "The Canadian Engineer" the practical technical ideas and data specially prepared for the man in the Machine Shop.

Recently an earnest appeal was made to practical workers in the workshops of the Dominion for aid and co-operation in the endeavor to provide a magazine which would be not only educational in aim, but of great practical value technically. The response, however, not having come up to our expectations, it has been decided to discontinue the publication of "The Canadian Machine Shop" in separate form, and to embody its aims in the columns of "The Canadian Engineer." Each subscriber, therefore, to the "The Canadian Machine Shop," will receive a copy of the August number of "The Canadian Engineer" in place of "The Canadian Machine Shop" for that month, and so on monthly until the end of their subscription year.

We have reason to believe that we have been well advised in the taking of this step, and further believe that every subscriber will say, upon receipt of the August number and subsequent issues of "The Canadian Engineer," that the transfer has been a manifest advantage.

In this attempt to combine theory with practice, the publishers are desirous of having frank criticism of their work from time to time, and will do their best to profit thereby. Under the new management "The Canadian Engineer" is finding great favor—the July issue being exhausted before the end of the month. No time or expense will be spared to make it still the first and best Engineering Journal of Canada.

Very truly yours,

BIGGAR-SAMUEL, Limited.

PROGRESS IN GREAT BRITAIN.

It is quite the fashion in these days, to talk superciliously of the conservatism and even decadence of the "Old Country." But the recent visit of the Canadian Manufacturers' Association to Great Britain, and the enlightening reports brought back by its members, has caused quite a flutter in the camp of our modern Cassandra's. Britain, like Swedenborg's angels, seems to have the gift of growing younger with age.

What son of the Empire can forget the dark days of the Boer war! when disaster in the field, and financial resources on "Lombard Street" strained to the uttermost, caused pale faces on the streets, and evoked gloomy, despondent editorials from the press; when the war lord of Germany patted Paul Krüger on the back; French cartoonists grossly insulted our revered Queen Victoria, and all the great European powers showed their teeth, and with one accord prophesied the decline and fall of the British Empire. But every cloud has a silver lining. Instead of coming out of the South African struggle with discredited and damaged prestige, the "Mistress of the Seas," emerged stronger and more powerful than she had been since the days of Cromwell and Blake. The civilized world learned three things, (1) the astonishing ease and rapidity with which a quarter of a million British troops were transported across the seas—bearing out Edward Dicey's famous description of England as "a modern Venice with the sea for streets;" (2) that modern warfare with its magazine rifles, quick firing guns, and open order fighting, is a totally different thing to what it was in the days of swords, muskets and squares; and that Great Britain had at her call 250,000 seasoned men, trained to the use of modern weapons, and up-to-date tactics; (3) that in tackling Britain, the nations had to reckon not only with the tight little islands on the western fringe of Europe, but with an Empire of almost unlimited military resources in Canada, Australia, and India. These are the main reasons why the so-called "Old Country," instead of sinking to the status of a third rate power, as was predicted, was at the beginning of, and throughout the recent war between Russia and Japan, able to look Europe squarely in the face and cry, "Hands off!" Great Britain's power in the council of nations is as great to-day, if not greater, than at any time in her eventful history. But tempting though it is to dwell on the larger outlook when dealing with the causes of recent progress, we are more concerned with the remarkable commercial development which is taking place before our eyes. Just as a ploughing up of the soil is needed in the springtime, if the earth is to bring forth a bountiful harvest, so it seemed that Britain needed a terrible lesson like the South African war to waken her up from Laodicean contentment and chronic inertia, to a rehabilitation of her waning industries and fading commerce. It was John Milton who sang,—

"Peace hath her victories, no less renowned than war."

The turn of the tide has evidently begun. Britain's foreign trade for the first seven months of this year was: Imports, £317,847,399, an increase of £4,954,008; exports, £183,527,272, an increase of £14,627,023; in each case the increase is over the corresponding period of 1904. Within the last three years one of the most admirably planned and perfectly equipped engineering plants in the world—covering 130 acres, has been established in Manchester for the making of electrical appliances, steam turbines, gas engines, etc., and is already enabling Great Britain to take the lead in electric locomotive traction. (See page 278). The article on Electric Steel (page 268), shows that Sheffield has already secured the patent rights of the best electric furnace invented so far; just as the same city secured, several years ago, a monopoly of the best converter system (Tropenas) for the making of steel castings. Within the last two years, the British and Scottish locomotive builders have been doing a flourishing business, especially in Japan. In the manufacture of gas engines, Crossley Bros., of Manchester, easily outstrip in sales all other makers; and their plant, specially designed for this class of work, is worth while crossing the Atlantic to see. Lately this firm has invented a gas turbine of which more will be heard. The famous Assouan dam in Egypt shows the genius and skill of her engineers. The Suspension Bridge across the wonderful Victoria Falls, on the Zambesi, South Africa, is one of the finest engineering feats of modern times. While the magnificent piece of railroad engineering and bridge building involved in the construction of the strategic railway across Mexico, done by Pearson Bros., of London, but of which the world has heard little, is one of the greatest Civil Engineering triumphs of the age. In naval architecture and engineering, the "Old Land" is supreme. Of the twelve Japanese warships engaged in the recent naval battle in the Sea of Japan, eight were designed and built in Great Britain, while the entire attack was conducted with guns made on the banks of the River Tyne! We could with pleasure, add to these startling revelations of commercial progress and mighty engineering achievements of recent date; but we have cited examples enough to prove, that instead of Great Britain being on the down grade, she is once more on the way to commercial supremacy. Canada has reason to be proud of her connection—even with the "Old Country."

Editorial Notes.

Thurston's Investigation Limit in Engineering. The late Professor Thurston, in an article entitled, "The Passing of the Steam Engine," set forth the opinion, that only three lines of invention were open to the investigator, (1) The production of electricity direct from coal; (2) the making of light without heat; similar to that of the glow-worm and fire-fly; (3) aerial navigation. We shall be glad to have the views of our readers on these lines of thought.

Data in Our Next. In this issue we have devoted considerable space to Metallurgy; in our October number we purpose setting forth the latest data on steam turbines, suction gas producer engines, and storage battery electric locomotives; together with a graphic description of machinery for the making of confectionery, etc., and the celebrated Iron Foundry of the British-Westinghouse Company, Manchester, England.

Utility First. Some of our technical contemporaries are evidently of opinion that the cover is an important factor. An attractive outside appearance is not to be despised, but there is a limit. We are anxious to consider our readers as intelligent Engineers and Mechanics, not inmates of a kindergarten.

Natural Selection.

Or the Law of the Survival of the Fittest, viewed as applied to the Development of the Industrial Arts.

BY EGERTON R. CASE.

(Registered in accordance with the Copyright Act.)

It occurs to me that it would be of considerable interest to draw a parallel (as far as possible) between Darwin's Law of Natural Selection, or the Law of the Survival of the Fittest, and the best rule for an inventor to follow in inventing, so as to prove the procedure I (and perhaps others) advocate embodies a law that is constantly at work in organic beings.

Darwin defines Natural Selection as implying the preservation of individual differences and variations that arise and are beneficial to the being under its conditions of life, and the destruction of those which are injurious.

There are gradations in the state of perfection in the development of an invention, as truly as there are gradations in the state of perfection in the development of organic beings; and it is only through a thorough knowledge of such "states of perfection" that an inventor can reach the highest success.

As is well known, all the modified descendants from a widely diffused species, belonging to a large genus, will tend to partake of the same advantages which made their parents a success in life; the same way with inventions belonging to the same class;

THEREFORE,

The Law of Industrial-Arts' Development implies the preservation of those elements and process-steps that are beneficial to the invention; the discarding of those elements and process-steps that are injurious thereto, and the combining with the beneficial elements or process-steps new elements or process-steps that will make the invention a MODERN success.

According to the spirit of this article, the inventor would naturally take up the art he is most familiar with, and pick out therefrom some invention (and there are many of them) that has failed for want of some improvement, to be most valuable. By studying carefully the state of the art relating to this invention, the inventor will have before him the elements that have made each succeeding invention a success over the immediately preceding ones, and will then have the foundation for the development of further steps. In other words, he will possess the genealogical succession, so to speak, of the beneficial elements. If he is careful, he will combine with the elements chosen from the prior state of the art, new elements that will make the invention a modern success, and thus follow after an industrial manner, the law at work in nature whereby organic beings are developed and equipped so that they can best exist under the then existing conditions of life. By following further this law, it is apparent that new genera and species of inventions will of necessity be developed from time to time, as are new genera and species developed in human beings.

The charge may be laid against this plan that it would tend to make inventors less original, that is, cause them to copy too closely the existing inventions in the prior art. But careful thought will dispel this belief, as above noted. Even if an inventor determines to work upon original lines, he must acquaint himself with the prior state of the art, in order that he may successfully keep away from the beaten paths of prior inventors.

It is well known that for every generic invention, there are many secondary inventions. So it is perhaps in connection with secondary inventions that a knowledge of the law set forth in this article will be most useful.

When an inventor goes blindly to work, that is, without any knowledge of the prior state of the art, he spends much time and money in travelling well-beaten paths made by the patient toil of previous inventors; whereas, if he followed out the plan herein set forth, he would soon acquaint himself with the successful and unsuccessful steps made by his predecessors, and act accordingly; this is an indisputable fact.

Because an inventor finds that all through an art certain elements therein have been retained, it does not follow that he need combine these elements in the same manner; the requirements of the case will, of course, determine this, coupled, of course, with the inventor's mental capacity.

I do not say that, between my statement of the law to be observed in developing inventions, and Darwin's Law above cited, there is a complete parallel. The inventor, of course, has more immediate freedom in his choice of combination of elements than if he were working through a process so slow as that of Natural Selection. But it would seem that he is bound to recognize and adopt those elements in prior inventions that have contributed to, or that have been the sole cause of, the success of same.

It is well known that inventors oftentimes find great difficulty in making improvements or fully developing their inventions in order to make them commercial. When these periods or states of non-development are taken into account, it appears to me that there is quite a parallel between the development of an invention (particularly a complicated one), and the Law of Natural Selection. When the inventor cannot at once make the step or improvement he wishes, it naturally follows that he cannot draw upon his past experience, and his knowledge of the prior state of the art, in order to supply that defect; consequently a mental process (which I might term Mental Natural Selection—Inventing) must be gone through before the inventor can arrive at the result he is aiming at. The more fertile the brain in which the idea has lodgment, the quicker will the mental powers absorb, so to speak, that idea, and give birth to it in concrete form. So likewise in the development of the organic being; the more suitable the conditions, the quicker will a genus or species be developed that can best exist under the then existing conditions of that period of life.

Darwin states it is notorious that specific characters are more variable than generic. In machines, the main or essential elements we will consider as being the basis for the generic claim. Although they may be modified, these main elements are not subject to the same amount of modification or variation as are the minor elements that are made use of in combination therewith. As is well known, these minor elements are often claimed as means or mechanism for the very reason that they are subject to great variation; that they may be constructed in many different ways and yet be capable of use in combination with the essential elements.

As Natural Selection will never produce in an organic being any structure more injurious than beneficial to that being, it follows that when an inventor proceeds along the right lines of development, he will naturally use elements that will always contribute to the success of the invention. Natural Selection tends only to make each organic being as perfect as, or slightly more perfect than, the other inhabitants of the same country with which it comes into competition. Consequently the properly-directed efforts of an inventor must essentially produce as good or better an invention than those prior thereto, and with which it must inevitably come into competition. The chances are greatly in favor of a better invention being produced, as all inventive effort is exercised for that very end.

I do not pretend to any great knowledge of Darwin's above-mentioned law, and any errors I may have committed must not be too strongly dealt with. If I have touched upon a method of development well known of organic beings so as to try and prove to inventors that there is an easier or more natural method of reaching their goals than is now generally practised, and succeed ever so little, I shall be content. When we look around us and consider what humanity at large owes to the inventor of all nations, we must acknowledge our great indebtedness to him. His success is many times purchased by the practice of great personal privations, and often without reaping the rewards his heroic and unselfish efforts have merited.

Many inventors will ask how they are to get knowledge of what inventions have been already made in a particular art. The best way to procure this information is to get copies of all the patents granted in that art.

As certain as day follows night, if an inventor proceeds in his investigations after the manner I have endeavored to prove to be the correct one, he will obtain the maximum success with the minimum expenditure of time and money.

What I have herein stated relative to the development of the Industrial Arts, applies with equal force to the development of the Fine Arts.

CORRESPONDENCE

Editor Canadian Engineer:

Sir,—Enclosed please find one year's subscription to "The Canadian Engineer." I would appreciate it if you would let me know what the standard rate paid for locomotive machinists is; also, how long do apprentices serve?

Yours respectfully,

(Sgd.), A. G. CUTHBERT,

Sacramento, Cal., U.S.A.

[(1) Locomotive machinists are paid 24 cents per hour. (2) Apprentices serve four years in contract shops, and five years in railway shops.—Editor.]

NATIONAL OWNERSHIP OF TOWN SITES ON GRAND TRUNK PACIFIC RAILWAY LANDS.

Editor Canadian Engineer:

As the Canadian Government is incurring great expenditures and liabilities in promoting the G. T. P., it seems only fair that the termini on the Pacific, Hudson Bay, and Atlantic, at least, should be, and remain, Dominion property, to be sold in "Zones of Value," only to parties ready to occupy and improve the same. Sites should not be less than ten miles square, and lots one-fifth to one-tenth acre each; with wide streets, parks, and public squares. The advantages of being freed from provincial and municipal interference must be reciprocated by a clean active style of management, and the power to "do things" must be in competent hands, and all ring influences carefully eschewed. The sites must be judiciously selected, and put into shape for immediate sale and use, with no boom methods. The rails, pavements, water and electric works, and sewage could be kept abreast of the building enterprises, so that the streets need not be broken up again.

By such a system progress would be uniform, and all the advantages of a city would be at the door of a house when it was ready for occupation; slums avoided, and more uniformity of building ensured.

With such a system, fully carried out, a very large proportion of the values created by building the railway would be recouped at once; and the same principle might be made applicable to a proportion of the lands intervening between the terminal cities. A portion might be given to the municipalities traversed, but the chief values should be retained to defray cost of survey and construction by the country. The more the government can retain, the greater benefit will arise to the nation, and the less influence to the boomer of real estate. If public ownership means anything more than a war-cry, let us give it a fair trial. Civilization is the logical outcome of intelligent public co-operation for the common weal.

Yours very truly,

(Signed) THOMAS FROOD,

Little Current,

North shore Lake Huron, Ont.

INDUSTRIAL NOTES.

Fire did $2,500 worth of damage to the premises of the Montreal Engine Works.

It is reported that an extensive cement plant is to be located at St. Peters, C.B.

Mr. D. L. Holden is preparing to establish a windmill and power pump industry in Whitby, Ont.

The London Tool Co. have purchased an $80,000 site in Hamilton, on which to erect a large factory.

The Ingersoll Nut Co. have awarded the contract for their building to Messrs. Nagle and Mills, the tender being $9,250.

The Consumers' Gas Company, Toronto, has begun work on its new $50,000 retort house at the foot of Saulter Street.

The Dominion Iron & Steel Company has ordered a 130 horse power Robb-Mumford boiler from the Robb Engineering Company.

It is stated that by November 1st, the Brantford Gas Co. will be supplying natural gas to that city at a charge of 35 cents per 1,000 ft.

The C.P.R. have given a contract to J. McDiarmid & Co., Winnipeg, for new machine shops at Moose Jaw. The price is said to be over $40,000.

The Robb Engineering Company is building two 200-horse-power Robb-Mumford boilers for the Cumberland Railway & Coal Company, Springhill.

The amount paid by the Chicago Pneumatic Tool Co. in the purchase of the Canadian Pneumatic Tool Co. was $60,000 instead of $600,000 as reported in our last issue.

The Green Fuel Economizer Co., of Matteawan, New York, has just completed the erection of a large shop, designed to provide for its rapidly increasing business.

The Climax Good Roads Machinery Co., Marathon, N.Y., manufacturers of structural steel road machinery, etc., are considering establishing a factory at Peterborough, Ont.

The premises of the Starke Hardware Co., Montreal, were recently destroyed by fire, which did $100,000 damage, partly covered by insurance. Work on a new building has already begun.

The Consolidated Hardware Co. are opening up a business in Hamilton. Mr. F. E. Robson, of Toronto, is the chief person in the enterprise. The company will employ about thirty hands.

The Dominion Carriage and Bearing Co., Limited, will at once secure a charter and erect a plant at Amherst, N.S. The capital of the company will be $200,000, with power tc increase to $500,000.

The R. E. T. Pringle Co., Limited, have opened a new office and warehouse in the Empire Building, 62-64 Wellington Street West, Toronto, where they will carry a full line of electrical supplies, etc.

H. A. Richardson will establish a peat-making industry at Winnipeg. He estimates that peat fuel produced by his patented process can be supplied to Winnipeg consumers at $5.50 per ton, and will compare favorably with anthracite.

The Ontario Portland Cement Co., of Brantford, have issued a writ against the city for $19,880, the balance of the contract money for the cement for the year, and a claim for damages of $10,000, for alleged breach of contract.

A representative of the Frost & Wood Implement Co., Smith's Falls, Ont., was in Edmonton, N.W.T., recently, with a view of having headquarters for the West established there. The intention of the company is to erect a large warehouse.

It has been announced that the control of the Niagara, Lockport and Ontario Power Co., and of the Iroquois Construction Co., together with the Westinghouse Company, has passed by sale of the individual interests to a new syndicate, headed by George Westinghouse and John J. Albright, Buffalo.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, has returned from Europe, where he spent several weeks in the interest of the company. He brought back with him orders for 3,400 tools for shipment from America, representing a value of over $300,000.

The shareholders of the Guelph foundry decided that for the purpose of reorganization the company should go into voluntary liquidation. W. M. Doherty was appointed liquidator. The factory and molding shop are running full force, and the proceedings will in no way affect the operations of the company.

One important use for compressed air is in the operation of quarries. Messrs. Kelly Bros., of Winnipeg, have just purchased from Allis-Chalmers-Bullock, Limited, Montreal, six Haeseler pneumatic hammers for dressing stone. These will be operated by an Ingersoll-Sergeant air compressor, class "E," driven by a 25-h.p. induction motor.

The Canada Brass & Supply Co. has opened a branch at 149 King Street West, Toronto. A full line of engineer's brass goods will be carried in stock. The whole of the ground floor and basement are occupied, and in addition, they have a warehouse on Queen Street. Mr. R. W. Crashley, formerly with the James Robertson Co., Ltd., is in charge.

An interesting engineering operation will be the construction for the Ontario Power Co., of a tunnel from the transformer station on the high bluff overlooking the Provincial Park, the falls and the river, obliquely through the bluff and the cliff to the power house just below the Horseshoe Falls. The intention is to use this long bore as an elevator.

Messrs. Krug & Crosby, of Hamilton, have, owing to a constantly increasing demand for their specialties been compelled to move into more commodious quarters at the corner of North Bay and York streets. They are finding a most ready market for their drill chucks, power hack saws, sensitive friction drills, and other specialties. We congratulate the gentlemen referred to on the happy condition which warrants them taking this move.

Among the recent sales of Allis-Chalmers-Bullock, Limited, Montreal, are a mining outfit to the Canada Metal Co., Ainsworth, B.C., including one 15-h.p. vertical boiler, one 40-h.p. vertical boiler, two No. 5 Cameron sinker pumps, one 6¼ x 8" hoisting engine, one 7 x 10 hoisting engine, ore buckets, etc., and to the Souris Coal Mining Co., of Bienfait, Assa., one 75-h.p. Lidgerwood hoisting engine of the combined friction drum and brake, and reversible link motion type.

The contract for the hydraulic and electrical machinery for the city of Nelson power plant on the Kootenay River has been awarded to Allis-Chalmers-Bullock, Limited, Montreal. The tenders were:—Canadian General Electric Co., $32,000, for the electrical machinery; the Canadian Westinghouse Co., $31,376, for the electrical machinery; and Allis-Chalmers-Bullock, Limited, $29,985, for the electrical, and $13,600 for the hydraulic machinery. The latter company having tendered for both the hydraulic and electrical machinery had an advantage over the other two, and were awarded the contract.

MINING MATTERS.

The Crow's Nest coal beds are estimated to hold enough coal to last for 5,000 years, if mined at a rate of four million tons a year.

The Montreal Copper Company has just made a large shipment of copper to China, which is to be used for the new coinage system.

Professor Miller, provincial geologist, reports an important discovery of bessemer iron ore at Loon Lake, east of Port Arthur. It is said the deposits are much more extended than first supposed, and that the quality is of a high grade.

A discovery is said to have been made by Herr Erfurt, a chemist, who has succeeded in transmitting the qualities of radium to a substance he calls radiopher, which can be made cheaply. It can be injected under the skin and in other parts of the body, and is said to possess all the qualities of the original radium.

The Canadian Copper Company will erect a customs smelter for the treatment of ores at Copper Cliff at a cost of $75,000. The smelter will be ready for business by October 1. The Copper Company has a water power at High Falls, 25 miles distant from Copper Cliff, and is establishing a plant there for the transmission of power to Copper Cliff, expending $750,000.

PERSONAL.

J. E. Dalrymple has been appointed general freight agent of the Grand Trunk Railway, with headquarters at Montreal, and John Pullen, assistant freight traffic manager.

Archie Glassco, of the Dominion Bridge Company, a graduate of McGill, and a native of Hamilton, has been appointed bridge engineer of the Grand Trunk Pacific, with headquarters at Montreal.

The governors of Dalhousie College, Halifax, have appointed E. B. Jack now with a Roanoke, Virginia, bridge company, to take the chair of civil engineering vacated by the resignation of Professor Dixon, who goes to Manchester University.

It is understood on the best authority that J. C. Sullivan, divisional engineer of construction for the Canadian Pacific Railway, with headquarters at Winnipeg, has been engaged as one of the expert engineers on the construction of the Panama Canal for the United States Government.

RAILWAY NOTES.

The C.P.R. will build a new station at Guelph, Ont., at a cost of $40,000.

Jas McDiarmid, contractor, Winnipeg, has begun work on the new $20,000 station for the C.P.R. at Medicine Hat.

The Michigan Central Railway have appropriated $100,000 for improvements in their shops and equipment at St. Thomas.

Surveys are being made for an electric railway from Peterborough to Young's Point, a distance of fourteen miles. The company will purchase its right-of-way.

The Guelph and Goderich Railway Co. are ready to call for tenders for twelve stations along the line. The contract which comprises $150,000 worth of buildings, will be awarded to one contractor.

The contract for the erection of a depot and office building for the Canadian Northern Railway at Winnipeg has been awarded to Winnipeg firms. Work has already commenced on the building.

The city council of Chatham, Ont., has appointed a railway committee, composed of Ald. Austin, Marshall, Edmondson, King, and Potter, to look after steam and electric railway matters for the city.

The Hill Electric Switch Co., Limited, of Montreal, has just received contracts for the construction of switchboards for the Canadian Pacific Railway at Brandon, Man., and the Valleyfield Electric Light Co., at Valleyfield, P.Q.

One fully equipped box car every 25 minutes, and one new engine ready for the road every seven days is the rate at which the C.P.R. Angus shops are preparing that road to handle the western wheat crop. The cars are of the most modern description, capable of carrying upwards of 700 bushels of wheat, while the engines are the most powerful known.

The National Construction Company has entered into a contract with the Grand Trunk Pacific Railway Co. to build their line from Winnipeg to the Pacific ocean as well as the branch line from Fort William to Lake Superior Junction. This corporation is composed of leading capitalists and railway men. All the tenders now being asked for will be addressed to the National Construction Co.

The C.P.R. have decided to gradually replace all their main line wooden bridges with steel, along tne Pacific division. A step in this direction has just been taken in the letting of contracts to the British Columbia General Contract Company for the replacing of the wooden piers of the company's main line bridge across the Pitt River with concrete piers.

EDUCATIONAL.

The University of Wisconsin, College of Mechanics and Engineering, Madison, Wis., U.S.A., has just issued bulletin 121, which describes the courses in Chemical and Gas Engineering, which have recently been adopted.

The Canadian Correspondence College, 161 Bay St., Toronto, Canada, has five distinct and separate courses in Electrical work. Viz.;—Electrical Engineering; Electric Lighting; Telegraphy; Telephone Practice; and a course for Electric Railway men. It also has a course in Machine Design and Mechanical Drawing.

The Grand Rapids School of Mechanical Drawing, 361, 362, 363 Houseman Building, Grand Rapids, Mich., U.S.A., gives a comprehensive description of its courses in Geometrical and Mechanical Drawing as taught by mail in an illustrated booklet which it publishes, and which will be mailed on request.

TELEGRAPH AND TELEPHONE.

The city council of Guelph has renewed the franchise of the Bell Telephone Company for five years.

The ratepayers of Dauphin, Man., have unanimously endorsed the principle of municipal ownership of the telephone system, and the council will at once proceed to raise the money by debentures to install the same. The Bell Company is already on the ground, which means that Dauphin is to have two telephone systems.

A new telephone line is to be constructed between Bancroft, Coe Hill, St. Ola, Trenton, Madoc, Marmora, Belleville, Bird's Creek, and Maynooth, to connect with a large number of places north of the C.P.R. in Hastings County. The people, it is said, tried in vain to have a line built by the Bell Company. Some of the merchants, therefore, formed a company of their own, and are now building an up-to-date line. The principal residents interested are Messrs. Clarke, Sargant, and Green.

MUNICIPAL WORKS, ETC.

The waterworks system of St. Boniface, Man., will be extended at a cost of $40,000.

At Palmerston a by-law to raise $3,000 to improve the town's electric light plant carried.

The municipality of Stanley, Man., has made arrangements to drain 19,000 acres of land at a cost of about $9,000.

At St. Mary's a by-law for $15,000 for the extension of the waterworks and electric light system was voted on and carried.

Perth town council has passed a by-law providing for the issue of debentures to the amount of $20,000 to complete the sewerage system in that place.

The town of Moosomin, N.W.T., has decided upon a drainage and sewerage system. A waterworks scheme is also under consideration.

At Listowel a by-law to borrow upon debentures the sum of $16,000 for the purpose of constructing permanent steel and concrete bridges on Bismarck, Wallace, Main, and Elma streets, was defeated.

The town of Chatham is considering spending about $35,000 on the enlargement of its electric light plant. This is in accordance with the recommendations of an expert from Montreal who has gone over the property.

MACHINE SHOP NOTES FROM THE STATES.

BY CHARLES S. GINGRICH, M.E.

XIX.

A large amount of work done in every machine shop must necessarily, from the very nature of things, consist of finishing flat surfaces. It is the law of many shops, that this sort of thing must be done on the shaper or planer, because that's the sort of work these machines are for. Besides, "it always was done that way."

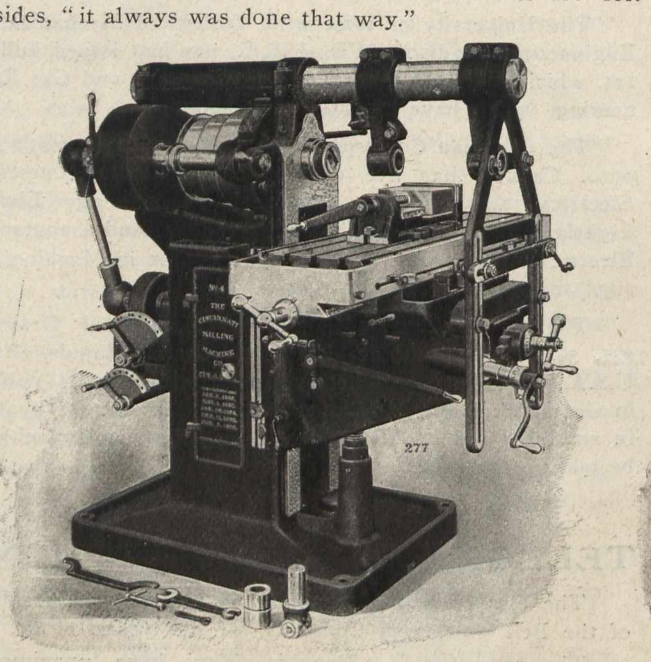


Fig. 1.—No. A. Plain Cincinnati Miller, with Double Back Gears and New Knee.

Now, one object of these articles is to show the poor economy of these old time methods. In most modern shops the tendency is to take more and more the work from the planer and put in on the miller. One of the machines that have won the widest popularity and have been chiefly instrumental in broadening the scope of milling, is shown herewith in Fig. 1. This type of machine has the broadest application and is in most general use. Fig. 2 shows it in operation on a job that would be exceedingly awkward on any other tool. The cutter is 12" diameter, taking a cut ⅛" deep across the entire surface of a grey iron casting 9" wide at nearly 5" per minute table travel. The piece is 18" long, and the cut takes just about 6½ minutes. The chucking takes

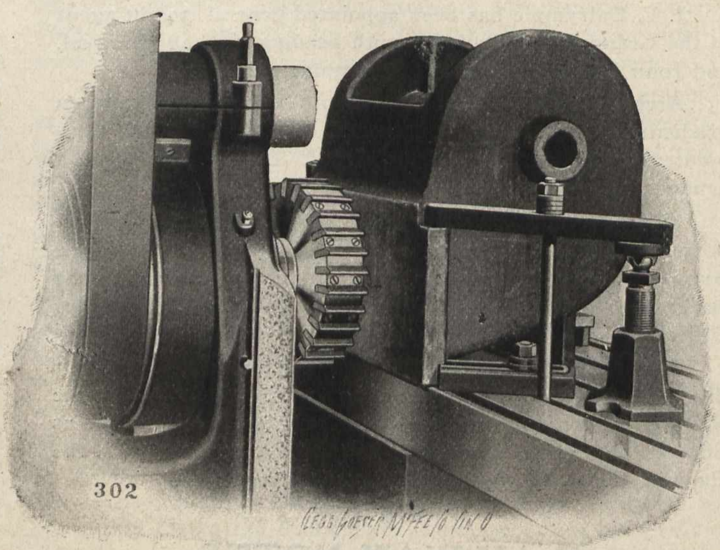


Fig. 2.

about as long as on a shaper or planer, but the saving is in the actual cutting time and is represented by the difference between 6½ minutes and the time a planer would take to do it.

CANADIAN ASSOCIATION STATIONARY ENGINEERS.

SIXTEENTH ANNUAL CONVENTION.

The members of the Canadian Association of Stationary Engineers held their annual Convention in the municipal council chamber of the city of Chatham, Ont., on August 22nd and 23rd. The thriving Maple City, located on the banks of the River Thames, is ambitious to be known throughout the Province as the "City Beautiful"; and if its eight miles of wide, well-paved business streets and fine tree-shaded residence avenues, picturesque Tecumseh Park—famous as the spot where the renowned Indian chieftain made his last stand—general air of orderliness and cleanliness, and true colonial hospitality entitle its inhabitants to use the æsthetic predicate of "beautiful" in describing their prosperous industrial city, then assuredly, their claim is valid; for before the end of their conclave, every member of the C.A.S.E. was evidently ready to declare upon affidavit that historic Chatham is an ideal Convention city.

The local Reception Committee, composed of Messrs. Hayes, Congdon and Jamieson, cordially received the delegates and visitors at the railroad station and at the headquarters in the Garner House, and extended a hearty greeting to their city; while the Entertainment Committee, viz., Messrs. Grandbois, Kelley and Head, announced the various social events, and succeeded admirably in making the automobile ride around the city, the steamboat ride down the river, the city fire department demonstration and the banquet, pleasures long to be remembered.

Owing to the nearness of the National Exhibition at Toronto, and difficulty in making convenient railroad connections, the attendance of delegates was not as large as the previous year; but if the earnestness, general knowledge of the stationary engineer's craft, and first-rate debating power of those present was representative of the general fraternity, then it is manifestly an organization of which any first-class mechanic might be proud.

The session was formally opened by President F. J. Sculthorpe, of Hamilton, at 10.30 a.m., and the following is a list of the Executive officers:

W. A. Sweet, of Hamilton, Vice-President; W. Inglis, of Toronto, Secretary; J. M. Dixon, of Toronto, Treasurer; W. Outhwaite, of Toronto, Conductor; E. Grandbois, Chatham, Door Keeper.

Below is a list of entitled delegates and past presidents, taken from "The Chatham Daily News":

Hamilton.—Messrs. F. J. Sculthorpe, W. A. Sweet, W. A. Crockett, J. Ironsides, R. C. Pettigrew.
Toronto.—Messrs. W. Inglis, W. L. Outhwaite, C. Moseley, J. Hughes, W. McGhie, F. J. Stubbs, J. M. Dixon, A. M. Wickens.
Chatham.—Messrs. Grandbois and Kelly.
Dresden.—W. R. Steeper.
Berlin.—W. R. Oelschlager.
Brantford.—Jos. Ogle.
Brockville.—W. F. Chapman.
Waterloo.—M. Beam.
St. John, N.B.—E. W. Graham.
Vancouver.—G. W. Flower.

At the various morning, afternoon and evening sessions numerous visitors were present.

In the absence of Mayor Cowan, the official greeting of the municipality was relegated to Charles Kelley, of Chatham.

Then followed the president's

INAUGURAL ADDRESS.

The President, F. J. Sculthorpe, commenced his brief, but pointed address by extending the fraternal greeting of the executive council to the assembled delegates. Referred to the work of the Association during the past year, and declared that, although progressive, their membership had not increased as rapidly as it ought. Although the best engineers in Canada were in their ranks, a large number of competent men were outside their Association, and he exhorted the ways and means committee to work wisely and strenuously to interest and win the unaffiliated stationary engineers. He also recommended the appointment of a legislative committee to draft a new bill making it illegal for any stationary engineer to have charge of an engine over 25 horse-power unless in possession of a Governmental license, and suggested co-operation with the Ontario Association of Stationary Engineers, with a view of jointly working for the enactment of the proposed License Law. Reference was made by the speaker to the change made at the last convention of the Association in striking out the word "Stationary" from the name of the Association, and substituting the word "steam" in place thereof. The president suggested that the word "stationary" be reinstated. He, moreover, advised the issuance of a certificate of membership, and strongly proposed the enlargement of their scope of membership, so that it should include any British subject possessing the necessary qualifications. (1) Good moral character; (2) practical knowledge, and (3) three years' experience.

The president concluded by expressing his heartfelt thanks for the way in which the members had stood by him in his year of office, and expressed the conviction that the association was entering on an era of unparalleled success.

This address was followed by the reading of the minutes and by the report of Executive Secretary, W. Inglis, of Toronto, which was as follows:

SECRETARY'S REPORT.

In presenting my third report to you, and our 16th annual report, I am pleased to say that we still live to do business, and propose to do so in the future.

The past year has been one of pleasant dealings in all the branches, and we have made some progress. We only need energy and means, to be what we should be—"The leading Society of Stationary Engineers in the Dominion."

There are some matters mentioned in a previous circular letter sent out by me on which I would urge some action. First, the institution of a sick benefit controlled by the executive, and this can be carried on successfully if organized properly.

Second.—We should have a board of examiners to grant certificates to competent engineers.

Third.—We should cut our per diem pay during convention so as to give the executive more funds to work on. It is a fact that if the executive had more funds at its disposal we would then be on a par with other societies having that privilege. During the past session of the Ontario Legislature a strong committee of stationary engineers applied for the License Bill to be passed, but failed. I am led to believe that we will never have the bill passed till all stationary engineers in all parts of the province unite in more faithful work in its interests.

During the year we were to get out a suitable button, and as I found my time much taken up, I asked the assistance of Bro. Outhwaite, and this Bro. procured a button and sold same to all the branches at reasonable cost. The thanks of the executive is due Bro. Outhwaite for the capable manner in which he handled this work. Your executive were also to procure a certificate of membership, but owing to the cost of getting a plate or a stone we abandoned the work to see if certificates of competency would be granted at this convention.

Re membership: I regret that we have not organized any new branches this year, but all the other lodges have made suitable progress to retain their membership in a good healthy condition. All the lodges have not yet reported, but they are expected to do so before the books are handed over to the auditors, and they will probably report regarding their finance and membership.

The correspondence during the year has been large, with inquiries regarding our organization generally, but we always lack the working point and in this is our weakness.

During the year my labors with the executive have been all of pleasure and good will, and all of your executive have worked for the good of the order at all times.

In conclusion, permit me to say that I cannot accept the position again as your secretary, so in the interests of the order choose well one as my successor, as he, you may say, is the guiding figure. I heartily thank you for the past three years' honors, and will always have a pleasant remembrance of my work and the co-operation of all the brethren, and will always do all in my power to further the work of the order, and I trust my successor will be tendered the same loyal support which has been tendered me.

Thanking you once again, I am,

Yours fraternally,

W. INGLIS, Executive Secretary.

The president's address and secretary's report having been referred to the "Good of the Order" Committee, consisting of A. M. Wickens, C. Mosley and Chas. Kelley, W. A. Sweet and W. L. Outhwaite, the first session was adjourned until 2 p.m.

Tuesday Afternoon Session.

Upon reassembling at 2 p.m. the proceedings were resolved into a general discussion on the reasons for the rejection of the proposed license bill at the last session of the Ontario Parliament.

Retiring President F. J. Sculthorpe.

W. A. Sweet, the New President.

Joseph Ironside, new Vice-President.

A. M. Wickens, of Toronto, opened the debate, stating his conviction that lack of harmony among the various Societies of Stationary Engineers—"International," "Ontario," and "Canadian,"—was mainly responsible for their failure to get a License Law passed. He handled without gloves the Canadian Manufacturers' Association, who opposed the Bill and issued a letter to the members of Parliament, which he read and denounced as containing misleading statements, and declared that "the man who wrote it, knew he was writing what was not true," inasmuch as the letter alleged that their aim was to compel all Stationary Engineers to have a license, whereas their demand only applied to those in charge of engines 25-horse-power and upwards. He recited their futile efforts to get a conference with the Canadian Manufacturers' Association, and concluded by pronouncing the rejected Bill as being very unsatisfactory; since it would compel engineers to report to an irresponsible body, and hence lead to much litigation. W. A. Crockett, of Hamilton, in a very able speech told how the Hamiltonians had worked for the Bill; referred to their correspondence in "The Hamilton Spectator," spoke of the courteous manner in which they had been treated by Premier Whitney, and concluded by saying, that they were astonished when the news reached them, that the Bill had been negatived; because all the indications in their part of the Province were favorable to the enactment of the License Law. Chas. Mosley, of Toronto, emphasized his belief that the Bill was rejected because "badly drawn," and "ridiculous." Said he, "even the Boiler Insurance Inspectors would have kicked, if they had thought it would be passed." A measure embodying their views was to have been drafted by Mr. Wier, but he failed, and at the last moment, the "old bill," prepared by factory inspectors, and which was simply an "election dodge of a dying Government," was caught up by Dr. Smellie, M.P., for Fort William, and thrown before the House—imperfect though it was.

At this stage a resolution was proposed by Secretary Inglis, as follows:

Resolved, that someone be appointed by the Association to draw up a letter in reply to the article against the License Law Bill, which appeared in the June Issue of THE CANADIAN ENGINEER, and that the same be forwarded to the editor, requesting that the statement of our case be printed in its columns.

Several of the delegates doubted if the request would be complied with, whereupon the Editor of THE CANADIAN ENGINEER, who was present, asked permission as a matter of privilege to make a statement. By unanimous vote the request was granted.

Mr. Groves pointed out, that since the negative article in question appeared, THE CANADIAN ENGINEER had changed hands, and the present Editor disclaimed any responsibility. He undertook, however, to give two columns for the proposed reply, and as their journal had the largest circulation of any Engineering paper in Canada, and which had lately been increased by incorporating therewith, "The Canadian Machine Shop," the Stationary Engineers' defence of the proposed License Law would have a wider circulation than the critique which went out in the June number. (Applause).

Retiring Secretary W. Inglis.

This explanation was accepted, the resolution adopted, and the incident closed.

A desultory discussion on the proposed Engineers' Handbook, in which Messrs. Wickens, Crockett, Ironsides, Sweet, Mosley, and the president took part, was terminated by the appointment of a committee to prepare an Official Handbook.

After a few words on the proposal to economize in the matter of per diem payments to Convention place delegates the meeting adjourned.

Tuesday Evening Session: 7.30.

Upon re-assembling the discussion was resumed upon the proposition to deprive the delegates in cities where conventions were being held of their per diem in the interests of economy. The proposal was negatived.

The Audit Committee reported treasurer's books O.K., with a balance in hand of $133.92.

After a report by the Mileage Committee, F. B. Utley, of the Goldie, McCulloch Co., Galt, in the name of his firm, made an eloquent plea before the assembly in favor of holding the next convention at Galt. The appeal was received enthusiastically but formal decision reserved until the following day. Then A. M. Wickens drew attention to the fact that a year ago it had been decreed to have three papers read at the current convention; but there was nothing doing. Seeing the next Convention was likely to prove an excellent opportunity for advertising the Association, he advised that first-class papers dealing with the Stationary Engineer's craft, up to date, be prepared. After some conversation upon the subject a committee was appointed. This closed the formal proceedings of the day.

Banquet.

At 11 p.m. the banqueting hall of the Garner House presented a gay and festive scene. At the tables were seated representative stationary engineers of Canada, supported by over one hundred distinguished visitors, Chatham's most prominent manufacturers and men of affairs. W. A. Sweet, of Hamilton, was toastmaster, and very felicitously he steered this grand function to a happy ending. The following was the toast list:

The King.—W. A. Sweet.
Canada Our Home.—A. B. McCoig, M. P.; H. S. Clements, M.P.; and W. A. Crockett.
The Maple City.—W. W. Scane, and Alderman H. Westman.
Mayor and Council.—The Mayor G. W. Cowan, and Ald. W. H. Marshall.
Delegates and Executive Officers.—A. M. Wickens and C. Mosley.
Sister Associations.—F. B. Utley, and F. J. Sculthorpe.
Manufacturing Interests.—N. H. Stevens and W. R. Landon.
The Press.—S. Groves (Editor THE CANADIAN ENGINEER), and "News."
The Ladies.—W. Pigott, and Alderman John Edmondson.

The banquet went off in splendid style. The service was excellent, viands delightful, music entrancing, and the oratory of a very high order, especially the speeches of W. A. Crockett, N. H. Stevens and F. B. Utley. Here is what the local press says of the last named:

F. B. Utley, of Galt, gave the most unique speech of the evening, illustrating his ideas with crayon sketches. He distinguished between a mechanical and an intelligent engineer, drawing sketches of the lazy, and then of the smiling engineer.

"Give your ideas to a brother engineer—he may have an idea—exchange them—you will both benefit by it."

[We purpose in our October issue giving an extended report of this admirable lecturette, together with the very amusing illustrations.—Editor.]

Wednesday Morning Session.

The first order of business was—

ELECTION OF OFFICERS.

Before proceeding to the vote it was resolved:

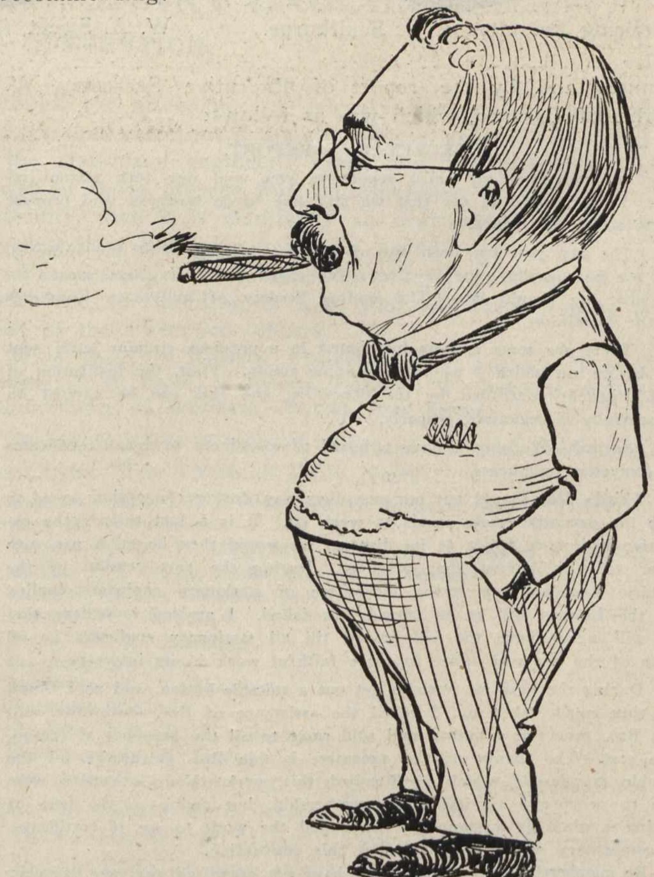
"That all Past-Presidents be entitled to vote, providing they pay their own expenses to the Convention."

The election resulted as follows: President, W. A. Sweet, Hamilton; Vice-President, John Ironsides, Hamilton; Secretary, W. L. Outhwaite, Toronto; Treasurer, J. M Dixon, Toronto; Conductor, E. Grandbois, Chatham; Doorkeeper, C. Kelley, Chatham.

Place of Meeting.

Unanimously resolved that the next Convention be held at Galt.

Then came the report of the "Good of the Order" Committee on the proposals in the president's address, recommending:



(Drawn by F. B. Utley.)

W. L. Outhwaite, of Toronto, the New Secretary.

(1) That a committee be appointed to co-operate with the O.A.S.E. for the purpose of drafting a new License Law Bill.

(2) That the name of the association be "Canadian Association Stationary (not Steam) Engineers."

(3) That the proposal to issue Certificates of Membership be not entertained. (Reason: Expelled members can use such certificate to get responsible positions, although unfit for membership in the C.A.S.E.)

(4) That "no person be eligible for election to the office of Executive President unless he is a past-president of a subordinate lodge."

(5) That Article III., Sec. I., of Subordinate Lodge By-laws read as follows: "This Association shall be composed of practical stationary engineers, who are residents of Canada, or are British subjects of good moral character, and who have a practical knowledge of stationary engineering, which shall be determined by an examination, and not less than two years' experience, and to be a resident of the jurisdiction not less than six months, or to possess an O.A.S.E. certificate."

That the preamble to the Constitution read thus:

This Association shall not at any time be used for the furtherance of strikes, or, in any way interfere between its members and their employers in regard to wages; recognizing the identity of interests between employer and employees, and not countenancing any project or enterprise that will interfere with perfect harmony between them. Neither shall it be used for political or religious purposes. Its meetings shall be devoted to education — professional, and mechanical knowledge.

The committee's report having been adopted, the session was adjourned for the purpose of witnessing a demonstration by Chatham's renowned fire brigade. And the marvellous activity of the "hitch up," dash down one of the fine avenues, and play of the hose on the huge trees in front of a fine residence half a mile away, in 1.57 minutes was a scene long to be remembered.

Group of Delegates, taken in Tecumseh Park.

After lunch the group photographed above was taken in Tecumseh Park. Then came the

Final Session: Wednesday, 2.30 p.m.

The principal business was the installation of Officers. Responsive speeches by the retiring and new Executives; hearty votes of thanks to mayor and corporation for use of the City Council Chamber; enthusiastic standing vote and vocal expression of gratitude to the local Association for their fraternal, generous, open-handed hospitality, terminated pleasantly the sixteenth annual convention of the Canadian Association Stationary Engineers.

NEW INCORPORATIONS.

Dominion.—The Canadian Fairbanks Company have increased their capital from $500,000 to $600,000.

The Steel Concrete Company, Montreal, $200,000; E. A. Wallberg, W. F. Boggis, J. L. Harrington, Montreal; H. Fisher, J. Murphy, Ottawa.

The Universal Nut Machine Co., Montreal, $200,000; A. Hendrey, W. Eckenstein, Montreal; C. A. Duclos, Westmount; H. L. Dinning, Lachine; C. Ralph, Longueuil.

Wallingford Brothers, Limited, Ottawa, $45,000; F. Cornu, L'Ange Gardien; E. Wallingford, F. S. Shirley, Hon. N. A. Belcourt, M. I. Hickson, Ottawa. To carry on business as a general milling, mining and development company.

Northern Construction Company, Montreal, $100,000; E. M. O'Brien, J. B. Rose, E. C. Perkins, G. A. Lafontaine, W. R. Stavely, Montreal. To carry on business as builders and contractors.

The Dominion Automobile Co., Toronto, $100,000; A. H. Beaton, C. L. Wilson, J. McArthur, J. Barber and C. E. Holland, Toronto.

N. J. Holden Co. Montreal, $200,000; L. Johnson, W. Palmer, A. L. De Guire, P. A. Masse, C. Bethell, Montreal. To manufacture railway, passenger, freight and street cars, car trucks, car wheels, etc.

The New Ontario Ore Refining Co., Toronto, $500,000; T. H. Barton, C. F. Taylor, C. E. Jenney, A. W. Barton and L. Duff, Toronto.

The Power and Gas Machine Co., Galt, $100,000; W. H. Cone, Berlin; F. E. Brown, I. R. E. Brown, W. Foster, E. J. MacDiarmid, Galt. To manufacture all kinds of gas generators, gas producers, steam engines, etc.

The Windsor and Cobalt Mining Co., Windsor, $150,000; J. Scott, J. H. Rodd, Windsor; J. S. Austin, J. W. Kerr, M. Price, G. H. Wintemute, C. F. Stafford, Maidstone Tp.; and others.

The Guelph Stove Co., Guelph, $200,000; J. Brown, C. Kloepher, M. Kelly, F. N. Nunan, F. T. Coghlan, Guelph. To manufacture furnaces, boilers, heating apparatus, etc.

The Wallaceburg Brass and Iron Manufacturing Co., Wallaceburg, $40,000; D. A. Gordon, A. La Course, H. W. Burgess, H. J. McDougall and J. F. McDougall, Wallaceburg.

The Coleman and Bucke Consolidated Cobalt-Silver Mining Co., Ottawa, $1,000,000; W. F. Powell, J. McIsaac, J. J. Heney, F. R. Latchford, Ottawa, and A. A. St. Laurent, Ottawa East.

Quebec.—Quebec Auto-Car Co., Quebec, $20,000; G. G. Stuart, J. G. Scott, J. M. McCarthy, A. E. Doucet and L. G. Scott, Quebec. To manufacture automobiles, motor-cars, etc.

New Brunswick.—Electrical Supply Co., Moncton, $30,000; G. R. Jones, J. S. Magee, D. McCuaig, G. McSweeney, E. A. Reilly, Moncton.

The Power Co., St. John, $24,000; J. E. March, C. J. Coster, R. A. March, C. S. March, J. P. Carritte, A. F. Emery, St. John, and F. V. Wedderburn, Hampton. To manufacture gas producers and engines.

Manitoba.—The Edrans-Brandon Pressed Brick Co., Brandon, $150,000; R. S. Thompson, R. Sword, C. C. L. Blackwood; W. N. Finlay and J. Moffat, Brandon.

NEW CATALOGUES.

ELECTRIC SWITCHES.—Canadian General Electric Co., Limited, Toronto, Ont., have issued an artistically printed and illustrated supply catalogue; showing their latest make of snap, flush, and knife switches. 8 x 10¼, pp. 76.

GAUGES.—The Schaeffer and Budenberg Manufacturing Co., New York, N.Y., are sending out a catalogue illustrating the various kinds of gauges which they manufacture for steam engines, boilers, etc. 9½ x 12, pp. 52.

AMMONIA FITTINGS AND REFRIGERATING MACHINES.—The De La Vergne Machine Co., 138th Street, New York, N.Y., are placing before the trade two well illustrated pamphlets, descriptive of the Ammonia Fittings and Horizontal Refrigerating Machines, which they manufacture. 4 x 8¾, pp. 4 and 6, respectively.

DUMP CARS.—Kilgore-Peteler Company, Minneapolis, Minn. The dump cars and steam shovels manufactured by this company are fully described in a recently issued catalogue. 6 x 9, pp. 31.

FORGES, POWER BLOWERS, ETC.—The Canadian Buffalo Forge Company, Montreal, Que.—General catalogue, 1905 edition, describing, and setting forth graphically their blacksmiths' forges and tools, power blowers, and ventilating apparatus. 3½ x 6½, pp. 250.

REDUCING VALVES.—The Mason Regulator Co., Boston, Mass.—Price list and catalogue of reducing valves, as manufactured by this company; including full page illustrations of the various types. 6 x 9¼, pp. 55.

BALL BEARINGS.—The Chapman Double Ball Bearing Co., of Canada, Limited, Toronto. "Results" is the title given to a neat little file of fac-simile letters received, in praise of the ball bearings manufactured by them. 5½ x 7, pp. 31.

ARC LAMPS.—The Canadian Westinghouse Co., Limited, Hamilton, Ont.—A booklet describing and illustrating their arc lamps of the multiple-alternating type. 3½ x 6, pp. 8.

OIL ENGINES.—The De La Vergne Machine Co, 138th Street, New York, N.Y.—A pamphlet of their "Hornsby Akroyd" oil engines. It is admirably illustrated, and contains complete descriptive matter. 4 x 8½, pp. 6.

MOTORS AND AUTO-STARTERS.—The Canadian Westinghouse Co., Limited, Hamilton, Ont.—Instruction Book No. 5082; instructions for the installation and operation of Type R Motors. 6 x 9, pp. 12.