PLATE I.

Fuel testing station and ore dressing and metallurgical laboratory.

Extract from 6 - 7 EDWARD VII Chap. 29

An Act to Create a Department of Mines

Functions of Mines Branch.

6. The functions of the Mines Branch shall be,--

(a) to collect and publish full statistics of the mineral production and of the mining and metallurgical industries of Canada, and such data regarding the economic minerals of Canada as relate to the processes and activities connected with their utilization, and to collect and preserve all available records of mines and mining works in Canada;

(b) to make detailed investigations of mining camps and areas containing economic minerals or deposits of other economic substances, for the purpose of determining the mode of occurrence, and the extent and character of the ore-bodies and deposits of the economic minerals or other economic substances;

(c) to prepare and publish such maps, plans, sections, diagrams, drawings and illustrations as are necessary to elucidate the reports issued by the Mines Branch;

(d) to make such chemical, mechanical and metallurgical investigations as are found expedient to aid the mining and metallurgical industry of Canada;

(e) to collect and prepare for exhibition in the Museum specimens of the different ores and associated rocks and minerals of Canada and such other materials as are necessary to afford an accurate exhibit of the mining and metallurgical resources and industries of Canada.

Functions of Geological Survey.

7. The functions of the Geological Survey shall be,--

(a) to make a full and scientific examination and survey of the geological structure and mineralogy of Canada; to collect, classify, and arrange for exhibition in the Victoria Memorial Museum such specimens as are necessary to afford a complete and exact knowledge of the geology, mineralogy, palaeontology, ethnology, and fauna and flora of Canada; and to make such chemical and other researches as will best tend to ensure the carrying into effect the objects and purposes of this Act;

(b) to study and report upon the facts relating to water supply for irrigation and for domestic purposes, and to collect and preserve all available records of artesian or other wells;

(c) to map the forest areas of Canada, and to make and report upon investigations useful to the preservation of the forest resources of Canada;

(d) to prepare and publish such maps, plans, sections, diagrams and drawings as are necessary to illustrate and elucidate the reports of surveys and investigations;

(e) to carry on ethnological and palaeontological investigations.

CANADA

DEPARTMENT OF MINES

HON. P. E. BLONDIN, MINISTER; R. G. MCCONNELL, DEPUTY MINISTER.

MINES BRANCH

EUGENE HAANEL, PH.D., DIRECTOR.

BULLETIN No. 13

# Description of the Laboratories of the Mines Branch of the Department of Mines Ottawa

OTTAWA
GOVERNMENT PRINTING BUREAU
1916



13A

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ILLUSTRATIONS.

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# DESCRIPTION

OF THE

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OF THE

# MINES BRANCH

OF THE

# DEPARTMENT OF MINES

# OTTAWA

## INTRODUCTORY.

In the Geology and Mines Act—assented to by the Dominion Parliament on April 27, 1907—one of the chief functions assigned to the Mines Branch of the Department of Mines was, "to make such chemical, mechanical, and metallurgical investigations as are found expedient to aid the mining and metallurgical industry of Canada."

It was foreseen from the first by those responsible for the successful attainment of the objectives set forth in the Act creating the Department of Mines, that the usefulness of the Mines Branch would depend very largely on the essentially practical tests of metals and minerals made under its direct supervision. At the outset, however, it was found next to impossible to meet the demands made for analytical work; due (1) to the limited capacity and equipment of the existing laboratories, and (2) to the lack of space for extension. Hence, it was found necessary to have some of the experimental work done at the laboratories of McGill, Toronto, and Queens, Universities; until such time as proper facilities could be provided at Ottawa.

The first of the new units for the proposed general laboratories and testing system, namely, the Fuel Testing Station, with its laboratory for the analysis of mine air, natural and other combustible gases, oils, etc., and well equipped machine shop, was opened at southwest Ottawa, in 1910; and this was followed, in 1911, by the erection of an Ore Dressing and Metallurgical laboratory, adjoining the Fuel Testing Station. Then, in 1912, came the combination, and installation under one roof at the headquarters of the Mines Branch, Sussex Street, Ottawa, of the old Geological Survey and newer Mines Branch Chemical Laboratories; and to these was added, in 1915, a fully equipped section for the testing of the waters of Canada. In the same year, a Ceramic laboratory, completely equipped for testing the clays of the Dominion, was erected in the Mines Branch building also; together with a fully equipped laboratory for the testing of structural materials: cement, concrete, building stones, and sands for concrete making, foundry purposes, and glass manufacture. The latest addition is a Metallographic laboratory, for the preparation and micrographic examination of specimens of steel and alloys required for the practical work of the Metallurgical Division.

It is purposed, in the near future, to still further extend the scope of the technical work carried on in the various laboratories above mentioned: such as the testing of lime, road materials, paint mixtures, etc.; and to provide suitable appliances and equipment for other lines of work which come under the statutory jurisdiction of the Mines Branch.

Having outlined the general character of the existing laboratories, it may be of interest to state some of the more important reasons which led to the establishment of the various units comprising the system; and this will be followed by a detailed, illustrated, description of each laboratory.

**Chemical Laboratories.—**

When the Geological Survey of Canada was founded in 1843, a chemical division was established as one of its necessary branches of work. When, however, the Department of Mines was created in 1907, all the chemical work pertaining to the entire department was placed under the direction of the Mines Branch. Since this change was made, applications from the mining and general public for the chemical analysis, examination, identification, and assays of rock and mineral specimens, ores, etc. have increased to such an extent, and the analyses and assays needed for supplementing the descriptive text in the many technical reports now being issued by the Department of Mines have become so numerous, that it has necessitated extensive alterations and additions to the old laboratory, in order to provide greater facilities, and to meet the constantly increasing demands from all quarters. The pressing importance of a pure water supply in all parts of the Dominion, led to the installation of a complete equipment for the analysis and testing of the waters of the country. At the present time, therefore, the chemical laboratories of the Mines Branch may be said to be well equipped for the analysis and assaying of all kinds of rocks, minerals, and ores; the preparedness and capability for doing useful work, in the interests of the country, being limited only by the number of staff experts employed.

**The Dominion of Canada Assay Office.—**

The Dominion of Canada Assay Office at Vancouver, B.C., was established during the month of July, 1901, and operated under the supervision and direction of the Mines Branch. The reason for the establishment of the Assay Office was, to furnish the mining communities of the Yukon and British Columbia with a convenient market for their gold, and to keep the trade involved in the marketing of the same, in this country. That the establishment of this assay office, by the government, is fully appreciated by the miners of the Yukon and British Columbia, is shown by the fact that they avail themselves of the market provided for them at Vancouver in preference to sending their gold to the Mint at San Francisco, or to the Assay Office at Seattle.

The amount of business done by the Assay Office since its establishment is shown in the following table:—

| Year. | Number of Deposits. | Weight Troy ounces. | Net Value $ |
|---|---|---|---|
| 1901–2 fiscal | 671 | 69,925·67 | 1,153,014.50 |
| 1902–3 " | 509 | 36,295·69 | 568,888.19 |
| 1903–4 " | 281 | 24,516·36 | 385,152.00 |
| 1904–5 " | 443 | 29,573·73 | 462,939.75 |
| 1905–6 " | 345 | 21,050·83 | 337,820.59 |
| 1906–7 (nine months) | 269 | 20,695·84 | 336,675.65 |
| 1907–8 fiscal | 482 | 46,540·25 | 751,693.97 |
| 1908 (nine months) | 590 | 90,175·48 | 1,478,893.74 |
| 1909 calendar | 573 | 48,478·60 | 789,267.94 |
| 1910 " | 490 | 46,064.31 | 746,101.92 |
| 1911 " | 442 | 39,784·70 | 647,416.38 |
| 1912 " | 527 | 59,068·83 | 974,077.14 |
| 1913 " | 783 | 111,479·95 | 1,448,625.37 |
| 1914 " | 1112 | 166,148·83 | 2,029,251.31 |
| 1915 " | 1901 | 183,924·49 | 2,736,302.31 |

**Fuel Testing Station and Laboratories.—**

One of the functions of the Mines Branch is the investigation of the fuel resources of Canada: solid, liquid, gaseous; and in order to gain a comprehensive knowledge concerning their value for the varied uses in the arts and industries, investigations of a practical character must of necessity be conducted on a sufficiently large commercial scale—where testing is concerned—to enable accurate conclusions to be drawn from the results obtained.

For the purpose of carrying out the provisions of the Act, and in order to study the best methods and processes whereby the various fuels found may be utilized to advantage, the Fuel Testing Station and its laboratories were erected as a permanent feature of Mines Branch operations.

The Fuel Testing Station is equipped with commercial-size gas producers, large steam boiler, and 60 H.P. gas engine, also fully equipped chemical and assay laboratories[1], and a well equipped machine shop.[2] The latter is an indispensable adjunct to the laboratories devoted to research and large scale work; since new apparatus of special design and construction, and repairs to existing apparatus and machines, must be made in the shortest time possible.

In addition to the large scale fuel testing investigations, for which special provision has been made, and which have been conducted since the inauguration of the Fuels and Fuel Testing Division, the laboratories have been fully equipped for the analyses of mine air, natural and other combustible gases, oils, etc.

The analyses of mine air, free of charge, which was begun by this Division a short time ago, has grown to large proportions, and has met with the hearty approval of the mine operators who have availed themselves of the services of the Department along this line. The results of the analyses of mine air are of special value to the coal operators, since defective ventilation, or parts of mines in which the air is dangerously charged with firedamp, are definitely indicated. The operators or managers are

[1] These chemical laboratories, while nominally under the supervision of the Fuels and Fuel Testing Division, are utilized for the analytical work of the Ore Dressing and Metallurgical Laboratory also.

[2] This machine shop is under the supervision of the Fuels and Fuel Testing Division. The work done therein, however, is not confined to the requirements of that Division, but embraces the mechanical work of the entire Department.

consequently provided with information which will enable them to correct defects, and otherwise safeguard the mines.

The physical examination, and chemical analysis of fuel and refined mineral oils have developed into an important part of the duties of the chemical staff of this division; particularly as the oils used by both the Militia and Naval Departments are sent to the Mines Branch for analysis and physical investigation, before contracts are let.

The analyses, both proximate and ultimate, and determinations of the heating value of the coals of Canada, have been begun in a systematic manner. Accurate mine samples are take from the various seams of producing mines, and transmitted in hermetically sealed containers to the Mines Branch. The published results of these investigations will put the public in possession of reliable information concerning the classification of the coals of Canada, as regards chemical analyses, etc., and their value and fitness for various purposes.

Research work on other practical problems is at present being undertaken, and which, if carried to a successful issue, will, it is hoped, materially aid in the commercial development of our fuel resources, and extend their utilization in the industries of the country.

**Ore Dressing and Metallurgical Laboratory.—**

The Ore Dressing and Metallurgical Laboratory is installed jointly with the Fuel Testing Station in a commodious and well appointed building situated on Division Street, Ottawa, S.W. The Ore Testing equipment has grown from a modest installation, in 1910, to one of the most completely equipped experimental laboratories that may be found anywhere in North America.

It was designed primarily to assist the prospector and small mine owner to secure concentration and metallurgical tests on his ore, at a nominal cost. Numerous Canadian prospects have remained undeveloped because the owners could not afford to have mill tests made on their ore, for, in many instances, this entailed a shipment of samples to testing laboratories in the United States, and the payment not only of freight charges but of a substantial fee for the service rendered. Since the establishment of the government laboratory, samples of Canadian ores and minerals have been received in such a constantly increasing volume, that in order to keep pace with the work it has been necessary to increase the original staff. Samples have been received from all parts of the Dominion, and an idea of the range and variety of work undertaken may be gathered from the following abbreviated list of ores and other mineral substances that have been submitted for testing:—

Iron ores from Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia; copper ores from British Columbia, Ontario and Quebec; zinc ores from British Columbia and Quebec; pyrites from Ontario; bauxite from Quebec; titanium ores from Quebec; molybdenite ores from Ontario, Quebec, and British Columbia; corundum bearing rock from Ontario; glass sands from Nova Scotia; infusorial earth from Quebec.

In designing the plant, care was taken to place the machines so that ore dressing combinations could be made with as little handling of the ore as possible. Actual mill conditions are therefore, duplicated to some extent. What the proper combination should be, and the best mode of treatment, is pre-determined by preliminary tests made on laboratory type machines. After having arrived at the most suitable flow sheet the large machinery is adjusted for this combination. The plant is equipped with large sized apparatus as employed in actual practice as well as with laboratory type apparatus used for small scale and preliminary tests.

The machinery installed comprises crushers, rolls, ball mills, and screens for purposes of crushing and sizing; various magnetic separators; electrostatic separation machines; apparatus for conducting cyanide tests on gold ores; a full scale gold stamp battery; hydraulic and pneumatic ore jigs; concentrating tables; oil and water flotation separation apparatus; roasting and sintering furnaces.

**Ceramic Laboratory.**—

In the great expansion and development of commercial activities, so apparent in the Dominion of Canada prior to the war, and which must, after its cessation, be even more vigorously prosecuted, the subject of ceramics is necessarily of great importance.

The commercial value of clay products in Canada may be estimated from the following figures, collected through the statistical division of the Mines Branch. The clay products mentioned were manufactured in Canada during the years 1912 to 1914.

| | Production in | | |
|---|---|---|---|
| | 1912 | 1913 | 1914 |
| Brick, common | $7,010,375 | $5,917,373 | $3,653,861 |
| „ pressed | 1,609,854 | 1,458,733 | 1,115,556 |
| „ paving | 85,989 | 75,669 | 49,627 |
| „ ornamental | 8,595 | 15,423 | 23,592 |
| Fire-clay and fire-clay products. | 125,585 | 142,738 | 107,568 |
| Fire-proofing | 448,853 | 461,387 | 405,543 |
| Pottery | 43,955 | 53,533 | 35,371 |
| Sewer pipe | 884,641 | 1,035,906 | 1,104,499 |
| Tiles | 357,862 | 338,552 | 366,340 |
| Kaolin | 160 | 5,000 | 10,000 |
| Total value | $10,575,869 | $9,504,314 | $6,871,957 |

During the year 1905 the importation of clay products amounted in value to $2,501,206, and it increased to $6,760,762 for the year 1913, but dropped in 1914 to $4,467,140, due to the war. In the year 1914, we utilized clay products valued at $11,291,024, yet the returns show that we imported over 39 per cent of these products. This simple statement shows that in 1914 we sent out of Canada for these products alone, $4,419,067 which if it had been held in our own country, would have meant the investment of a large amount of capital, and would have given employment to a large number of men.

It must not be concluded from this statement, that this very large importation is due to lack of raw materials at home. Reports on the location and character of the clay deposits of Manitoba, Saskatchewan, Alberta, Quebec, and the Maritime Provinces, issued by the Geological Survey, show that Canada is rich in materials for an important ceramic industry. New

2

deposits are constantly being discovered and specimens sent to our laboratories, with the request that we state what use can be made of the material. To merely send the owner of the deposit a chemical analysis of his clay, does not meet the case; since chemical analysis is only a preliminary step in ascertaining the fitness or unfitness of a clay for the manufacture of any special product. Before a sound opinion can be arrived at, as to whether a particular specimen of clay is suitable for the manufacture of tiles, brick, terra cotta, sewer pipe, or other clay products, the specimen must be submitted to a physical examination to ascertain the character of the product as it comes from the kiln. It is during this investigation that the problem, in many cases, admits of solution, namely, how a clay, otherwise unfit, may, by special treatment, be rendered suitable for the manufacture of a commercial product. To enable the government to furnish this complete information regarding clays submitted by prospective operators of clay deposits, provision was made for the establishment of a ceramic division in the Mines Branch, with a properly trained and experienced ceramic specialist in charge. The completion and equipment of the ceramic laboratory was accomplished during the latter part of last year (1915). Through the activities of this Division, intelligent assistance will be given to the manufacturers of clay products. It is expected that this course will lead on the one hand, to a decrease in the large imports of clay products, and on the other hand, tend to the further development, and increasing importance of the ceramic industry in the Dominion.

**Structural Materials Testing Laboratory.**—

During 1914 and 1915, field investigation of the numerous sand and sandstone deposits of the provinces of Quebec and Ontario, was made with a view to determining the suitability of these materials for use in concrete making; in the iron and steel foundry; and in the manufacture of glass. Field work in an investigation of this nature is of secondary importance; definite commercial results depend almost entirely on physical tests conducted in a suitably equipped laboratory. Such a laboratory was installed in the basement and rear of the Mines Branch building, Sussex street, Ottawa, early in 1915, and testing operations were commenced during the last months of the same year. In equipping this laboratory, adequate provision was made for conducting complete tests on all kinds of building supplies, etc., such as sands, brick, stones, cement, concrete, and like materials. The laboratory equipment includes machines for making all the physical tests necessary for the determination of the transverse, tensile, and compression strength of all structural materials. The installation of the machines for testing iron and steel is complete.

The increasing use of bituminous materials in the surfacing of city streets and interurban highways, has emphasized the necessity for apparatus suitable for the testing of such materials; but in connexion with the installation of apparatus for the examination of bituminous road materials—including bituminous sand—there has been a regrettable absence of generally accepted standard methods of testing. The apparatus available in the Mines Branch Structural Materials Testing Laboratory however, is well suited for classifying, and for determining the value of bituminous road materials.

**Metallographic Laboratory.—**

In the basement of the Mines Branch Building, Sussex street, Ottawa, complete appliances, machines, and accessories, have been installed for the grinding and polishing of metal specimens for the microscopic examination of steels and alloys; and on the second floor of the same building is a room completely equipped for the photomicrography of metals.

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The foregoing, is a general account of the origin and present extent of the testing system inaugurated and being maintained under the direction of the Mines Branch. The phenomenally rapid rise of this series of technological laboratories, and constant additions to the staff of technical experts, has been due (1) to the incessant demands by the mining public for the examination and testing of promising ores and minerals; (2) to requests for the investigation of special subjects of commercial importance; and (3) to experimentation along lines of study which it was conceived would be of practical value to the manufacturing interests of the country.

This descriptive pamphlet is issued at the present time, in order to make it known throughout the Dominion, that the Mines Branch of the Department of Mines is now well equipped for conducting systematic tests of metals, minerals, fuels, and all materials pertaining to the Mining and Metallurgical industries.

**Eugene Haanel,**
Director.

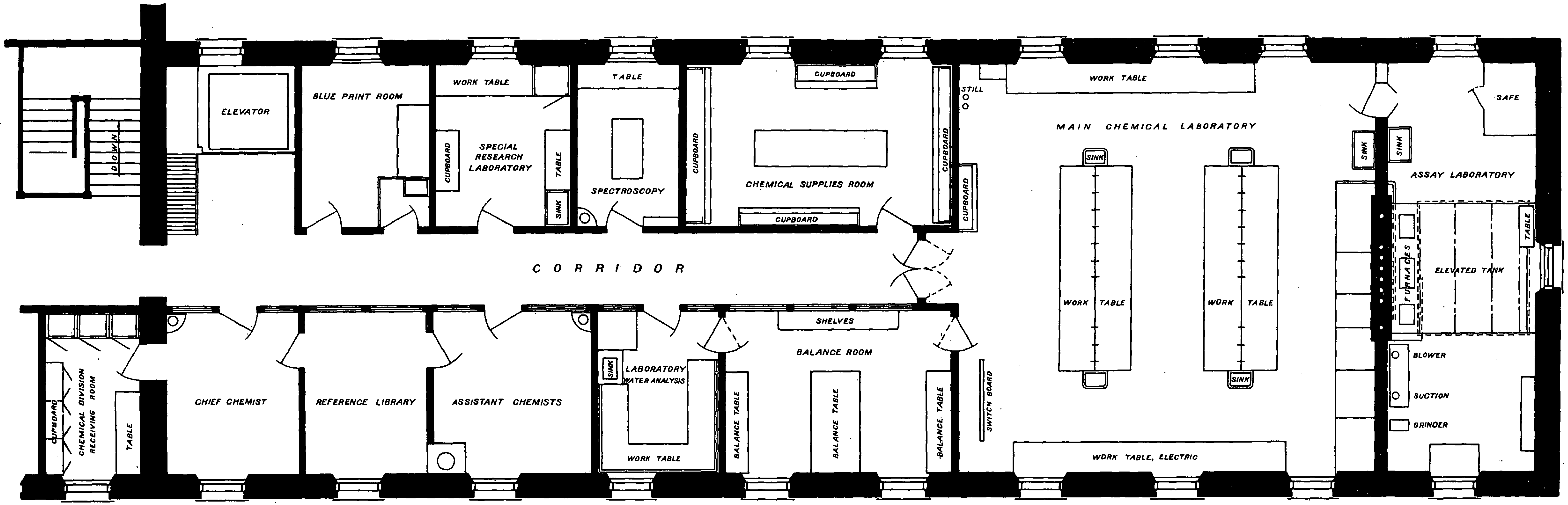



Fig. 1. Plan of Chemical Laboratories, Mines Building, Sussex Street, Ottawa.

# Detailed Description of the Laboratories and Testing System

## THE CHEMICAL LABORATORIES, SUSSEX STREET.

On May 1, 1913, the chemical laboratory was transferred from its temporary quarters in the Thistle Chambers to that portion of the Mines Branch building—corner of Sussex and George streets—which has been set aside and remodelled for its accommodation.

In the alteration of what had long been known as the Geological Museum, the upper flat of the George St. wing of the building was set apart for re-arrangement, as a chemical laboratory, which would serve not only our present requirements, but would permit of considerable augmentation in the numbers of the chemical staff as might be required in the future.

A brief description of the plan and equipment may appropriately be given here.

The floor area—exclusive of corridor—of the space allotted to the laboratory is 2,961 square feet, divided into 11 rooms as follows:—

| | | |
|---|---|---|
| Main laboratory | 1,133 | square feet. |
| Assay laboratory | 402 | " |
| Water analysis laboratory | 130 | " |
| Special research laboratory | 146 | " |
| Spectroscopy laboratory | 109 | " |
| Balance room | 242 | " |
| Chemist's office | 142 | " |
| Assistants' room | 170 | " |
| Chemical library | 120 | " |
| Room for storage of specimens awaiting analysis | 102 | " |
| Supplies room | 265 | " |
| | 2,961 | " |

The arrangement of the several rooms is shown in the accompanying plan. (Fig. 1).

*The Main Laboratory.*—

This has been planned with the object of providing a maximum of both light and ventilation. Three windows on either side, and four skylights—the latter equipped with the necessary shades—admit an abundance of daylight. Electric lighting is provided over each working space, on the tables.

Ventilation is secured by two electrically driven fans—one of six feet and another of two feet diameter. The larger is connected with the draught cupboards and the assay furnace hoods, and very effectively removes all evidence of vitiated air, while the smaller withdraws from the upper portion of the main laboratory over the work tables, and from the water analysis room and draught cupboard. Fresh air is forced into this room, as well as all others in the building, from the ventilating system established in the basement.

*The work tables, or benches* (Plates II and III) are each sufficiently large to accommodate four men—two on either side. The four tubes, shown over the middle of each table, provide respectively, gas, exhaust, compressed air, and water. Each of these is tapped once in every three feet. An earthen drain pipe in the centre of each table and just below the surface makes provision for the waste from any piece of water cooled apparatus.

Electric current has been led to three plugs at either end of both centre tables.

The table tops are of teak wood.

*The draught cupboards* (Plate IV). This very important feature of any well-equipped laboratory is 24 feet in length by 2 feet 6 inches deep, and is sub-divided into six separate compartments,—four of 4 feet 6 inches and two of 3 feet each.

By means of sliding sashes, these may be connected by twos to form a single compartment, designed to accommodate a longer train of apparatus than a single unit would permit. Each compartment is supplied with taps for water, gas, compressed air and exhaust, and with plugs for electric connexion for heaters and other forms of apparatus.

Each compartment is ventilated separately and distinctly from each other. Direct connexion, by means of leaden conduits, with the larger exhaust fan, is made both from the top and the bottom of each sub-division. These openings, either top or bottom, may be regulated at the will of the operator. Each compartment is provided with a separate lighting, and with a waste water pipe. The floor and back wall are of white glazed tiles, the front, top and sides of plate glass.

*Distilled water apparatus* (Plate V). A Barnstead still, capable of furnishing from 8 to 10 gallons per hour, supplies distilled water for laboratory use, and the surplus is stored in a block tin-lined reservoir from which it is conveyed to a cooler in the basement, and thence to drinking fountains on the three floors of the office building, to supply the needs of the members of the staff in this respect,

### ELECTRICAL EQUIPMENT.

*Switchboard.* (Plate VI).

The laboratory is supplied with two switchboards, one for alternating, and one for direct current distribution.

The alternating current switchboard is equipped with the necessary switches for distributing the current to the different work tables and fume cupboards for hot plates, drying ovens, electric furnaces, small motors and lights. One volt-meter and two ammeters furnish readings of the current being used.

The direct current switchboard is used to distribute current to the work table devoted to electro chemical analysis.

The current is supplied by ten Edison storage cells, type B-6. The normal ampere hour output of these cells is 120 ampere hours, which is ample for the work they have to do.

For the purpose of charging the storage battery, a one K.W. motor-generator is used. The generator has a fifty per cent voltage regulation, 15 to 30 volts, which allows a charging current of almost any desired amperage to be used. An automatic cut-out between the dynamo and the storage battery prevents a back discharge through the generator, should the alternating current be cut off at any time during a charge of the cells.

A 40-volt voltmeter and a 40-0-80 ampere ammeter give readings during charge or discharge of the battery.

On the switchboard are four 11-point, semi-circular switches, one for each of the four outlets on the work table. Each switch is connected independently to the cells in such a manner as to allow the chemist to draw off current from one, two or any number of cells up to ten, at any one of the four outlets on the work table. The arrangement allows four different determinations, each one using a different voltage if necessary, to be made at the same time, or it will allow four chemists to use the battery independently at the same time.

The work table (also shown on Plate III) has a small distributing board for taking readings with portable laboratory voltmeters and ammeters, which are used in preference to switchboard instruments.

*The Assay Room.* (Plate VII).

In this room are placed the following appliances:—

a. Melting and cupelling furnaces.
b. Large muffle furnace, with a capacity of ten fireclay crucibles.
c. Oilshale distillation furnace.
d. Exhaust.
e. Air compressor.
f. Agate mortar grinder.
g. Anvils, mixing table and assay supplies cupboard.
h. The larger ventilating fan.

Withdrawal of fumes from the several furnaces has been provided, by means of adjustable hoods, connected directly with the large ventilating fan, above referred to.

The main laboratory and the assay room have been made as nearly fireproof as the construction of a remodelled building would permit.

*Water analysis laboratory.* (Plate VIII).

This small laboratory has been designed, as its name indicates, to permit of this special type of analysis being carried on in a room free from the interference of ammoniacal or other deleterious vapours which are present in some measure in a general laboratory.

This room is supplied with water, gas and electricity, and a well-ventilated draught cupboard connected with the smaller of the two exhaust fans.

*Special research laboratory.*

This is a room, provided with work tables, gas, electricity, water, and draught cupboard, which has been set aside for the carrying on of any special line of research which is not likely to be of a permanent character.

*The balance room.*

Plates IX and X show the general arrangement and the equipment of this room. Ten balances of various types are installed.

*The spectroscope room.* (Plate XI).

When completely equipped, this room will be devoted entirely to spectroscopy as applied to the analysis of minerals and rocks.

Thus far, it has been supplied with—

a. König spectrophotometer.
b. Browning double prism reflecting spectroscope, and accessories.
c. A direct vision spectroscope.

The electrical attachments have yet to be installed.

Such is a brief description of the present equipment of the laboratory. It is intended primarily to give the necessary attention to the samples collected by the field officers of the Geological Survey and Mines branches; but, as has been the custom prevailing for many years, examinations, analyses, or assays are made upon specimens sent to us by persons not members of our own staff.

For this latter class of work a nominal fee is charged, and certain conditions are imposed. The schedule of charges so made and the governing regulations are as follows

## SCHEDULE OF CHARGES

*(Revised, Dec. 1, 1911.)*

Free chemical analyses and assays of metallic and non-metallic minerals have been discontinued, and the charges indicated in the following schedule were duly authorized on June 29, 1909.

Specimens will be dealt with in the order of their arrival; at such times as do not interfere with regular departmental research work.

TERMS:—Money in payment of fees—sent in by registered letter, Post-Office Order, Postal Note, or Express Order, etc., and made payable to the Director of Mines—must invariably accompany the samples, as no examination will be commenced until the regulation fee is paid.

Specimens should be addressed as follows:—

To—

DIRECTOR OF MINES BRANCH,
DEPARTMENT OF MINES,
OTTAWA.

### TARIFF OF FEES FOR ANALYSES AND ASSAYS.

1. ASSAYS.—

| | |
|---|---|
| Gold | $ 2 00 |
| Silver | 2 00 |
| Platinum | 4 00 |
| Gold and silver in one sample | 2 50 |
| Gold and platinum in one sample | 5 00 |
| Gold, silver, and platinum in one sample | 6 00 |
| Iridium, palladium, and osmium—each | 5 00 |

2. IRON ORES.—

Determination of:—

| | |
|---|---|
| i. Iron—metallic | 2 00 |
| ii. Iron, and insoluble residue | 2 50 |

| | | |
|---|---|---|
| iii. | Ferrous oxide | 3 00 |
| iv. | Sulphur | 2 00 |
| v. | Phosphorus | 3 00 |
| vi. | Titanium | 3 00 |
| vii. | Iron, sulphur, phosphorus, and insoluble matter | 5 00 |
| viii. | Manganese | 2 00 |
| ix. | Complete analysis—determination of ferrous oxide, ferric oxide, total metallic iron, silica, manganese, alumina, lime, magnesia, sulphur, phosphorus, titanium, water | 20 00 |

3. LIMESTONES, DOLOMITES, AND MARLS.—

Determination of:—

| | | |
|---|---|---|
| i. | Insoluble matter, oxide of iron and alumina together, lime, and magnesia | 5 00 |
| ii. | Insoluble residue and magnesia (qualitative test only) | 1 50 |
| iii. | Insoluble residue and magnesia (quantitative determination) | 3 50 |
| iv. | Phosphoric anhydride | 3 00 |
| v. | Carbonic anhydride (carbonic acid gas) | 3 00 |

4. CLAY, CLAY SHALE, AND CEMENT STONE.—

| | | |
|---|---|---|
| i. | Qualitative examination of clay as to its adaptability for manufacture of porcelain, bricks, and refractory ware | 2 00 |
| ii. | Examination of clay, shale, or cement stone, for cement manufacture—determination of silica, iron oxide, alumina, lime, magnesia, and volatile matter | 10 00 |
| iii. | Complete analysis of clay, shale, etc., including determination of:—silica, free and combined, ferric oxide, ferrous oxide, alumina, lime, magnesia, titanic oxide, carbonic anhydride, carbon, sulphur, and combined water | 25 00 |

5. Coals, lignites, and coke.—

Determination of:—

| | | |
|---|---|---|
| i. | Water, volatile matter, fixed carbon, and ash | 5 00 |
| ii. | Sulphur | 2 00 |
| iii. | Phosphorus | 3 00 |
| iv. | Calorific value | 5 00 |
| v. | Ultimate analysis—determination of carbon, hydrogen, oxygen, nitrogen, and sulphur | 25 00 |

6. Mineral waters.—

| | | |
|---|---|---|
| i. | Qualitative examination—giving amount of saline matter per gallon, and a general idea of the chemical nature of its constituents | 3 00 |
| ii. | Quantitative analysis according to number of constituents determined. | 25 00 and upwards |

7. Ores and minerals.—

Determination of:—

| | | |
|---|---|---|
| i. | Alumina | 3 00 |
| ii. | Antimony | 3 00 |
| iii. | Bismuth | 3 00 |
| iv. | Carbonic anyhdride | 3 00 |
| v. | Chromium | 3 00 |
| vi. | Cobalt | 4 00 |
| vii. | Copper | 2 00 |
| viii. | Ferrous oxide | 3 00 |
| ix. | Ferric oxide | 2 00 |
| x. | Lead | 3 00 |
| xi. | Lime | 2 00 |
| xii. | Magnesia | 3 00 |
| xiii. | Manganese | 3 00 |
| xiv. | Nickel | 4 00 |
| xv. | Silica | 3 00 |
| xvi. | Water—combined | 3 00 |
| xvii. | Zinc | 3 00 |

Non-metallic minerals: asbestos, gypsum, etc., complete analysis of Prices on application.

8. Rocks: complete analysis............Prices on application.

9. Metals and alloys.—

Determination of:—

| | | |
|---|---|---|
| i. | Aluminium | $ 3 00 |
| ii. | Antimony | 3 00 |
| iii. | Arsenic | 3 00 |
| iv. | Bismuth | 3 00 |
| v. | Cadmium | 3 00 |
| vi. | Chromium | 3 00 |
| vii. | Cobalt | 4 00 |
| viii. | Copper | 3 00 |
| ix. | Gold | 2 00 |
| x. | Iridium | 5 00 |
| xi. | Iron | 2 00 |
| xii. | Lead | 3 00 |
| xiii. | Manganese | 3 00 |
| xiv. | Mercury | 5 00 |
| xv. | Molybdenum | 5 00 |
| xvi. | Nickel | 4 00 |
| xvii. | Osmium | 5 00 |
| xviii. | Palladium | 5 00 |
| xix. | Phosphorus | 3 00 |
| xx. | Platinum | 4 00 |
| xxi. | Silicon | 3 00 |
| xxii. | Silver | 2 00 |
| xxiii. | Sulphur | 2 00 |
| xxiv. | Tellurium | 5 00 |
| xxv. | Tin | 4 00 |
| xxvi. | Titanium | 3 00 |
| xxvii. | Tungsten | 3 00 |
| xxviii. | Vanadium | 5 00 |
| xxix. | Zinc | 2 00 |

10. Iron and steel.—

Determination of:—

| | | |
|---|---|---|
| i. | Total carbon | 5 00 |
| ii. | Graphite | 3 00 |
| iii. | Combined carbon | 2 00 |

| | |
|---|---|
| iv. Sulphur | 2 00 |
| v. Phosphorus | 3 00 |
| vi. Silicon | 2 00 |
| vii. Manganese | 1 00 |

11. FERRO-ALLOYS.—
Ferro-silicon, Ferro-chromium, Ferro-manganese, and Ferro-titanium—
Determination of:—
i. Silicon, sulphur, phosphorus, manganese, chromium, titanium, each ............ 3 00

12. SLAGS AND FIRE-SANDS.—
Determination of:—
i. Silica, iron oxide, alumina, lime, magnesia, and loss on ignition .................. 10 00
ii. Complete analysis ...................... 15 00

13. GAS ANALYSIS ....................Prices on application.

14. OIL SHALES.—
Determination of:—
i. Crude oil content ......................... 4 00
ii. Ammonium sulphate ..................... 6 00

15. Identification of minerals and rocks not requiring chemical analysis ........................ Free

## DIRECTIONS.

### ORES.

For analysis it is necessary that the sample sent in should weigh from 2 to 5 pounds; and consist of a number of small fragments rather than one large piece.

### MINERAL WATERS.

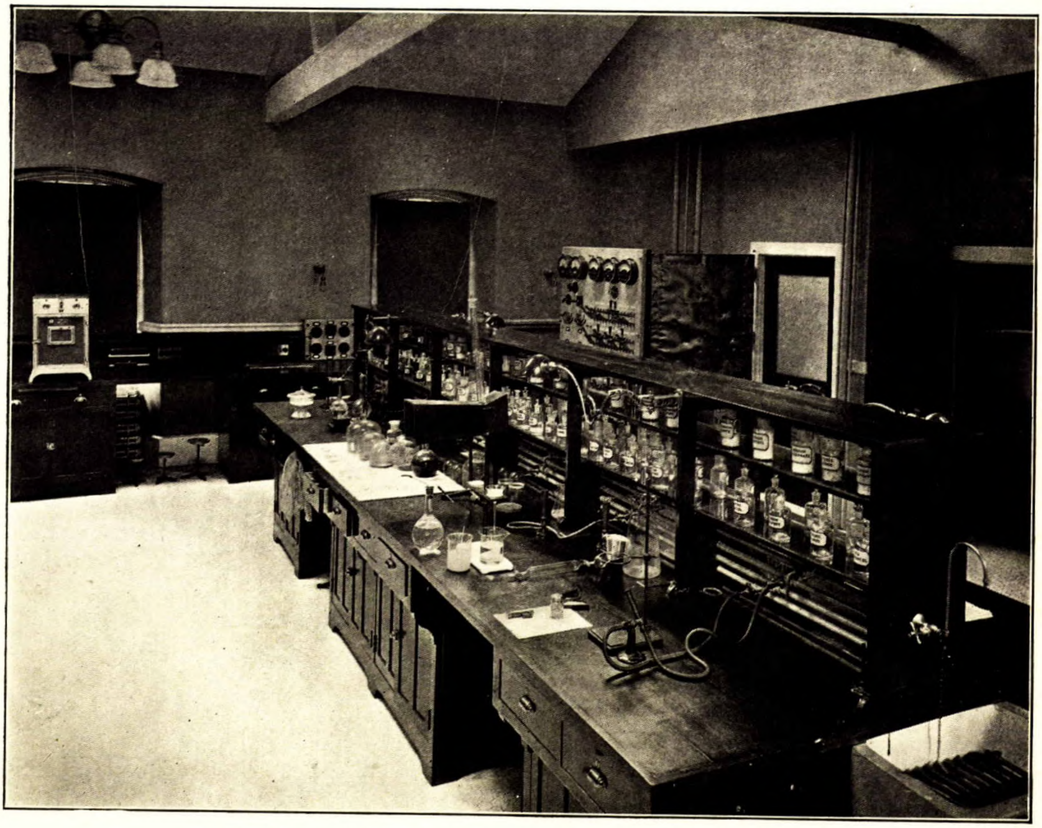
Sample waters should be sent in clean, stoppered, glass bottles, containing, at least, one-half gallon for qualitative, and two gallons for quantitative examination. The bottle must be well rinsed with the same water as the sample itself, and have a label attached stating whether the respective samples are from a boring, spring, or stream.

LOCALITY.

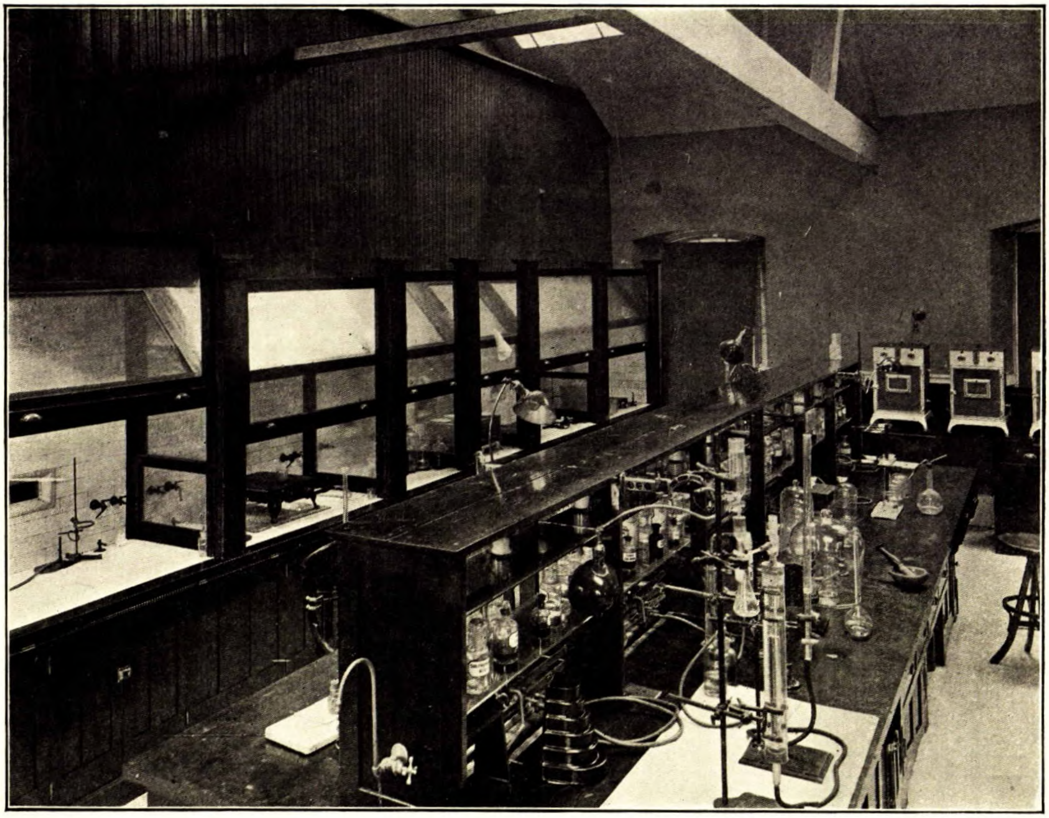
In every instance, specimens and samples should be accompanied by a statement specifying the precise locality whence they were taken.

Main chemical laboratory: work table.

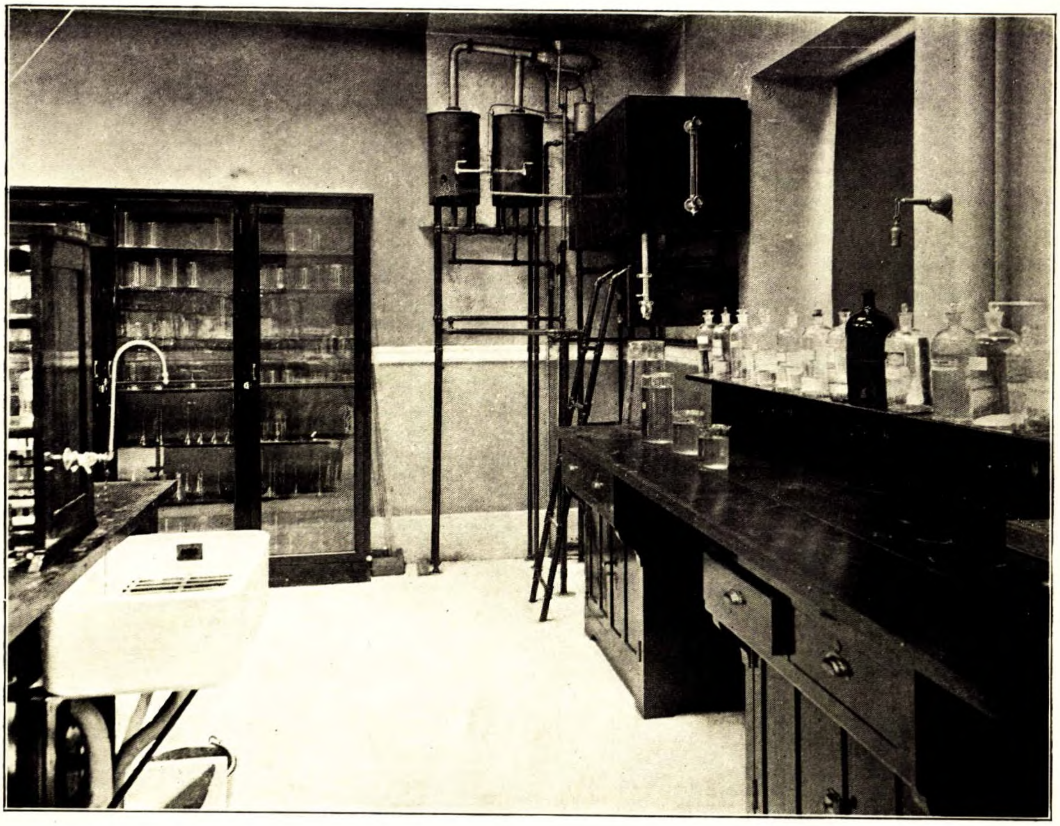
A



Main chemical laboratory: work table and electrical equipment.

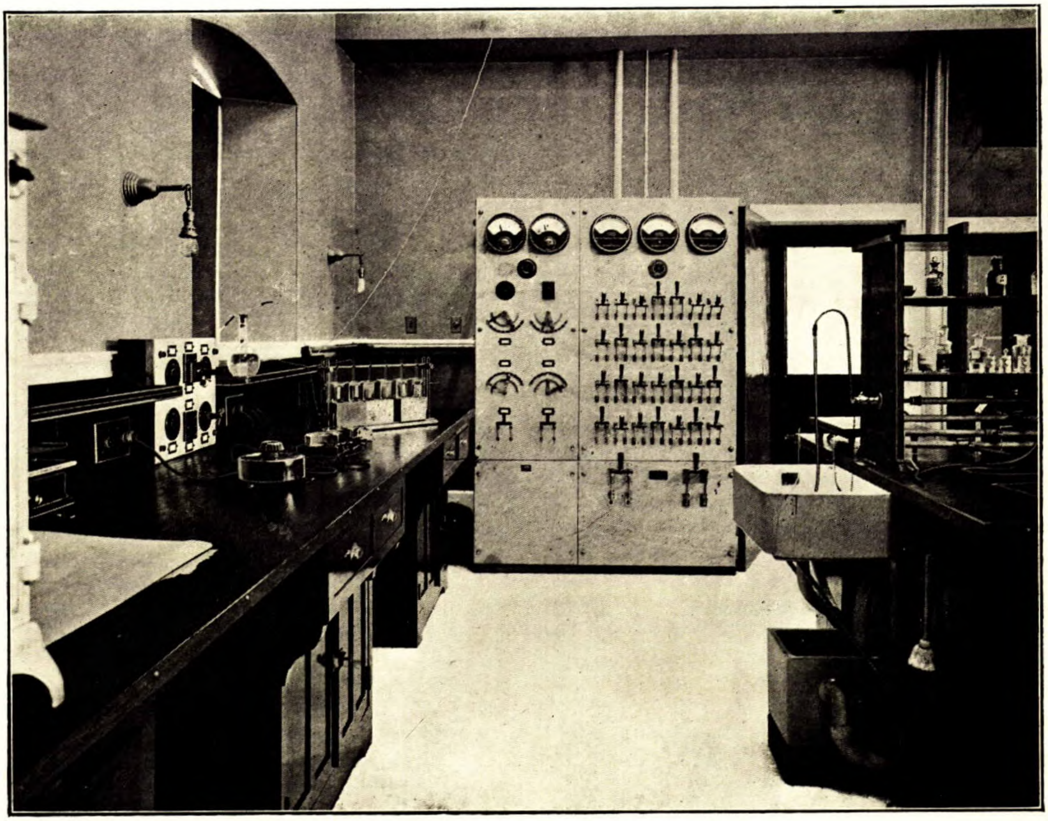


Main chemical laboratory: draught cupboards.



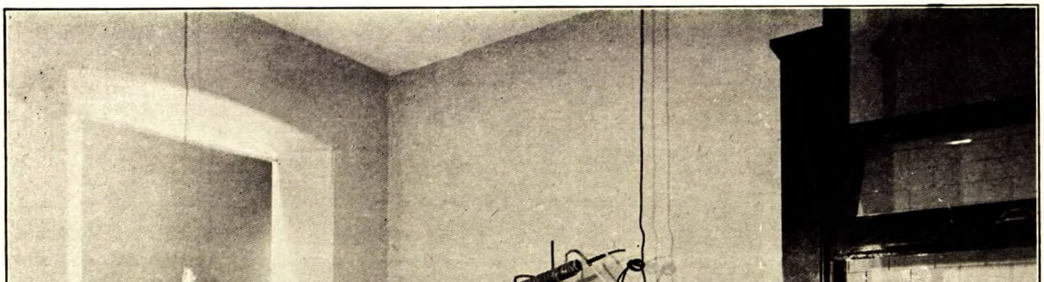
Main chemical laboratory: distilling apparatus and storage tank.

PLATE VI.



Main chemical laboratory: switchboard and electrical equipment.

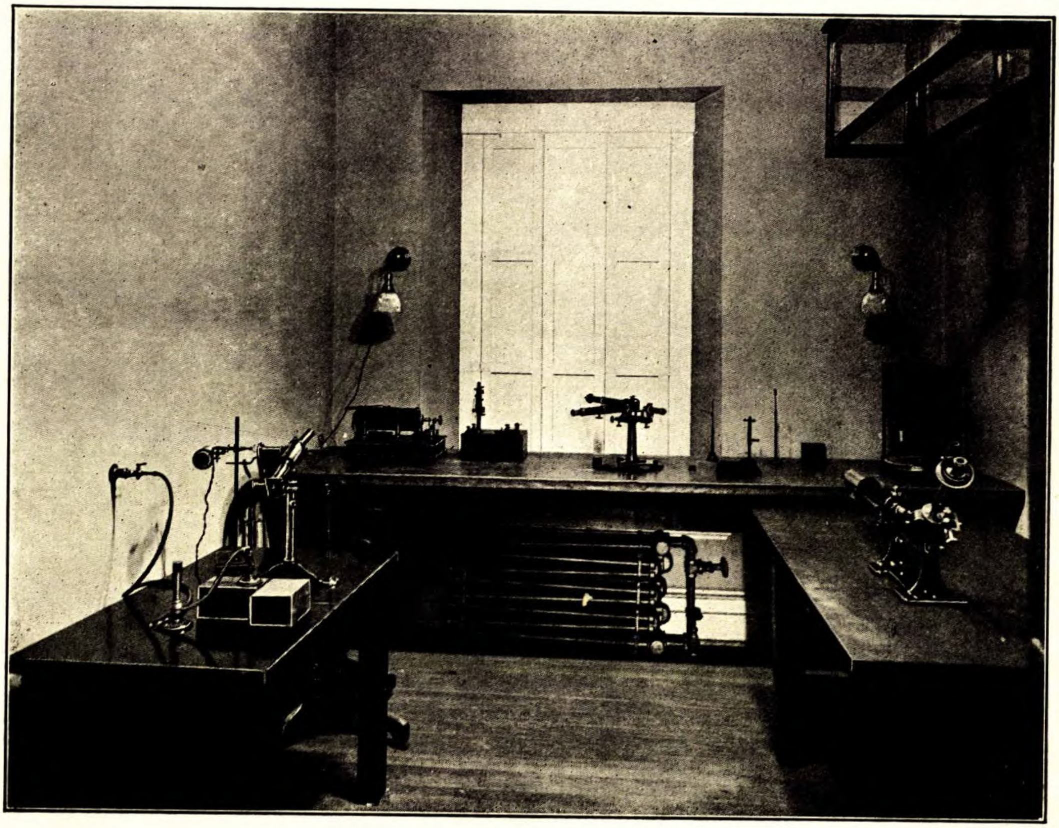
Assay room, showing furnaces, and ventilating fan.



Water analysis laboratory.

Balance room, east end.

Balance room, west end.



Spectroscope room.

## DOMINION OF CANADA ASSAY OFFICE, VANCOUVER, B.C.

The Dominion of Canada Assay Office, Vancouver, B.C., is located on one of the most prominent corners in the business section of the city, adjacent to all the Banks, Express Offices, Post-Office, Railway Stations, and Docks; and has been fitted up somewhat in keeping with the surroundings and the class of business being transacted, viz.: assaying and purchasing gold bullion. The building faces to the east on Granville Street, the north side being on Pender Street, and there is an alley 8 feet wide on the south side by 13 feet wide on the west side of building; which is closed to the Public by steel gates at the ends of alley on Pender and Granville Streets. The Office signs (two), are rectangular tablets in bronze, measuring 42″ × 21¼″, the legend "Dominion of Canada Assay Office" being in relief and classical in style, surmounted by a shield in relief bearing the Dominion Coat of Arms with all the heraldic emblems chased and enamelled in correct heraldic colouring. One sign is placed on the corner of the building facing Pender Street, and the other on the Granville Street wall close to the entrance.

The entrance to the Assay Office is on Granville Street, there being a strong steel screen with a gate in two sections outside the glass panelled oak entrance door, which opens into the Vestibule, measuring 10 × 27 feet, where the receiving counter which is of vert antique marble, and measuring 2′–6″ × 11′–1″, is located.

There is a marble dado 4 feet high on three sides of the Vestibule, and three feet high at the end where the receiving counter forms the cap. The desk in the Vestibule, for the use of depositors, is also of marble, and the floor is laid with tile.

There are seven rooms on ground floor, viz.: the General Office, Manager's Office, Melting Room, Muffle Furnace Room, Balance Room, Janitor's Room, and a room outside of grille for depositors, but located so that they may look into the different rooms and see their bullion melted. The motor, high pressure blower, cupel-making machine, supplies, bathroom, lavatories, etc., are located in the basement, the entrance leading down to same being through a steel gate in Muffle Furnace Room.

Access from the Vestibule and Depositors' Room to the General Office and work rooms, is shut off by a strong steel screen extending from the top of dado to the ceiling. The General Office is of irregular shape owing to position of Vestibule and vault; it has a floor space outside of vault of 640 sq. feet. The weighing-in bullion balance stands on the receiving counter; part of the counter being in the General Office and part in the Vestibule; it being divided by the steel screen in which there is a wicket through which the bullion is received. The balance on which the bullion after melting is weighed stands on a heavy table convenient to the vault entrance. There are two sets of weights used for weighing the bullion, and one set of test weights, each set ranging in weight from 1/100th of an ounce to 500 ounces.

The vault is electrically protected, it being lined with two sheets of steel rivetted together with a wood liner between, which is grooved lengthwise every $\frac{3}{4}''$, and into which wires are placed. There is also a cross groove near each end of the liner for the connecting wires which connect with an instrument and switch on the outside of the vault. The vault door is also electrically protected, glass doors, in which wires are moulded every $\frac{3}{4}''$, closing over it, so that it is impossible to tamper in any way with the vault, or with any of the electric protection connexions, without sounding an alarm. There is also a large, strong bullion safe inside of the vault, which is divided into three compartments, with a three-wheel combination lock on each of the compartment doors, and two four-wheel combination locks and a time lock on the outer door.

The Manager's Office measures 11 × 21 feet, and is directly opposite the receiving counter, with an uninterrupted view of the Vestibule and everything passing to and from the vault.

The Melting Room measures 26 feet × 36 feet, and is equipped with two No. 7 gas melting furnaces of 1,200 ounces capacity each; a No. $4\frac{1}{2}$ gas melting furnace of 400 ounces capacity; and a No. 2 gas melting furnace of 100 ounces capacity; all of which are equipped with hoods connected with flues. There is also the following equipment in melting room, viz.: four cast iron pouring tables—three of which measure 2 feet × 4 feet each, and one 2 × 3 feet—a swinging crane over the larger furnaces for lifting heavy melts, a crusher and pulveriser for crushing and pulverising the slags, both driven by belts leading through the floor from a shaft in the basement; a cast iron chipping table 23″ × 26″; an electric drill; a gas-heated drying plate; an iron table 2 × 4 feet for hot crucibles covered with a hood connected with flue; a cleaning bench and sink supplied with hot and cold water; a lead-lined cooling tank and a general work bench and vice. The room is kept cool by two electric suction fans connected with flues, the outlets of which are above the roof of the building.

The Muffle Furnace Room is of irregular shape, with a floor space of 642 sq. feet, and is equipped with four gas muffle furnaces; a well-lighted fume chamber with a sliding glass door and connected with a flue to carry the fumes over the roof of building; a platinum parting apparatus consisting of two dipping hooks; two boilers with covers, and two trays each containing thirty-six cups; two sinks with hot and cold water and a sink with vitrified pipe connexions for carrying off the used or waste acid and connected with basement drain; one pair of hand rolls, two button anvils, a gas-heated drying plate, apparatus for washing gold cornets and a water still. The room is kept cool by an electric suction fan connected with a flue, the outlet of which is above the top of building.

The Balance Room measures 17 × 16 feet, and the table on which the assay balances are placed stands on concrete points projecting from a concrete pillar, the foundation for which is on hardpan beneath the level of the basement floor.

The Janitor's Room measures 22 × 15 feet.

The ceilings of the different rooms are painted white; the walls a light buff, with a darker coloured dado four feet high in the Melting, Muffle Furnace, and Balance Rooms, and a panelled oak dado four feet high around the walls of the General Office, Manager's Office, and Depositor's Room. All the floors are of strongly reinforced concrete, with a hardwood floor laid on top of same in the Manager's Office and Balance Room, and tile on the floor of Depositor's Room and on the greater part of the floor of the General Office. The floors of the Melting and Muffle Furnace Rooms are painted with a specially prepared paint.

The officer, whose duty it is to receive the bullion, weighs same in presence of depositor, and the weight is checked by another officer. A specimen of the depositor's signature is taken, and he is handed an interim receipt, to be returned endorsed when he receives cheque in settlement and certificate of assay. The bullion is placed in a box on which there is a frame for a number card, the box is then locked, and a card placed in the frame on which has been written the number assigned to the deposit, and by which it is identified during the different operations through which it passes, and also appears in all reports and records connected with the deposit. The bullion box is handed to the melter, opened in the Melting Room, and the bullion transferred to crucible in the presence of the manager, or whom he may appoint, the necessary flux added, then melted, and thoroughly stirred so that the bullion will be homogeneous, then poured into mould, the resulting bar cleaned, dried, and stamped with the melt number. The slag from the melting of deposit is crushed, then pulverised and washed, and the granules recovered are cupelled, weighed, and included in the weight of deposit after melting.

Clippings for assay purposes, of all the higher grades of bullion, are taken from top and bottom corners of the bar at diagonally opposite points; these corners of the bar being then stamped with the letter "A," Dip samples in addition to drillings from diagonally opposite points of the top and bottom of bar are taken of all the lower grades of bullion. The bar, after being clipped or sampled, is weighed in the balance for that purpose and the weight stamped on bar. The clippings or samplings are weighed and charged by manager to assayers while assay is being made, and when assay is completed are returned to manager, weighed, and included in the weight of deposit after melting; the loss in weight by assaying being seldom more than the one-hundredth part of an ounce; two assays are made by each assayer (two), making four checks and these checks must all agree to within ·16 of a part, otherwise the bar has to be remelted and re-assayed; proofs accompany all assays. A report to the manager, on a form provided for the purpose, is then made by each assayer, of the proportion per thousand parts of fine gold, fine silver, and base metal contained in the deposit, gold being reported to the next quarter-thousandth part below, and silver to the next half-thousandth part below.

The computation of the values is then made by two computers, each using a different formula; $20.6718 per ounce is paid for the fine gold contained in the deposit, and the price paid for the silver is regulated by market value.

The certificate handed to depositor contains particulars of the weight before and after melting; proportion of gold or fineness and value of same; proportion of silver or fineness, rate per ounce and value of same; deductions; net value of deposit, and value per ounce on weight after melting. The letter of credit cheques issued in settlement are negotiable without charge at any Bank in Canada.

## Schedule of Charges.

1. Melting Charge: $1,00 on each melt of 1,000 troy ounces or fraction thereof. The Melting Charge is not exacted on gold bullion from the Yukon Territory on which the Royalty Tax has been paid.
2. Toughening and Alloy Charge: 2 cents per ounce, on 1/11th of the standard weight of gold contained in the deposit.
3. Parting and Refining Charge: 4 cents per ounce on the weight after melting. On bullion containing from 950 to 991¾ thousandths, inclusive, of gold, and not more than 30 thousandths of base, the parting and refining charge is 2 cents per ounce on the weight after melting.

### CHARGES ON FINE BARS (992 FINE AND UP.)

1. Melting Charge: $1.00 on each melt of 1,000 troy ounces or fraction thereof.

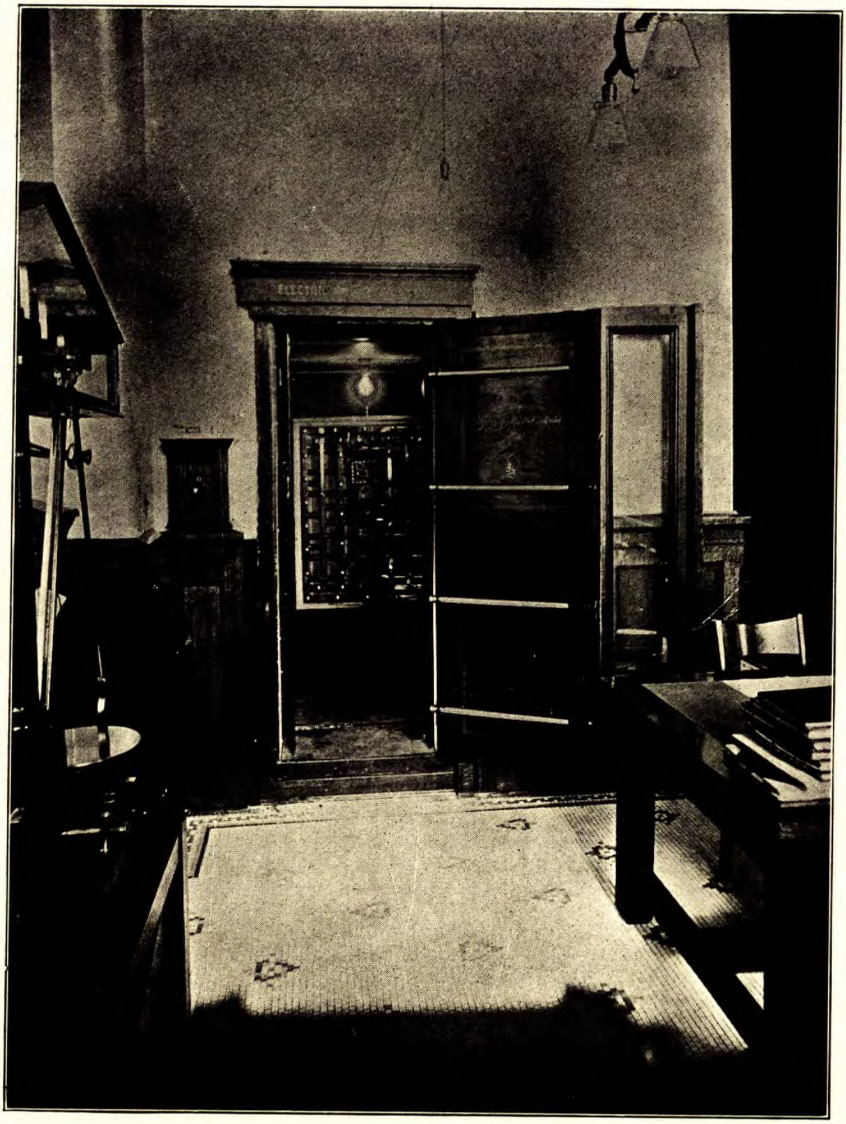
2. Alloy Charge: 2 cents per ounce of copper required to make into coin.
3. A charge of $\frac{1}{4}$ to 2 cents per gross ounce on brittle bars; the adjustment of this charge depending on the difficulty of rendering the bar ductile, to be left to the Manager of the Assay Office.

Dominion of Canada Assay Office: Corner Granville and Pender Streets, Vancouver, B.C.

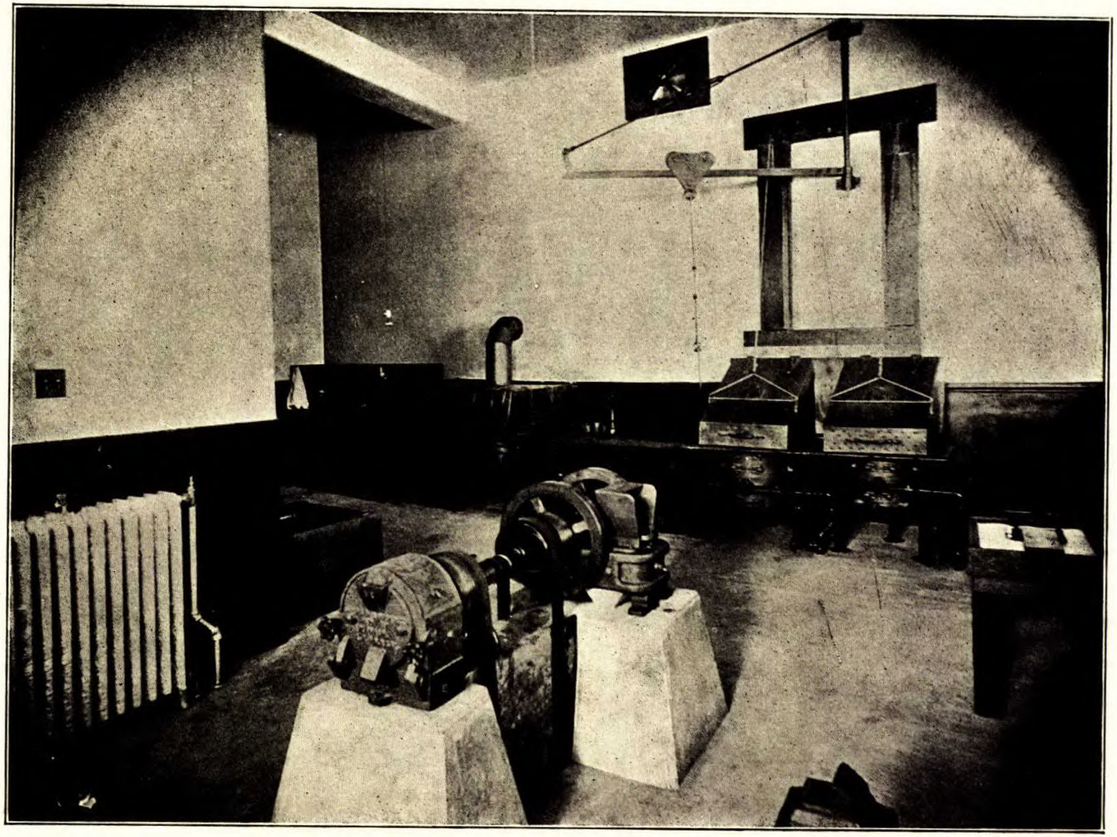
Vestibule.

Receiving Office.

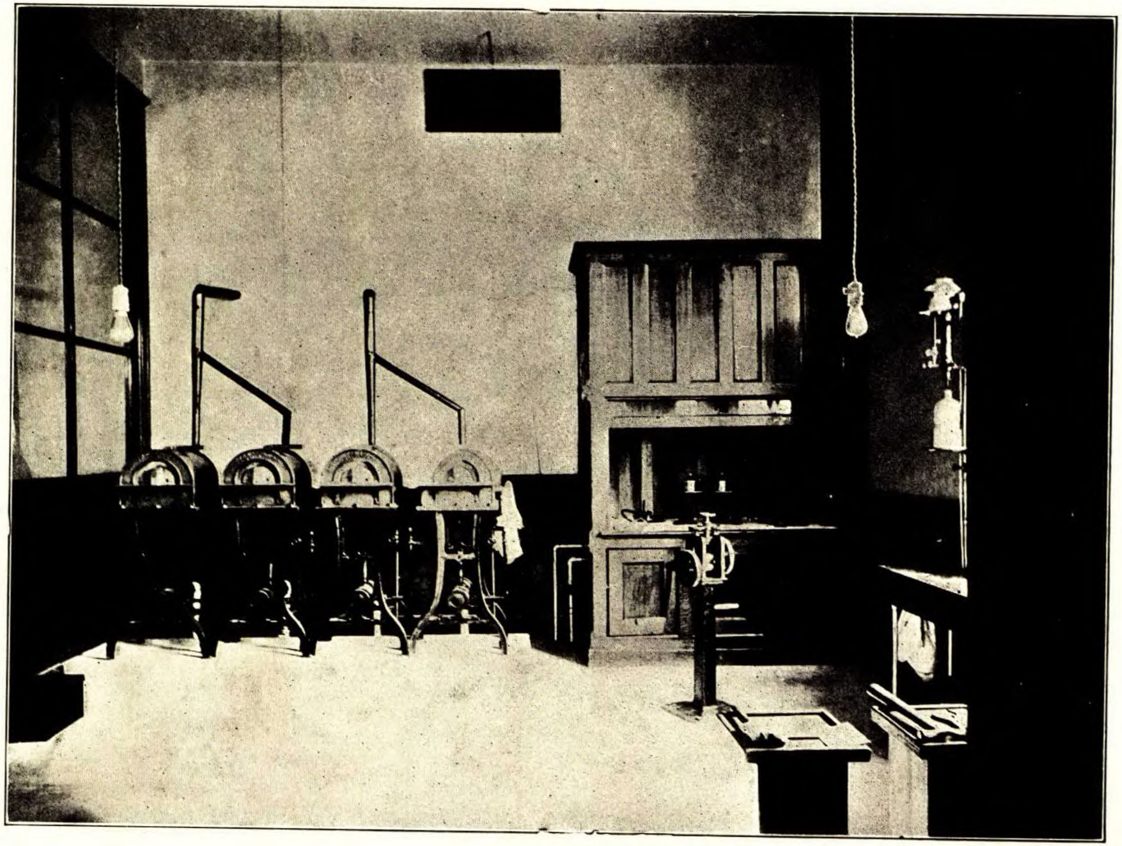
PLATE XV.



Safe Vault.



Melting Room.



Muffle Room.

## FUEL TESTING STATION AND ITS LABORATORIES.

With a view to classifying the various coals of Canada, and to ascertain the most efficient methods for their preparation for the market, and their utilization for the various purposes of the arts and industries, an investigation was undertaken about eight years ago, by the engineering staff of the University of McGill, under the auspices of the Mines Branch, Department of Mines. The published reports, embodying the results of this special work, are entitled—"An investigation of the Coals of Canada." Prior to the completion of this work, begun at McGill University, the Mines Branch, in 1909, established an experimental station at Ottawa, primarily intended for the examination and testing of low grade fuels; but the scope of the work of this experimental station was subsequently extended to include all fuels—solid, liquid, and gaseous—met with in Canada. This extension of the field of investigation necessitated the reconstruction and enlargement of the Fuel Testing Station, and the addition of complete chemical laboratories. The work of modifying the existing plant to meet the new conditions was begun about three years ago, and completed within the last twelve months.

The Fuel Testing Station is at present equipped for the complete investigation of the fuels of Canada, along the following lines: (1) their chemical examination, including the determination of heating value; (2) the distillation of petroleum and bituminous coals, such as lignites, for the purpose of ascertaining their value for the recovery of various oils, and (3) the investigation, on a commercial scale, of the value of the various coals for the generation of gas when burned in a producer, and for the generation of steam. Inasmuch as many of the lignites of the western Provinces cannot be advantageously utilized for the production of power through the media of steam boilers and steam engines, but are particularly well adapted for the production of power through the media of a gas producer and gas engine, the latter phase of the investigation will prove of direct and immediate value to those Provinces.

*Testing Laboratory.*—

The Testing Laboratory is equipped with a Westinghouse double zone bituminous suction gas producer of 125 horse-power capacity, including an exhauster, gas washer, gas receiver and gas regulator. This producer is used for determining the value of bituminous coals and lignites for the production of gas for power or other industrial purposes. A Körting, double zone suction gas producer of 60 B.H.P. capacity, is installed for determining the value of the various peats for the production of a gas. The latter producer is exhausted by means of the gas engine.

For the purpose of measuring the quantities of gas produce, a rotary meter is employed. Between this meter and the gas engine an anti-pulsator is interposed, in order that the volume of gas produced can be accurately measured when the engine is in operation.

The temperatures in various portions of the producers are measured by means of pyrometers, the recording and indicating mechanisms of which are fixed on a suitable wall board. On this board are also attached a Smith recording gas calorimeter, and the various water manometers for recording the suctions or pressures in various portions of the producers and cleaning systems.

*A Babcock and Wilcox Marine Water Tube Boiler* is used for determining the value of the various fuels for steam raising. This boiler is encased in steel, thus reducing air leakage to a minimum. A plate fan built by the Canadian Sirocco Company is used for exhausting the products of combustion. The boiler room is equipped with the necessary feed water pumps and weighing tanks.

The equipment described serves the purpose of determining the relative values of fuels for the production of power when burned in a gas producer, or under a steam boiler.

The accompanying plates and figures illustrate the several laboratories, apparatus, testing plant, and the manner in which they are placed in the building.

During the last two years, the Mines Branch has been collecting both mine and commercial samples of coal for purposes of testing and chemical examination at the fuel testing station. These samples are supplied to the Department by the mine operators, free of charge; the Department paying the freight charges only. Such commercial samples as are obtained by the officials of the Mines Branch are carried by the railways, from the mines to Ottawa, at a special tariff.

Any mine operator desiring to have his coal tested on a commercial scale—independently of the investigations now being conducted—with a view to determining its value for power or other purposes, can do so by sending to Ottawa a commercial sample of not less than 15 tons, all charges prepaid; providing arrangements have been made, previously, for the accommodation of such sample. Independent work of this character will be undertaken only at such times when the laboratories are not engaged on the routine work of the Department.

*Chemical Laboratories.*

These laboratories are well equipped to carry out all kinds of fuel analyses, and also for research work on fuels. Equipment has also been provided for the making of all the analyses required by the Ore Dressing and Metallurgical Division.

There are at present six rooms in the laboratories, and a seventh room is now being equipped to accommodate the bomb calorimeters.

The Balance Room and Office is shown in Plate No. XVIII, In this room there are desks for the principal chemists, bookcases for works of reference, racks for current chemical literature, and a number of different types of balances. The balances are on a slate slab supported on iron girders and pillars, rising from a large concrete pier which stands on a rock foundation, and isolated from the walls of the building.

In the general laboratories, determinations of moisture, sulphur, volatile matter, and nitrogen are carried out, Extraction and distillation tests of coals, oil sands, oils, etc., and other miscellaneous tests, are also made here. The bench shown in Plate XIX is reserved for the work of the Ore Dressing and Metallurgical Division.

Plate XX is a photograph of one end of the furnace room, and shows an electrical combustion furnace and gas furnace, with all accessories necessary for the determination of the carbon and hydrogen in fuels; also an electric muffle furnace for the determination of ash, etc. The furnace room also contains an electrically heated tar still, an autoclave, an optical pyrometer, a gas muffle furnace, and fire assay equipment.

Plates Nos. XXI and XXII show interior views of the gas analysis and calorimetry room, Plate XXIII shows the bomb calorimeter bench, with calorimeters for determining the heating value of fuels, and an electrical resistance thermometer capable of reading 0·001°C.

Plate XXII shows the gas analysis bench. Three complete gas analysis apparatus are here set up, also an apparatus for directly determining nitrogen in gas, an electric signal clock, and a standard barometer.

Plate XXIII shows the gas calorimeter bench where determinations of the heating value and of tar content of gas are made. Two calorimeters, and one of tar determination apparatus are shown, together with the necessary pressure regulators and meters. Producer gas from the producer room and flue gas from the boiler room are brought to this bench in suitable pipes. A sampling pump and motor are shown on the right, and a mercury gas sampling device on the left, by means of which gas is supplied to the calorimeters, etc., and average samples of gas automatically taken over definite periods for analysis. A mercury still is also shown in the photograph.

Plate XXIV shows several forms of standard apparatus for the determination of the colour, flash point, viscosity, and refractive index of oils. The laboratory is also equipped with apparatus for determining the lubricating value, sulphur content, and specific gravity of oils, and with a standard apparatus for distillation tests, but these are not shown in the photograph.

*Calorific and Mine Air Testing Room.*

Recently, separate rooms have been equipped with the necessary apparatus for determining the calorific value of fuels, and for the examination and analysis of mine air.

Previous to 1915, calorific determinations were made in the general laboratory, but the increase in the quantity of such determinations necessitated a separate room, containing only the apparatus required for this class of work.

In 1915, systematic examination and analysis of mine air was inaugurated, and the work was at first done in the general laboratory also; but as in the case of calorific determinations, the demand for this work increased to such magnitude, that it was found necessary to set apart another room, completely equipped with apparatus, for the examination of mine air.

*Sampling Room.*

The sampling room of the Station is equipped with crushing and grinding machinery for the preparation of samples of coal and ashes, etc., and samples are stored here for a year or more after analysis, in case any question concerning them should arise.

*Storeroom.*

The storeroom is provided with suitable cupboards and drawers for stores of chemicals and apparatus.

*Machine Shop.*

In order to facilitate the work of the Fuels and Fuel Testing and Ore Dressing and Metallurgical Divisions—which from time to time involves considerable original and research work, a machine shop has been provided. The equipment includes a Brown and Sharpe universal milling machine; Pratt and Whitney engine lathe; Stockbridge shaper; Brown and Sharpe universal grinding machine; one precision drill, and one drill press. All of the machines are operated by individual motors attached to the machines.

The complete equipment of this machine shop enables these divisions to rapidly construct special pieces of apparatus or to repair those already in existence.

*Power Plant.*

The power plant consists of a 60 B.H.P. Körting, 4 cycle, gas engine, direct connected to a Westinghouse 50 K.W., D.C.

generator. The current generated is led to a switchboard from which it is delivered to the desired points. From this switchboard the alternating current, led into the building from the street lines, is also distributed to the various parts of both the Fuel Testing Station, and the Ore Dressing Laboratory.

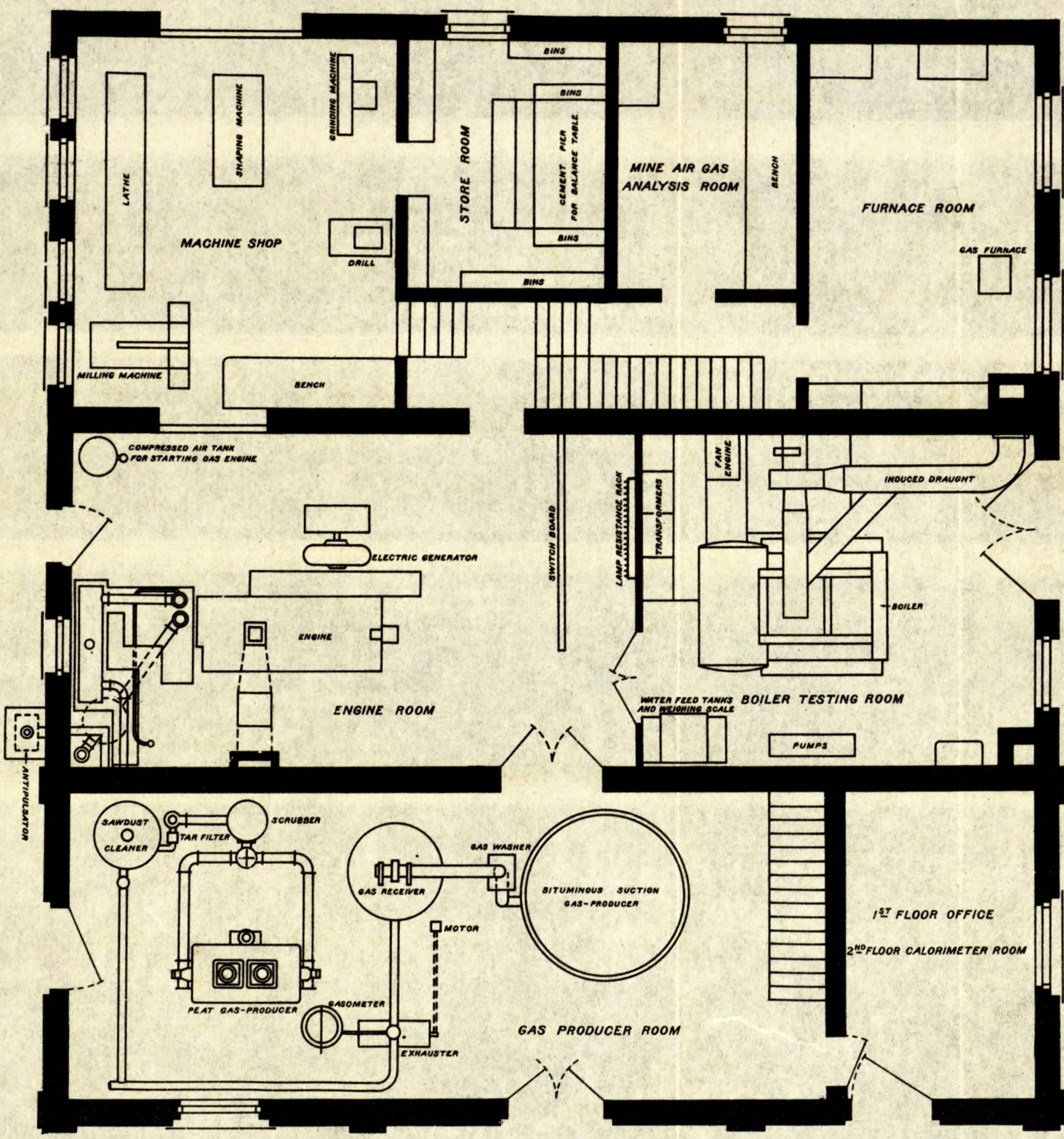



Fig. 2, Plan of Ground Floor, Fuel Testing Station, Ottawa.

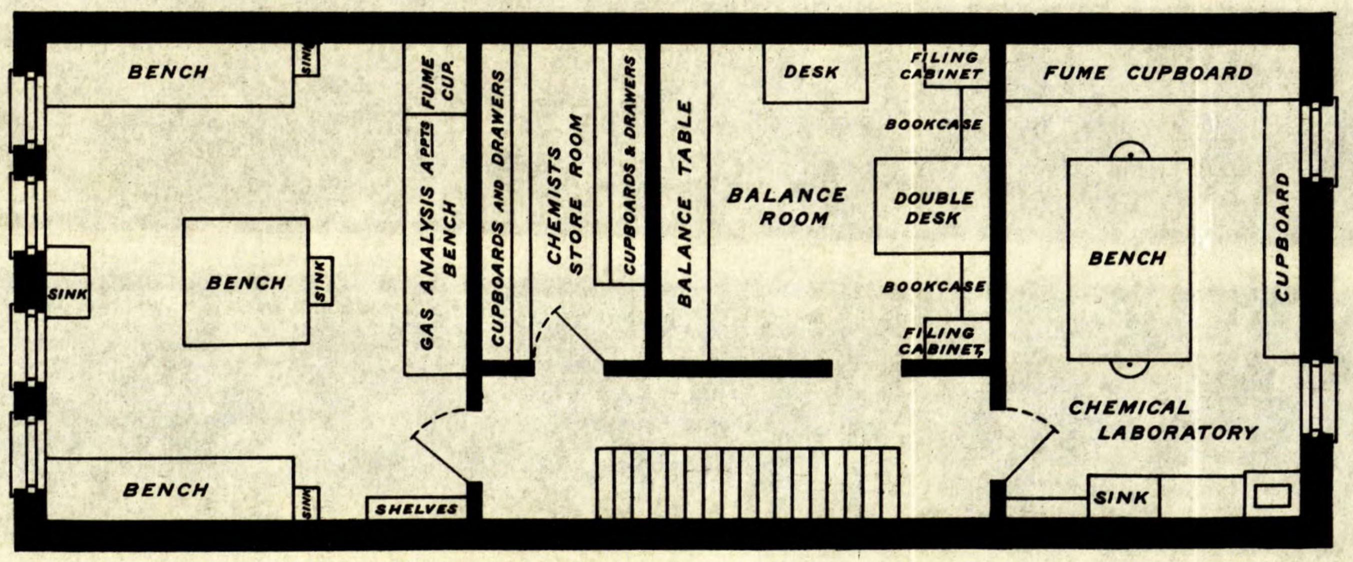
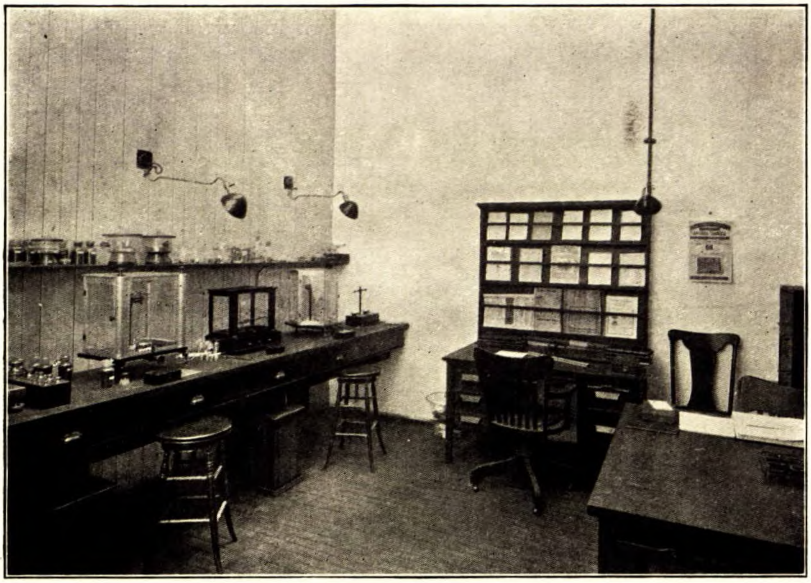



Fig. 3, Plan of first floor, Fuel Testing Station, Ottawa.

PLATE XVIII.

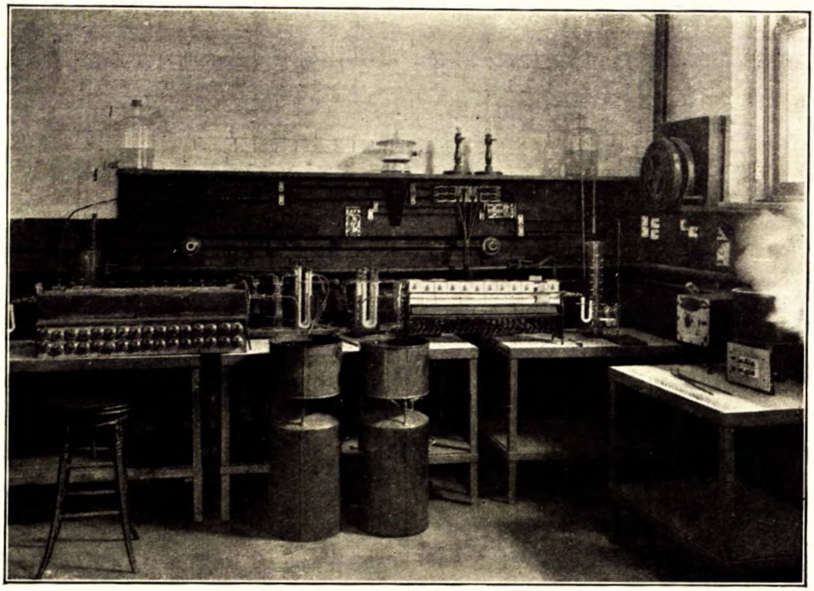


Fuel testing station: balance room.

PLATE XIX.

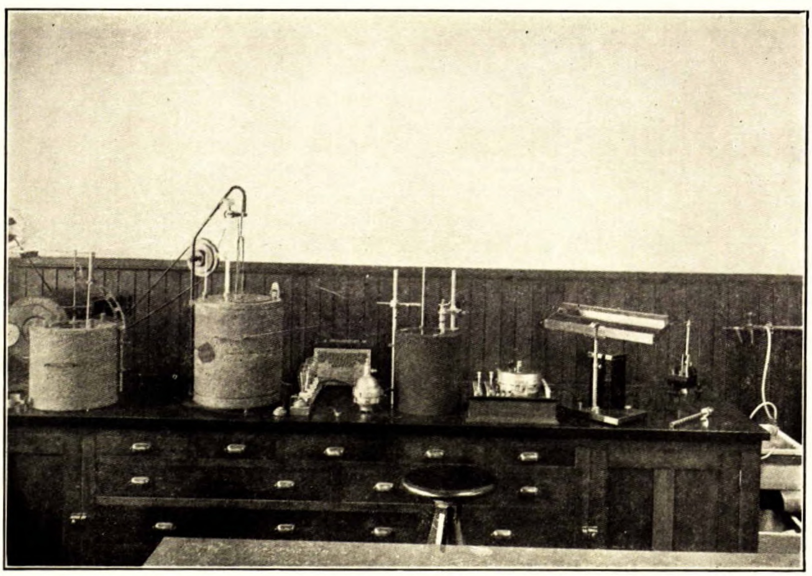
Fuel testing station: analytical laboratory.

PLATE XX.



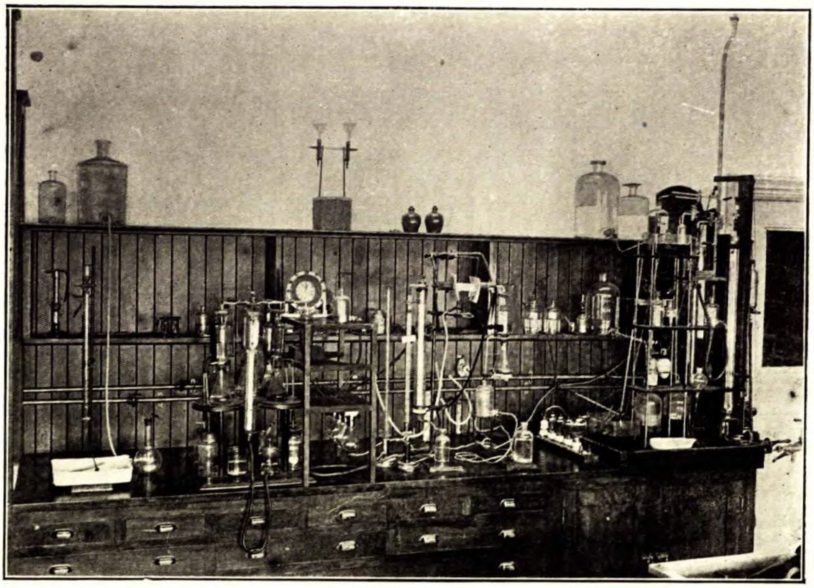
Fuel testing station: chemical laboratory, combustion furnaces.

PLATE XXI.



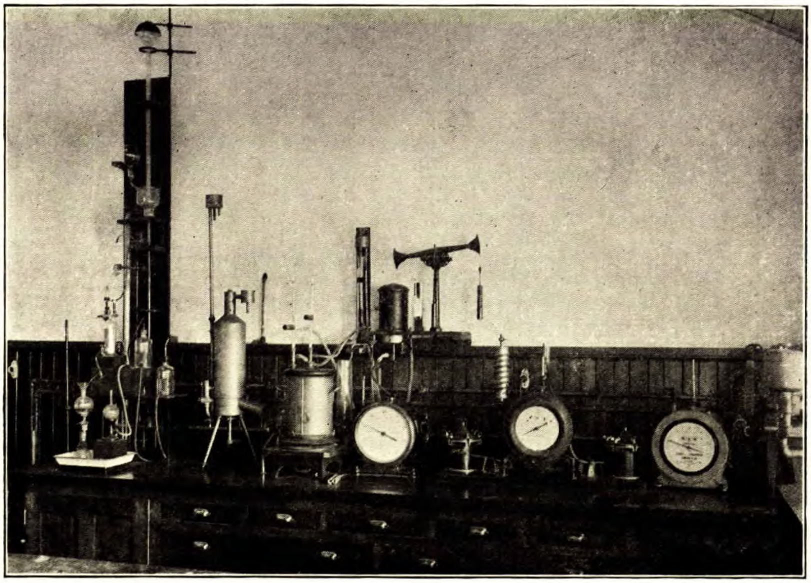
Fuel testing station: calorimeter room, coal calorimeters.

PLATE XXII.



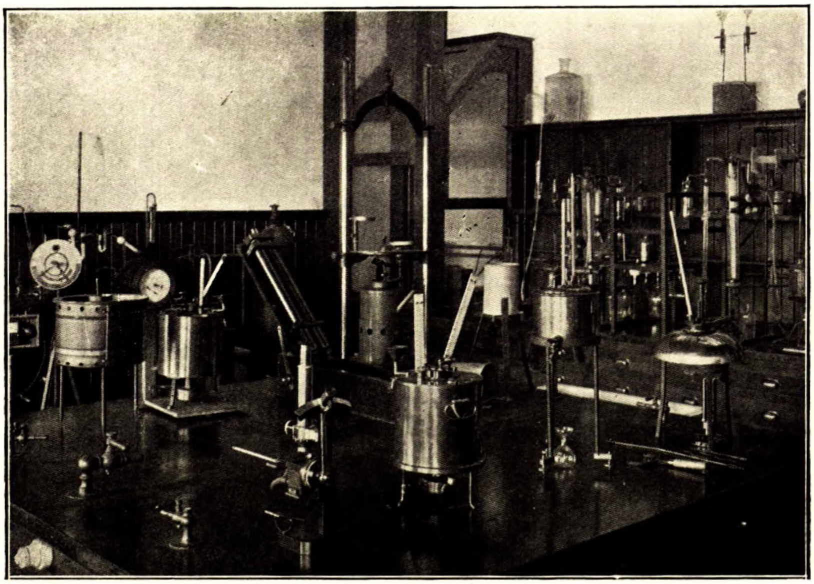
Fuel testing station: laboratory for gas analysis.

PLATE XXIII.

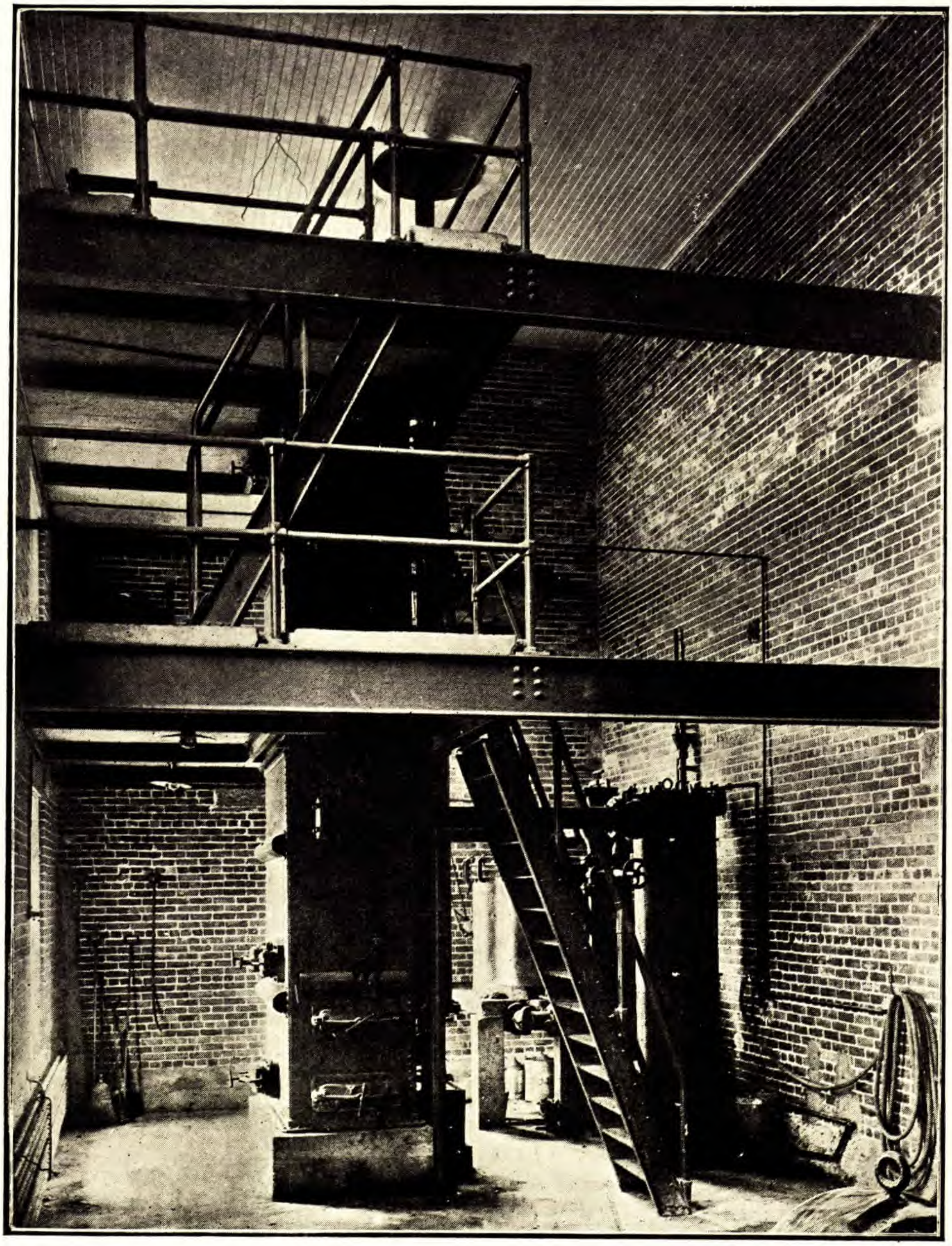


Fuel testing station: calorimeter room, gas calorimeters.

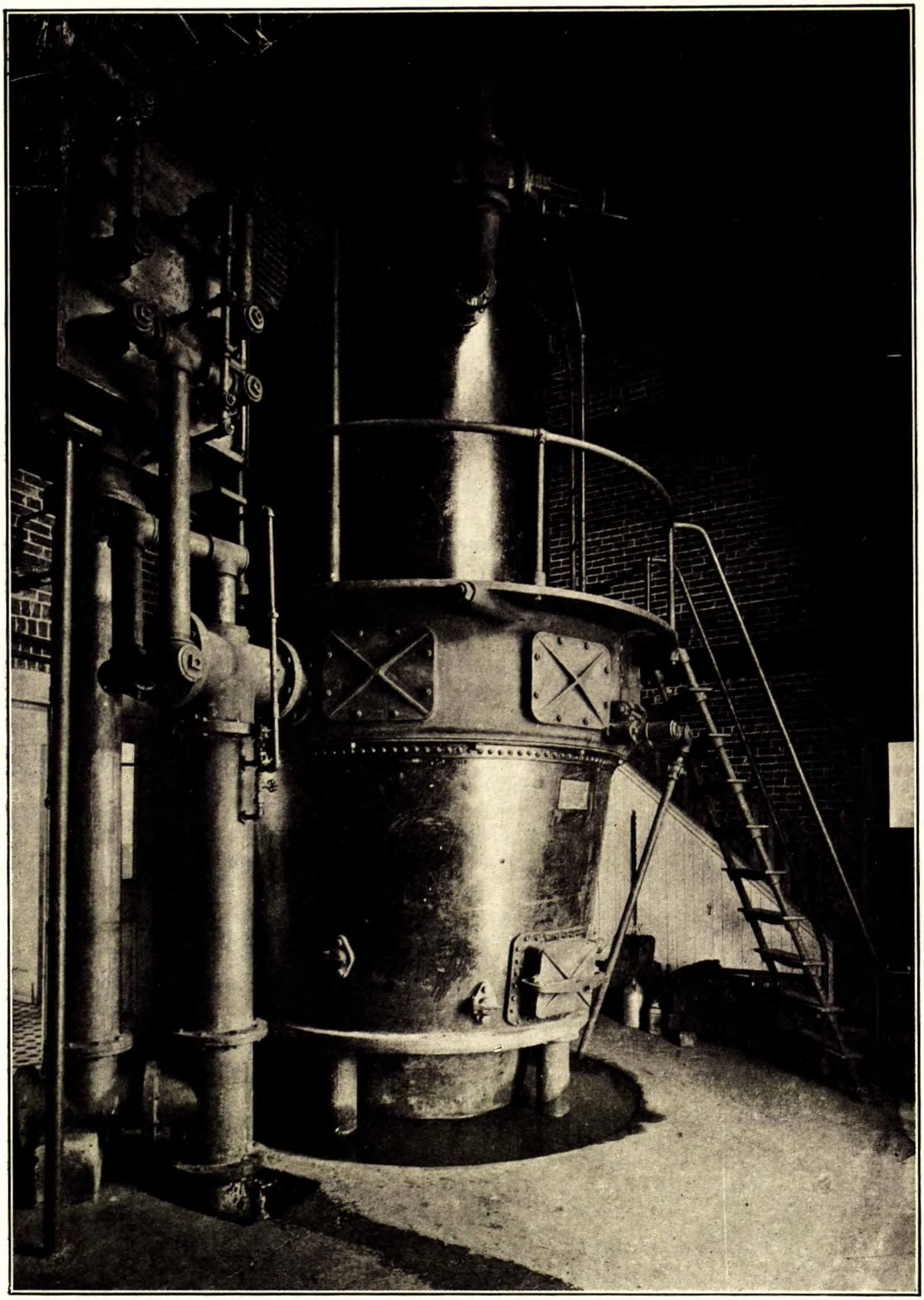
PLATE XXIV.



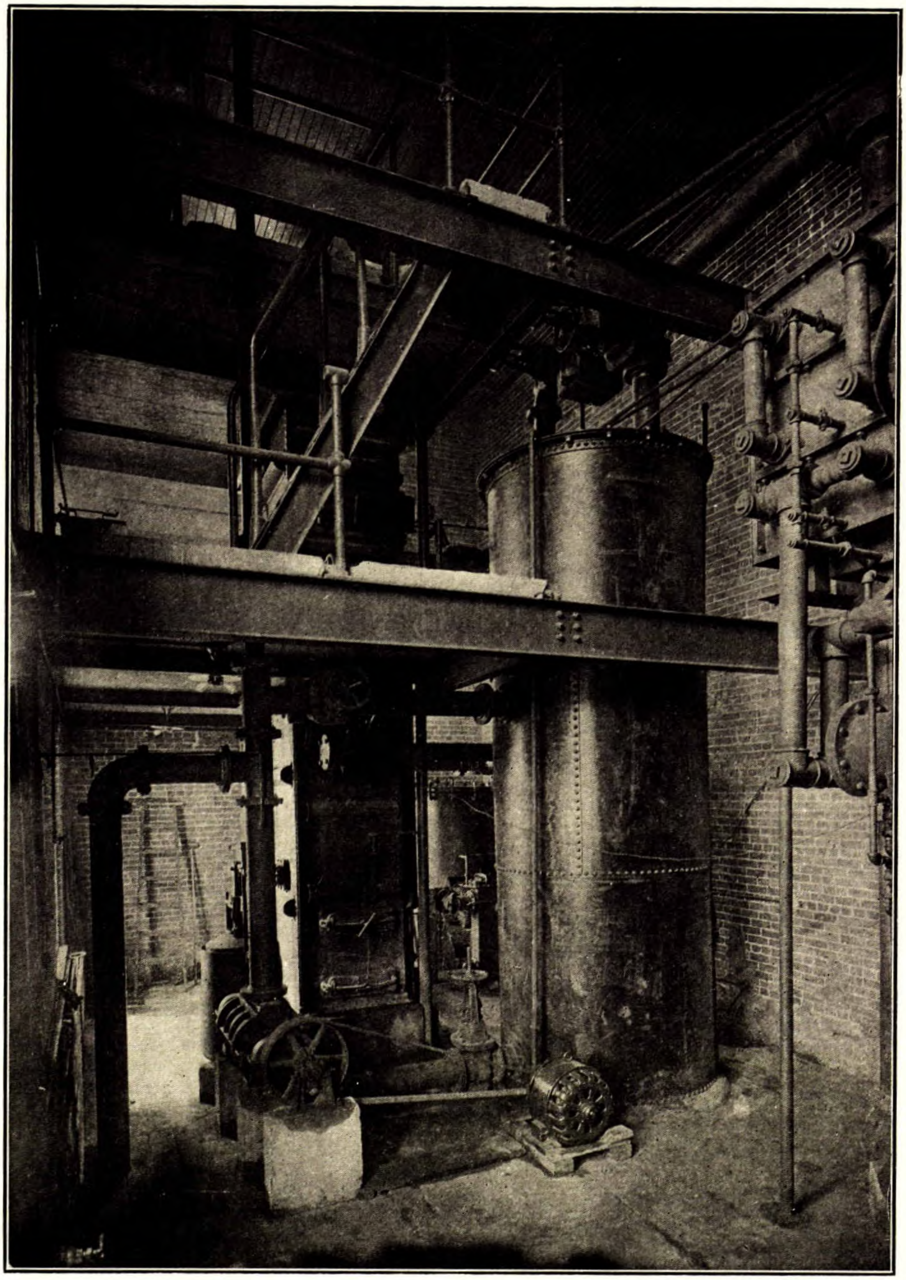
Fuel testing station: chemical laboratory, apparatus for oil analysis.



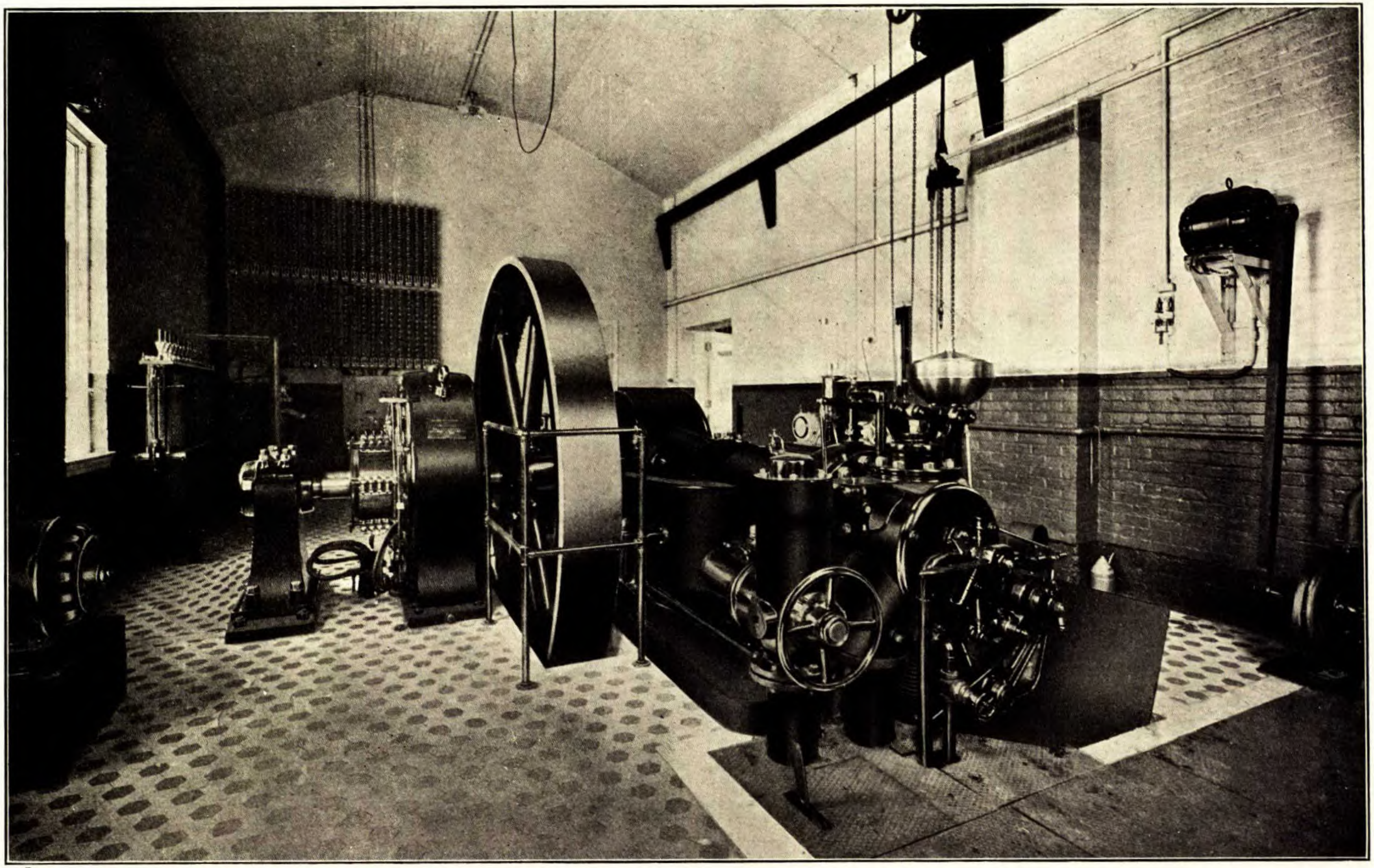
Fuel testing station: general view of a peat gas producer.



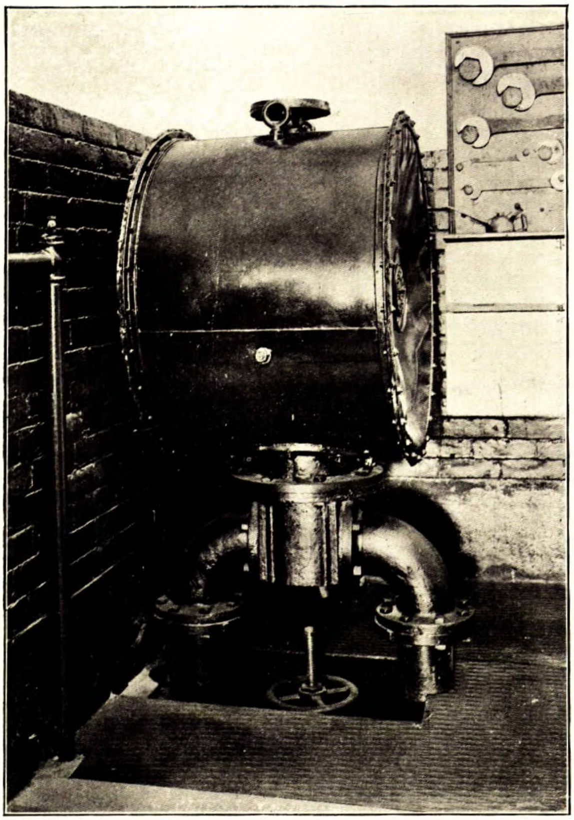
Fuel testing station: Westinghouse suction bituminous gas producer.



Fuel testing station: gas receiver and motor exhauster set of the 125 h.p. Westinghouse suction bituminous gas producer.

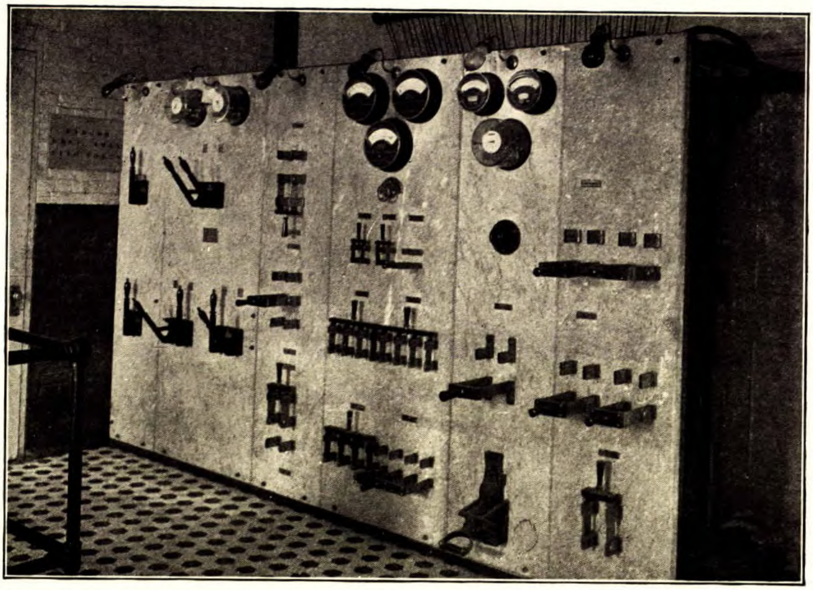


Fuel testing station: general view of Körting gas engine and interior of the engine room.



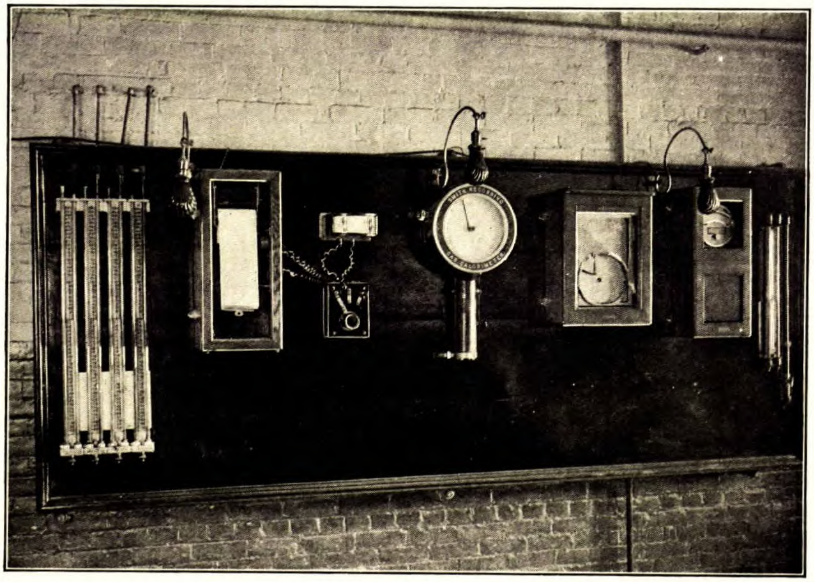
Fuel testing station: engine room, anti-pulsator.

PLATE XXX.

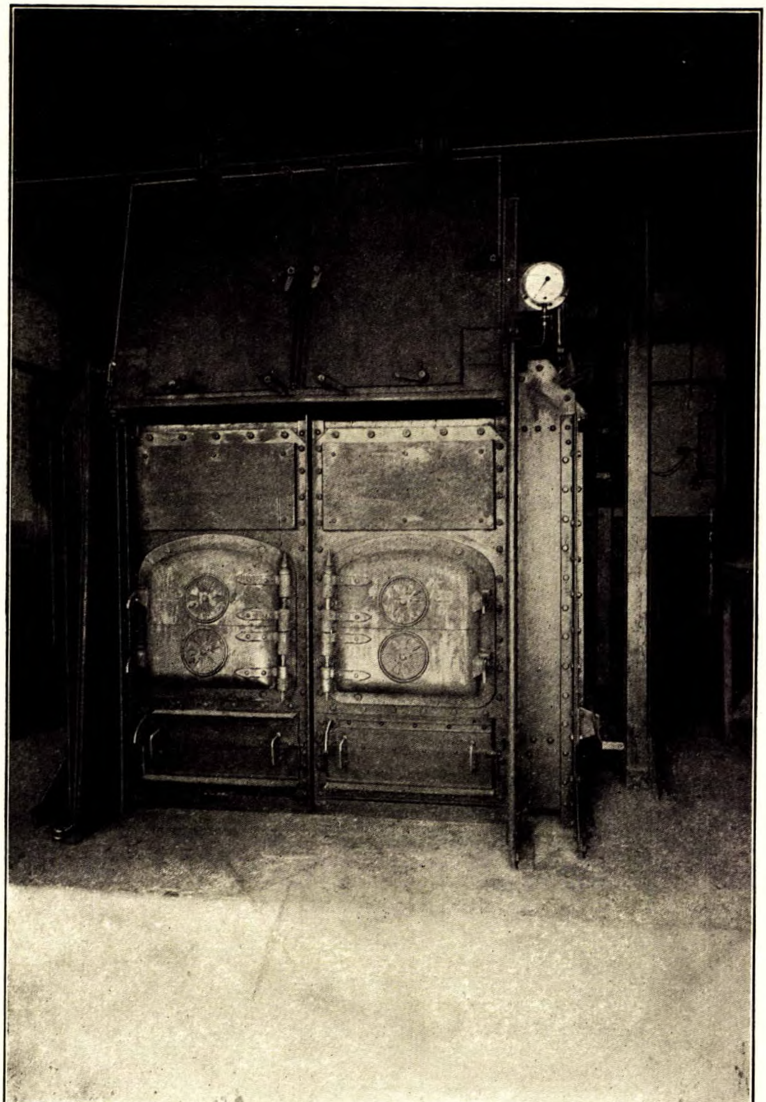


Fuel testing station: power plant switchboard.

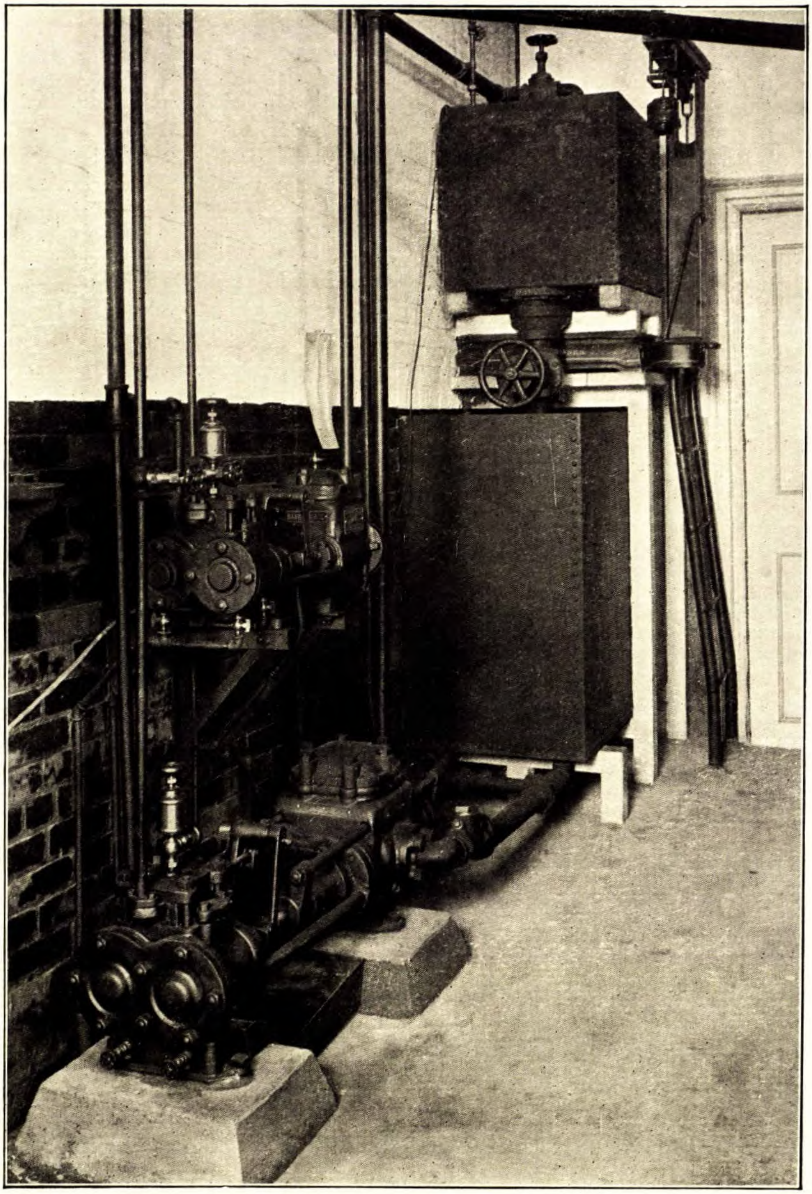
PLATE XXXI.



Fuel testing station: wall board with testing instruments.

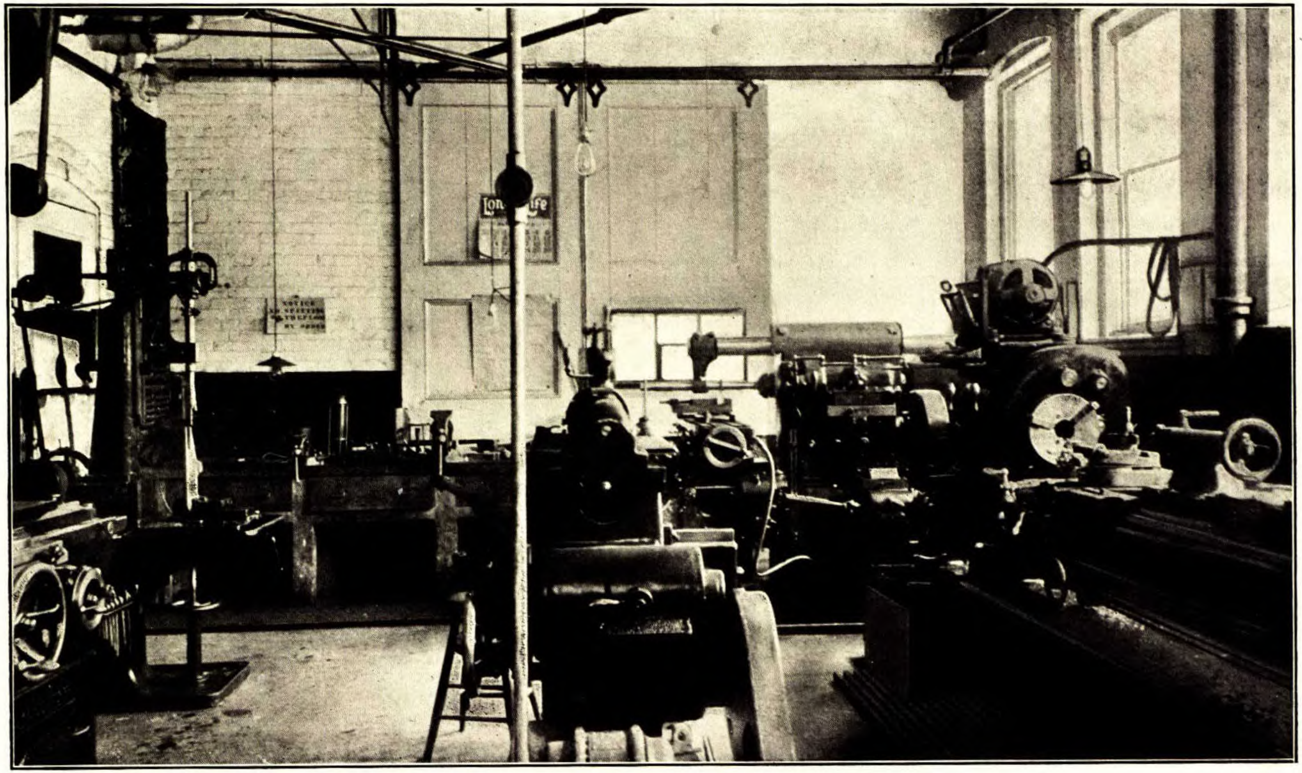


Fuel testing station: boiler room.



Fuel testing station: boiler room, feed pumps, and weighing tanks.

C2



Fuel testing station: machine shop.

## ORE DRESSING AND METALLURGICAL LABORATORIES.

The ore testing laboratory of the Mines Branch Department of Mines, at Ottawa, was designed primarily to assist the prospector and small mine owner to secure concentration and metallurgical tests on his ore at a nominal cost. Numerous Canadian prospects have remained undeveloped because the owners could not afford to have mill tests made on their ore, for, in many instances, this entailed the shipment of samples to testing laboratories in the United States, and the payment not only of freight charges but of a substantial fee for the service. Since the establishment of the government laboratory, samples of Canadian ores and minerals have been received in such a constantly increasing volume that in order to keep pace with the work, it has been necessary to increase the original staff. Samples have been received from all parts of the Dominion; and an idea of the range and variety of work undertaken may be gathered from the following abbreviated list of ores and other mineral substances that have been submitted for testing:

Iron ores from Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia; copper ores from British Columbia, Ontario, and Quebec; zinc ores from British Columbia and Quebec; gold ores from Ontario; pyrites from Ontario; bauxite from Quebec; titanium ores from Quebec; molybdenite ores from Ontario, Quebec and British Columbia; corundum bearing rock from Ontario; glass sands from Nova Scotia; and infusorial earth from Quebec.

*Arrangement of the Plant.*—In designing the plant, care was taken to place the machines so that ore dressing combinations can be made with as little handling of the ore as possible. Actual mill conditions are therefore duplicated to a large extent. What the proper combination should be and the best mode of treatment is predetermined by preliminary tests made on laboratory type machines. After having arrived at the most suitable flow sheet the large machinery is adjusted for this combination. The large scale machinery and apparatus are placed on the ground floor, which is of concrete. This is channelled to carry the overflow water to two large concrete sumps, below the floor, connected with the drain from the building. The feeders to the machines and the laboratory type apparatus are placed on the second floor.

*Equipment.*—The plant is equipped with large size apparatus as employed in actual practice, as well as with laboratory type apparatus used for small scale and preliminary tests.

In June, 1912, work was commenced on the construction of the addition to the Fuel Testing Station, which contains the new and enlarged laboratories for ore dressing and metallurgical investigation. In the following December a start was made in the installation of machinery. In addition to the ore dressing laboratories, the new building contains a laboratory in which gas analyses are conducted, as well as general chemical and furnace laboratories, with the necessary balance, store and office rooms. A machine shop has also been provided for general repair work, and for the making of new apparatus.

The ore dressing laboratory consists of one large room, approximately 52 feet square and one and a half stories high. As equipped, it contains the following machinery and apparatus:

*Crushing and Screening.* — One Hadfield and Jacks, 12″ × 8″, Blake crusher; one Allis-Chalmers, 24″ × 14″, style "C" crushing rolls; one Hardinge, 4″–6″, conical mill; one Ferraris, 6′ screen, for coarse sizing and scalping; and one No. 3 Keedy ore sizer, for fine sizing.

*Sampling.*—For sampling two standard Vezin machines are provided, placed in favourable positions to cut out preliminary samples of coarse materials. The fine material is sampled by an eight-unit system of the Flood automatic sampler. Provision has also been made for sampling by hand, using the Jones riffled samplers. All water lines serving standard apparatus are equipped with Keystone water meters to enable the keeping of an accurate record of water consumption.

*Amalgamation and Concentration.*—The equipment comprises an Allis-Chalmers 5-stamp battery with 1,250 pound stamps, with a 10 ft. tilting amalgamating table, followed by a Pierce amalgamator. The mortar of this mill may be, if so desired, arranged for inside amalgamation. Also six 8 ft. Callow tanks; two Richards pulsator classifiers, launder type; one Richards pulsator, two compartment jig; one Overstrom sand table; one Deister slime table; one tandem unit Gröndal magnetic separator for wet separation of strongly magnetic minerals; one Gröndal magnetic cobber, with dust collector for dry separation of strongly magnetic minerals; one Ullrich four-pole magnetic separator for either dry or wet separation of weakly magnetic minerals; one Huff electrostatic unit, comprising a standard generator and two laboratory type separators; one 2″ × 6″ Sturtevant laboratory crusher; one 8″ × 5″ Sturtevant laboratory rolls; one Sturtevant laboratory screen; one Braun planitary pulverizer; one gyratory screen frame (Hoover type for making dry screen analysis with nested screens); one six-jar, Abbe sample mill; one combination Richards pulsator jig and classifier, laboratory type; one 24″ laboratory Wilfley table; one laboratory Gröndal magnetic separator; one laboratory cyanide comprising a Parrell agitator and air pump with the necessary solution, zinc and sump tanks; two laboratory filter presses; one complete set of I.M.M. standard screens; one complete set of Tyler standard screens, after Rittinger scale; one laboratory plumb pneumatic jig; one full scale plumb pneumatic jig; one tandem set James automatic jigs; one laboratory mineral separation oil flotation apparatus; one standard unit mineral separation oil machine; one Wood water flotation machine.

A roaster building 30 × 60 feet, placed at the rear of the main laboratory, contains: one 8-foot Wilfley roaster with complete pyrometer accessories; and one laboratory duplex Dwight and Lloyd sintering pan, with accessories.

*Power and Transmission.*—The power and transmission machinery and apparatus comprises one 35 H.P. Locomobile boiler and engine in roaster building; one 40 H.P., D.C. motor; two 25 H.P., A.C. motors; one 5 H.P., A.C. motor; one 5·5 K.W. generator set; one ·5 K.W. generator set; two main line shafts for large scale machinery; one main line shaft for laboratory machinery; and intermediate shafts, pulleys, step cones, belt and cone shifters, leather and balata belting, friction clutches, belt tighteners, etc.

Two main line shafts drive the large scale machinery. Most of the machinery on the ground floor is driven direct from the line shafts, thrown in and out of operation by friction clutches on the pulleys. Intermediate shafts from the line shafts drive the balance of the machinery on the ground and second floors. The proper speed is given the shafts and machines by various sized pulleys. Step cones are used in a number of cases where several speeds are required. The machines are thrown in and out of operation by friction clutches on the pulleys, and by belt shifters, which move the belt on to the fast or loose pulley. Tighteners are used with the cone pulleys and larger belts to take up the slack.

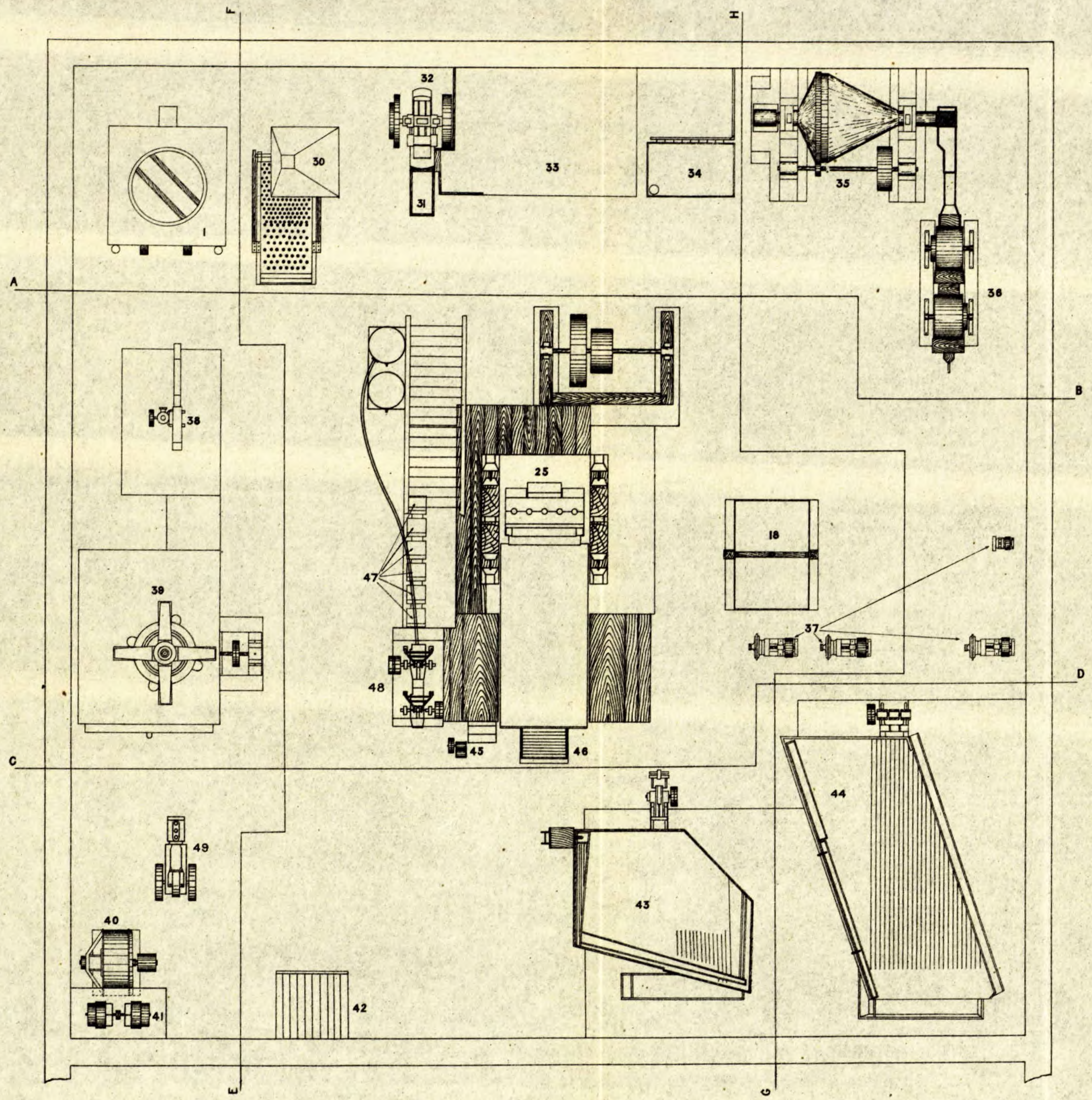
*Switch Boards.*—Besides the main switchboard in the engine room, a sub-board of two panels is placed in the laboratory. On these panels are placed the switches for the motors, generator set, and for the current to the magnets of the magnetic separators. The voltmeters and ammeters are placed to one side of the sub-board, from which the current strength to the magnets is regulated. A small board is placed on the second floor, on which are the rheostats, meters and switches for the laboratory wet and dry separators. On the Huff electrostatic panel are placed the two rheostats for raising or lowering the voltage on the electrodes, the voltmeter, switches and starting compensator.

*Water Supply.*—The machines are supplied with water through pipe lines and launders. Water meters are placed on the lines to measure the amount each machine is using while in operation. In the case of the jigs, where a definite head of hydraulic water is required, the water is supplied from tanks set at the proper elevation.

*Storehouse.*—A stock of supplies is kept in a room to one side of the machine shop. Records are kept of all material and supplies received and issued to the fuel testing, chemical and ore testing laboratories. An ore stock shed 20 × 40 feet has been built to house the various shipments of ore awaiting test.

*Regulations.*

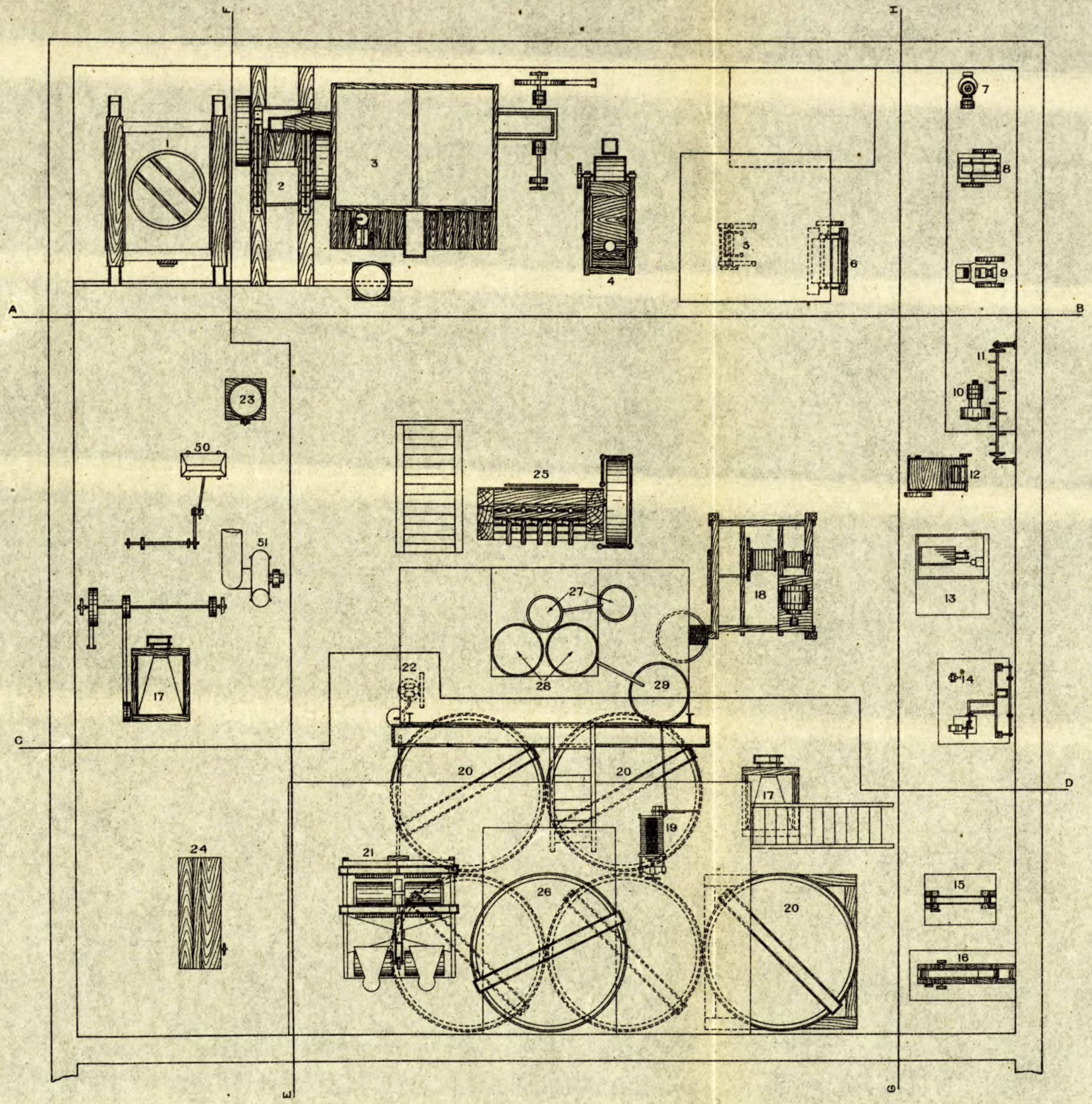
Two kinds of tests are conducted, namely: preliminary and small scale tests, and mill or large scale tests. Preliminary and small scale tests are made on shipments up to 600 pounds, by the use of the laboratory apparatus. Every likely combination is tried, and all data and facts are recorded and tabulated. Mill or large scale tests are made on shipments of 5 tons. The best mode of procedure and the proper flow sheet having been determined by small scale tests, the large machinery is adjusted to conform with the requirements, and the tests are made under actual mill conditions. For preliminary and small scale tests the consignment must not be less than 200 pounds. For mill or large scale tests shipments should not be under 5 tons. All shipments must come bagged and be consigned prepaid to the Mines Branch, Department of Mines, Ore Testing Laboratory, corner of Plymouth Avenue and Division Street, Ottawa. The assaying and analysis of the necessary samples are made by the Mines Branch officials, in the laboratories at the plant, or at the Sussex Street Building. Tests on Canadian ores including the necessary assays and analysis for test purposes, are undertaken without charge to the consigner; but all testing products become the property of the Mines Branch, unless otherwise arranged. The tests are conducted by the officials of the Mines Branch, but arrangements may be made, whereby engineers or other competent persons may supervise their own experiments. This, however, does not apply to tests made on machines and by processes on which it has been necessary to guarantee the protection of patents. The reports on all tests made are published in book form by the Mines Branch, but after the completion of a test the owner of the samples tested is entitled to receive a copy of the report thereon. Those desiring to have ores tested in the Government laboratory should make application direct to the Director Mines Branch, Department of Mines, Ottawa.




**Reference.**

1 *Keedy Ore Sizer*
18 *Elevator*
25 *5-Stamp Battery*
30 *Ferraris Screens*
31 *Elevator*
32 *Jaw Crusher*
33 *Feeding Floor*
34 *Dryer*
35 *Hardinge Ball and Pebble Mill*
36 *Gröndal Wet Separator*
37 *Centrifugal Pumps*
38 *Richards Pulsating Jig*
39 *Ullrich Magnetic Separator*
40 *40-H.P-D.C.-Motor*
41 *5½ K.W. Generator Set*
42 *Switch Board*
43 *Deister Concentrator*
44 *Overström "*
45 *Rotary Pump*
46 *Pierce Amalgamator*
47 *Precipitating Boxes*
48 *James Ore Jig*
49 *Air Compresser*

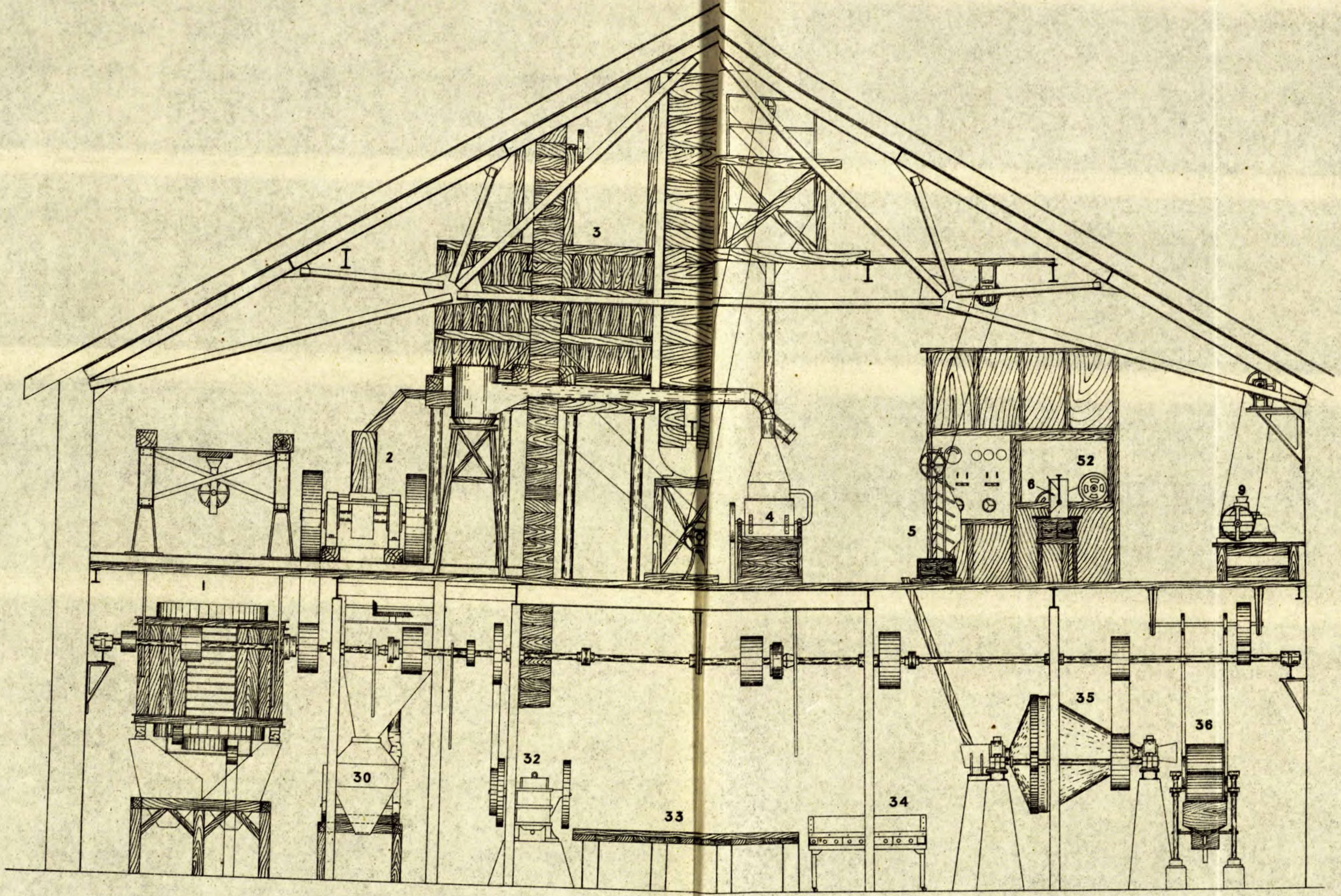
Fig. 4, Plan of Ground Floor, Ore Dressing and Metallurgical Laboratory, Booth Street and Plymouth Avenue, Ottawa.




**Reference.**

1 *Keedy Ore Sizer*
2 *Roll Crusher*
3 *Ore Bins*
4 *Gröndal Cobber*
5 *Huff Electrostatic Fine Separator*
6 " " *Single Roll Separator*
7 *Laboratory Hoover Sizer*
8 " *Roll Crusher*
9 " *Jaw Crusher*
10 " *Braun Pulverizer*
11 " *Pebble Mill*
12 " *Sturtevant Screen*
13 " *Wilfley Table*
14 " *Richards Jig and Classifier*
15 " *Wet Gröndal Separator*
16 " *Dry* " "
17 *Push Feeder*
18 *Elevator*
19 *Slime Filter Press*
20 *Callow Classifiers and Settling Tanks*
21 " *Screen Classifier*
22 *Air Pump*
23 *Jig Feed Water Tank*
24 *Work Bench*
25 *5-Stamp Battery*
26 *Callow Cone Classifier*
27 *Feed Water Tanks*
28 *Cyanide Storage Tanks*
29 *Parral Agitator*
50 *Plumb Pneumatic Jig*
51 *Exhauster*

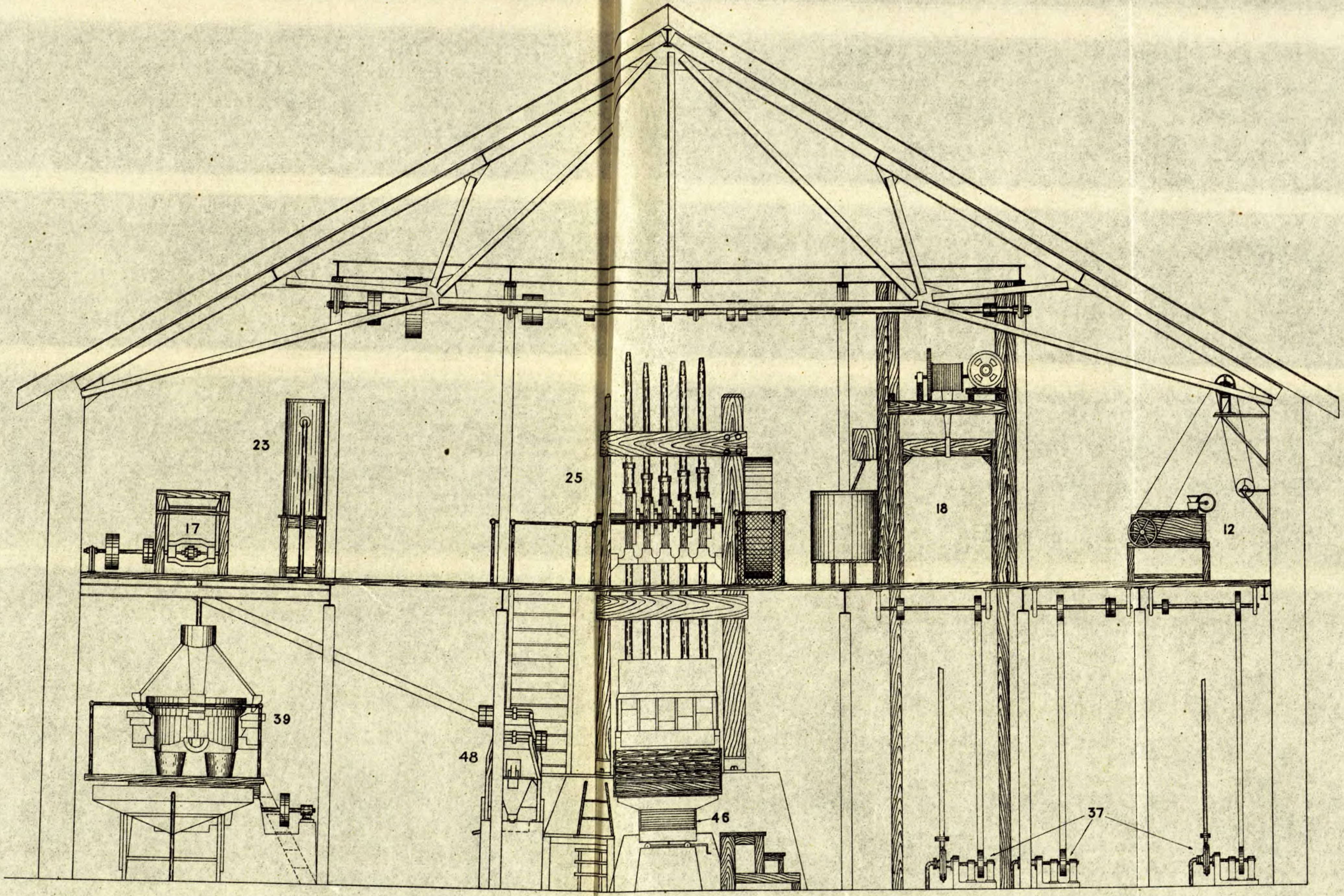
Fig. 5, Plan of Second Floor, Ore Dressing and Metallurgical Laboratory, Booth Street and Plymouth Avenue, Ottawa.




**Reference.**

*1 Keedy Ore Sizer*
*2 Roll Crusher*
*3 Ore Bins*
*4 Gröndal Cobber*
*5 Huff Electrostatic Fine Separator*
*6 " " Single Roll Separator*
*9 Laboratory Jaw Crusher*
*30 Ferraris Screens*
*32 Jaw Crusher*
*33 Feeding Floor*
*34 Dryer*
*35 Hardinge Ball and Pebble Mill*
*36 Gröndal Wet Separator*
*52 Huff Electrostatic Generator Set*

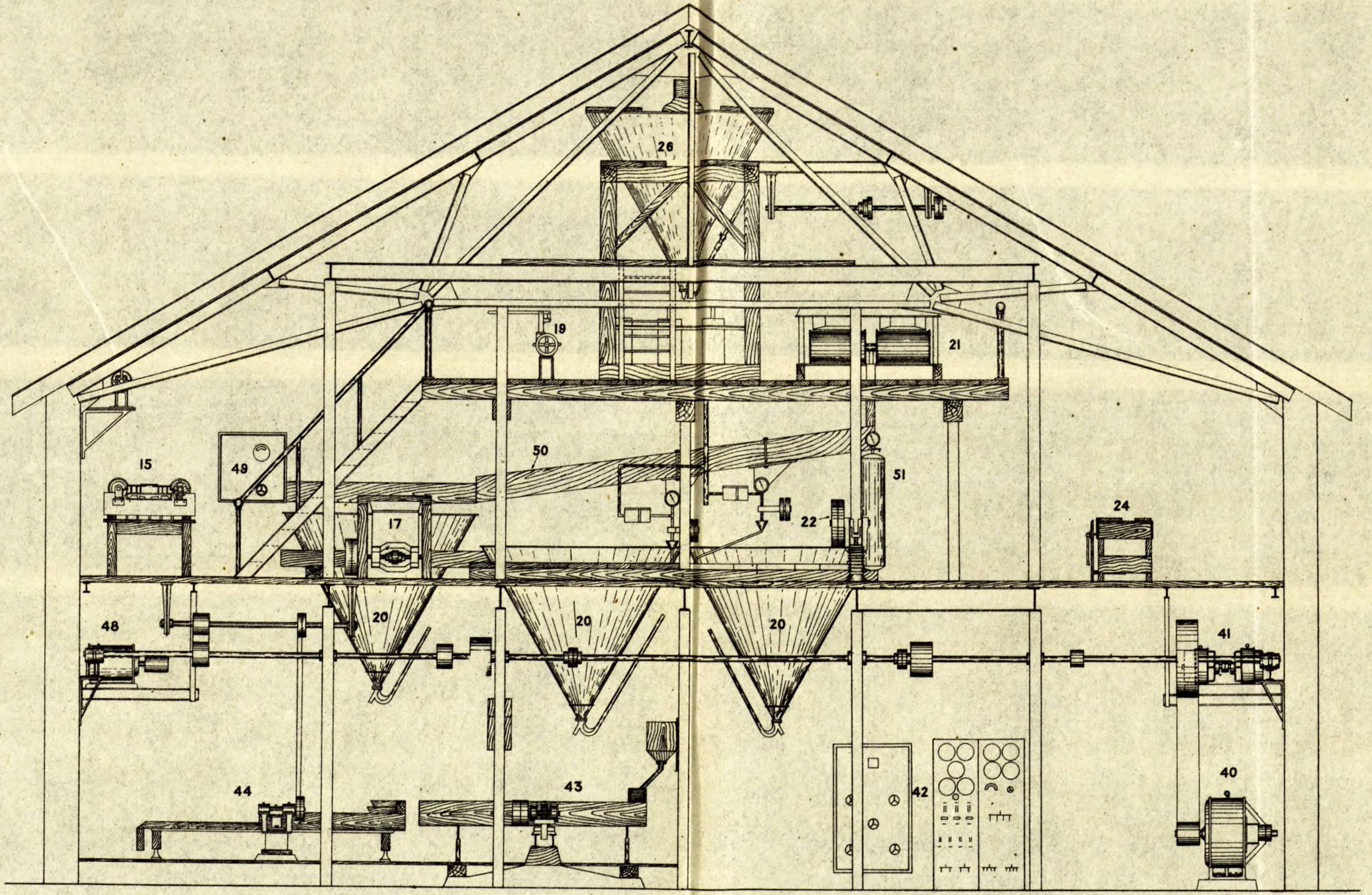
Fig. 6, Ore Dressing and Metallurgical Laboratory, Booth Street and Plymouth Avenue, Ottawa, Section on A-B, looking west.




**Reference.**

*12 Laboratory Sturtevant Screen*
*17 Push Feeder*
*18 Elevator*
*23 Jig Feed Water Tank*
*25 5-Stamp Battery*
*37 Centrifugal Pumps*
*39 Ullrich Magnetic Separator*
*46 Pierce Amalgamator*
*48 James Ore Jig*

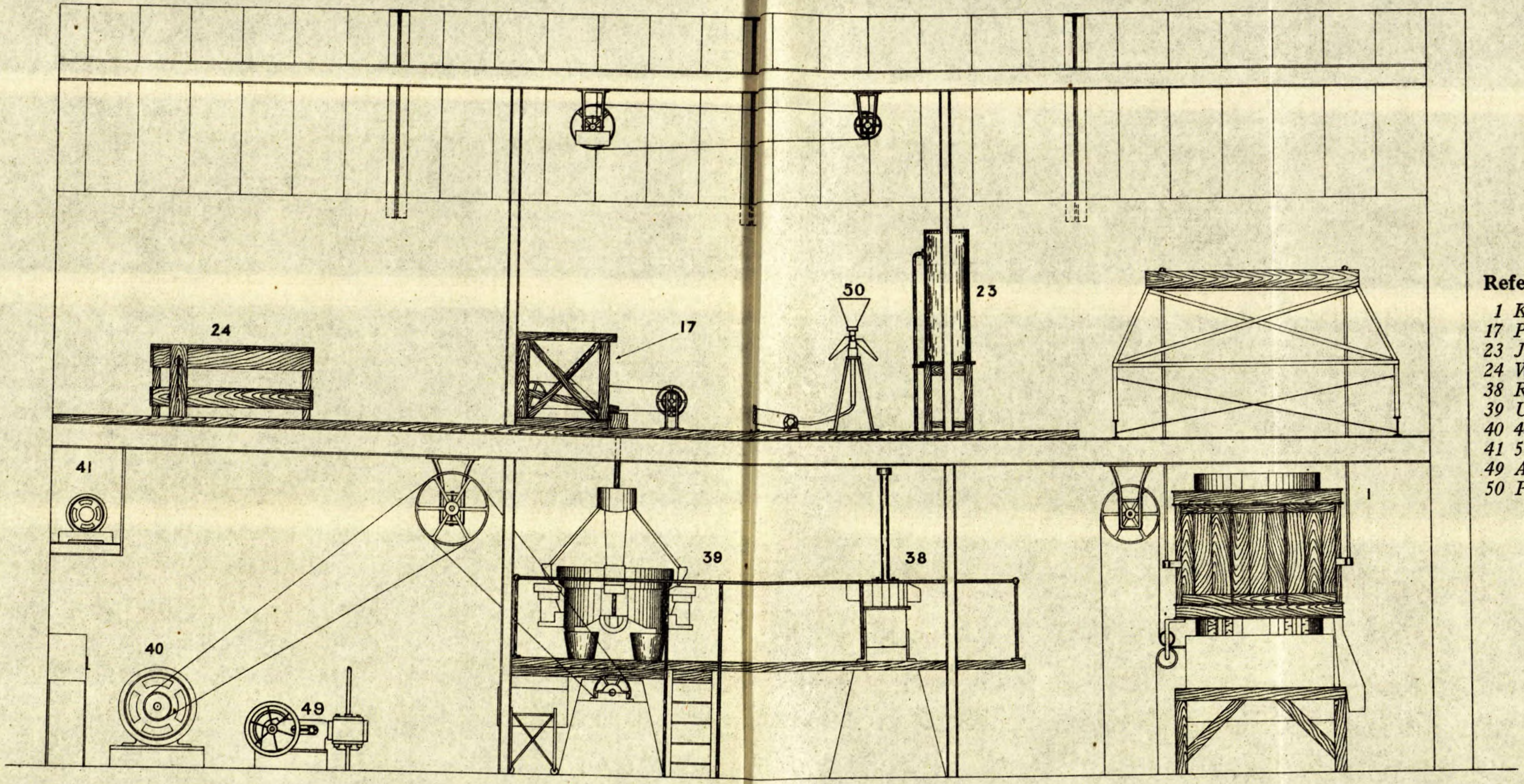
Fig. 7, Ore Dressing and Metallurgical Laboratory, Booth Street and Plymouth Avenue, Ottawa. Section on C-D, looking west.




**Reference.**

*15 Laboratory Wet Gröndal Separator*
*17 Push Feeder*
*19 Slime Filter Press*
*20 Callow Classifiers and Settling Tanks*
*21 " Screen Classifier*
*22 Air Pump*
*24 Work Bench*
*26 Callow Cone Classifier*
*40 40 H.P.-D.C. Motor*
*41 5½-K.W. Generator Set*
*42 Switch Boards*
*43 Deister Concentrator*
*44 Overström "*
*48 25- H.P-A.C. Motor*
*49 Switch Board*
*50 Launder Classifier*
*51 Air Receiver*

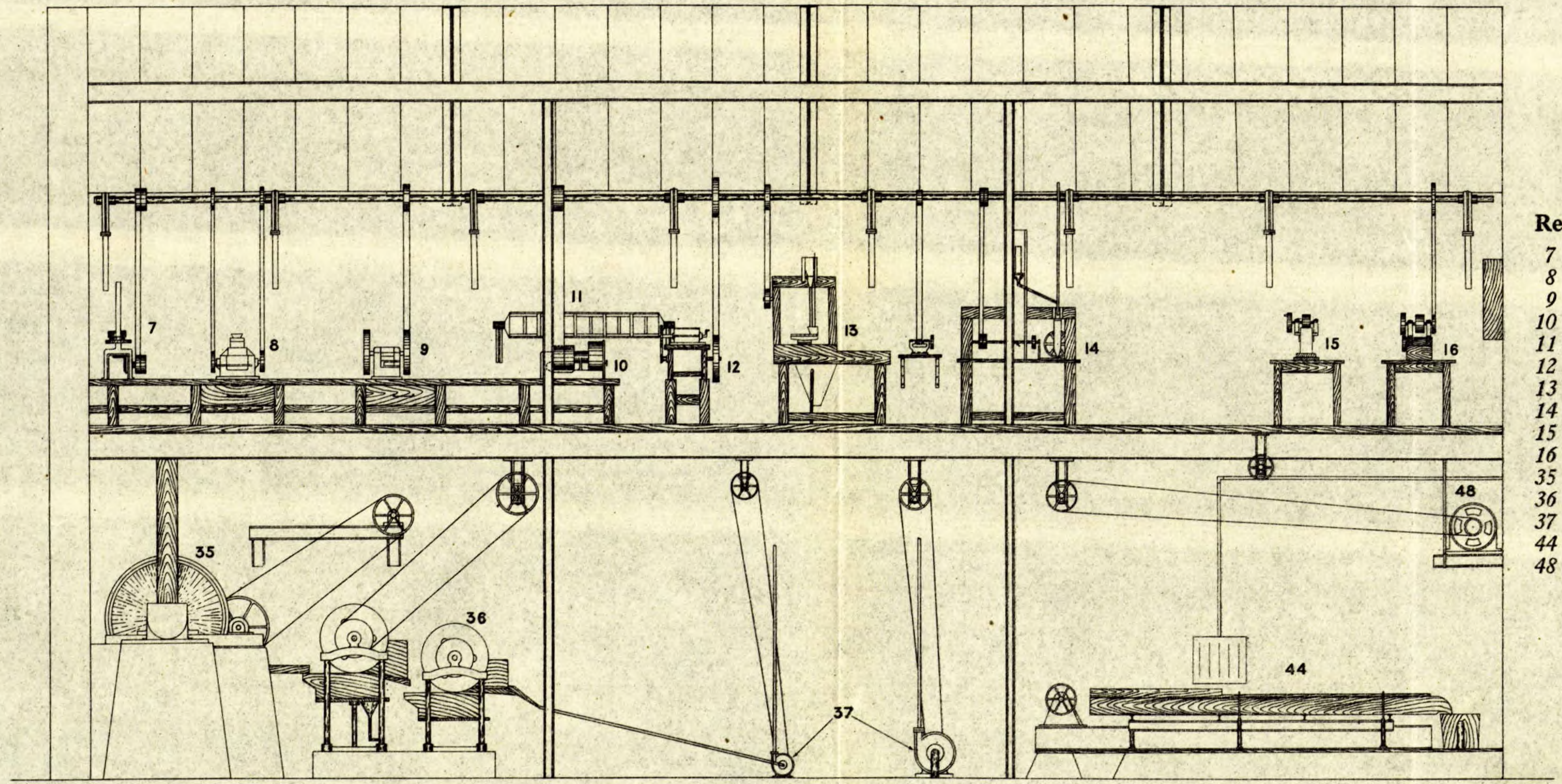
Fig. 8. Ore Dressing and Metallurgical Laboratory, Booth Street and Plymouth Avenue, Ottawa, Section on C-D, looking east.




**Reference.**

*1 Keedy Ore Sizer*
*17 Push Feeder*
*23 Jig Feed Water Tank*
*24 Work Bench*
*38 Richards Pulsating Jig*
*39 Ullrich Magnetic Separator*
*40 40-H.P.-D.C. Motor*
*41 5½ K.W. Generator Set*
*49 Air Compresser*
*50 Plumb Pneumatic Jig*

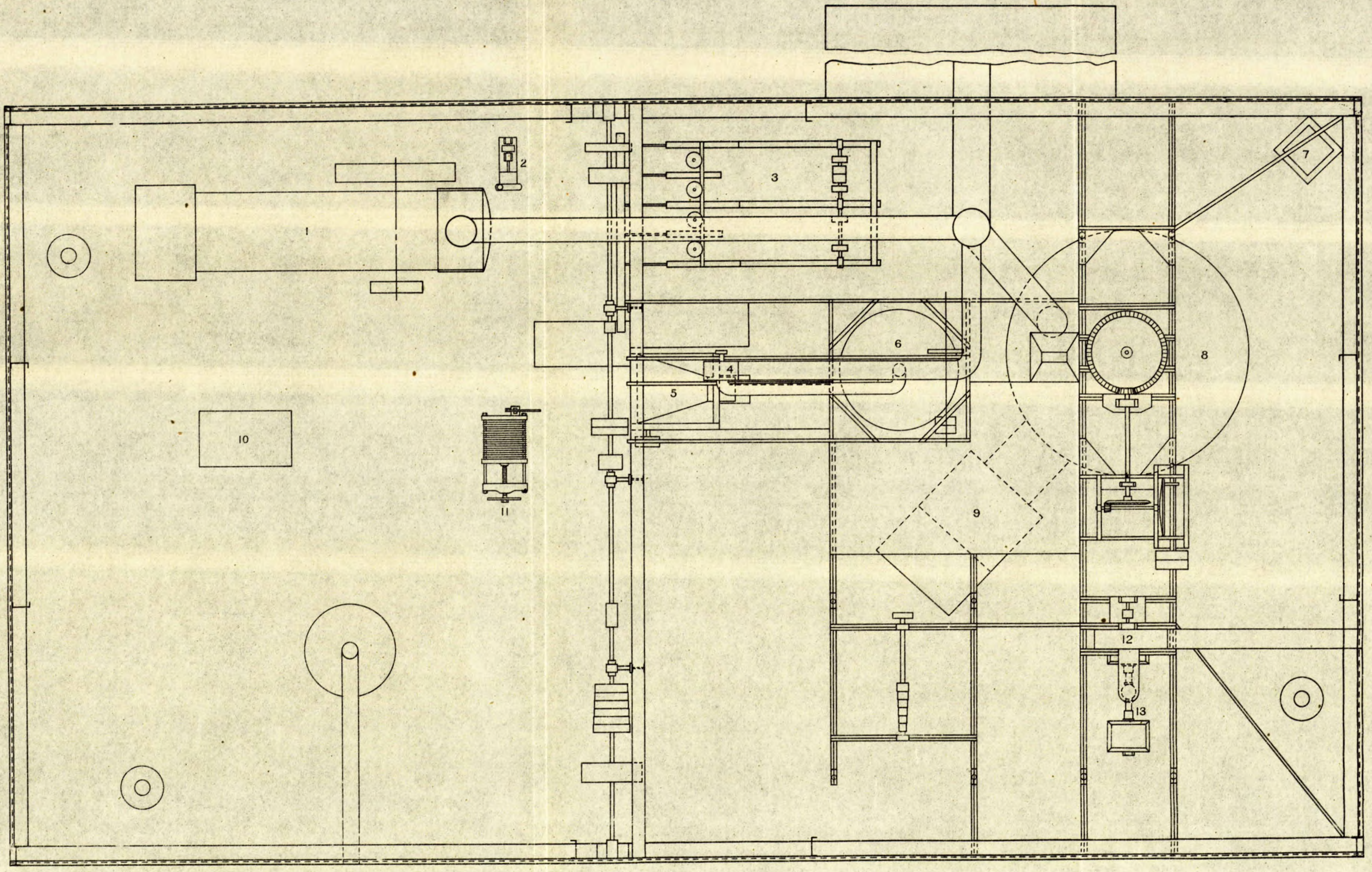
Fig. 9, Ore Dressing and Metallurgical Laboratory, Section on E-F looking south, Division and Plymouth Streets, Ottawa.




**Reference.**

*7 Laboratory Hoover Sizer*
*8 " Roll Crusher*
*9 " Jaw "*
*10 " Braun Pulverizer*
*11 " Pebble Mill*
*12 " Sturtevant Screen*
*13 " Wilfley Table*
*14 " Richards Jig and Classifier*
*15 " Wet Gröndal Separator*
*16 " Dry " "*
*35 Hardinge Ball and Pebble Mill*
*36 Gröndal Wet Separator*
*37 Contrifugal Pumps*
*44 Overström Concentrator*
*48 25- H.P.- A.C. Motor*

Fig. 10, Ore Dressing and Metallurgical Laboratory, Booth Street and Plymouth Avenue, Ottawa, Section on G-H, looking west.

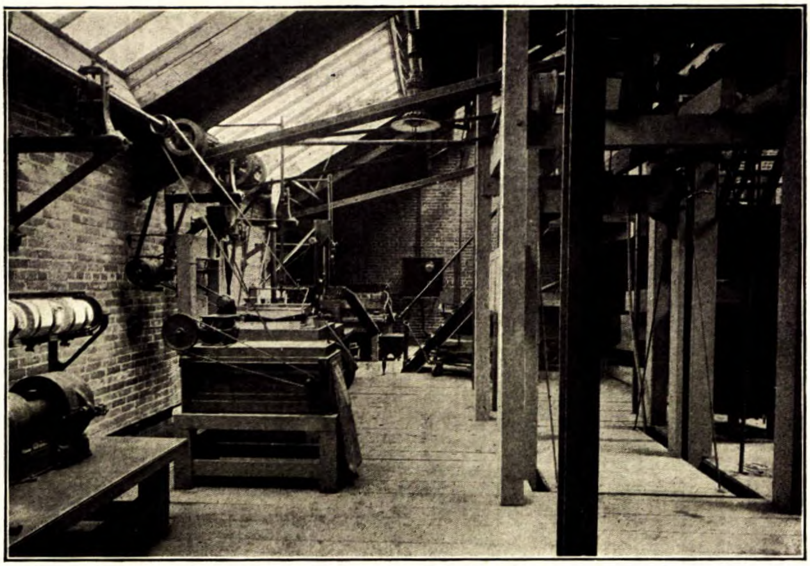


**Reference.**

1 *Engine*
2 *Press*
3 *Oil Flotation Machine*
4 *Sand Pump*
5 *Feeder*
6 *Settling Tank*
7 *Pyrometer*
8 *Roaster Furnace*
9 *Fire Box*
10 *Bench*
11 *Filter Press*
12 *Exhauster Fan*
13 *Sintering Pan*

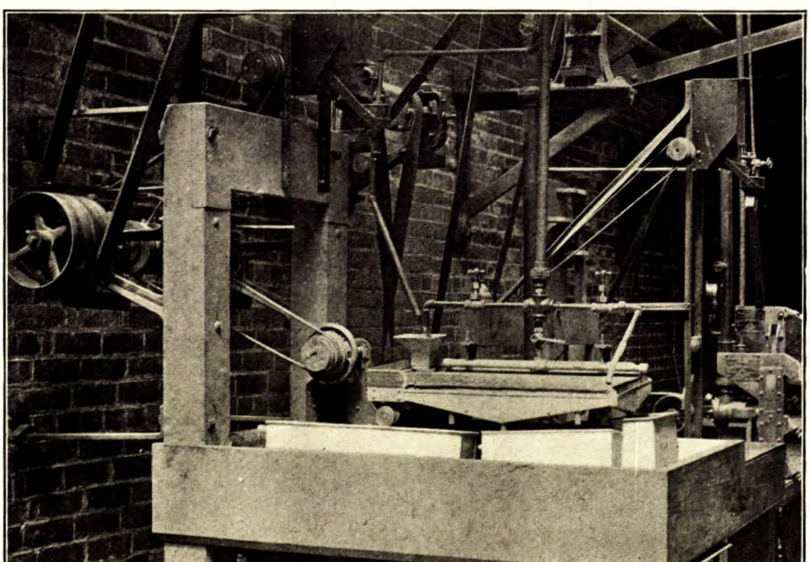
Fig. 11. Plan of Roaster Building, Booth Street and Plymouth Avenue, Ottawa.

PLATE XXXV.



Ore dressing laboratory: sizing apparatus, second floor.

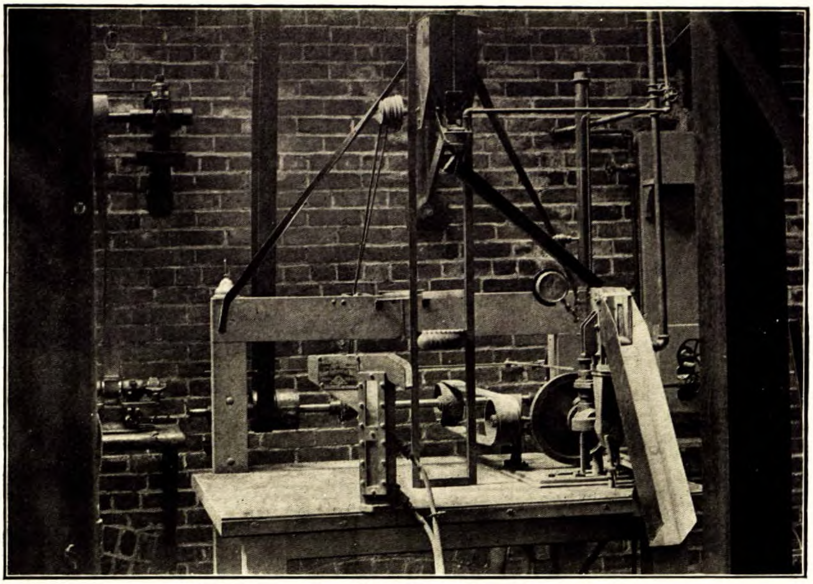
PLATE XXXVI.



Ore dressing laboratory: Wilfley table.

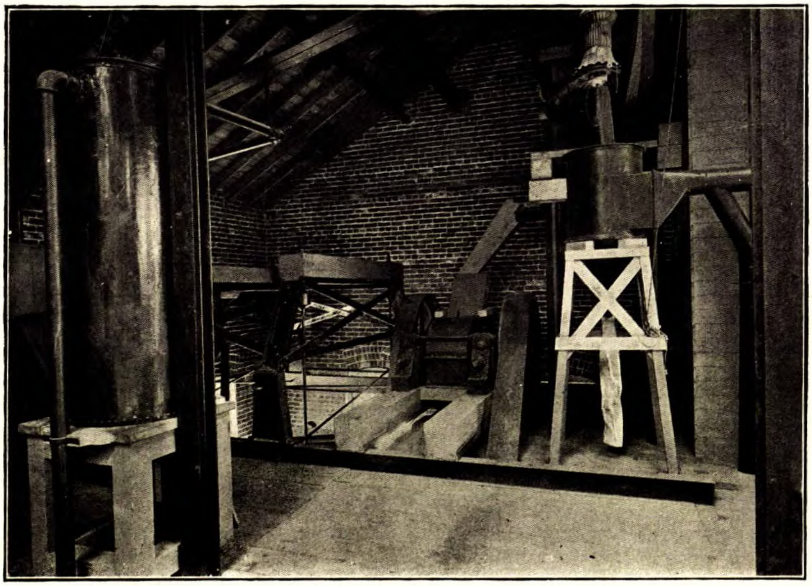
D

PLATE XXXVII.



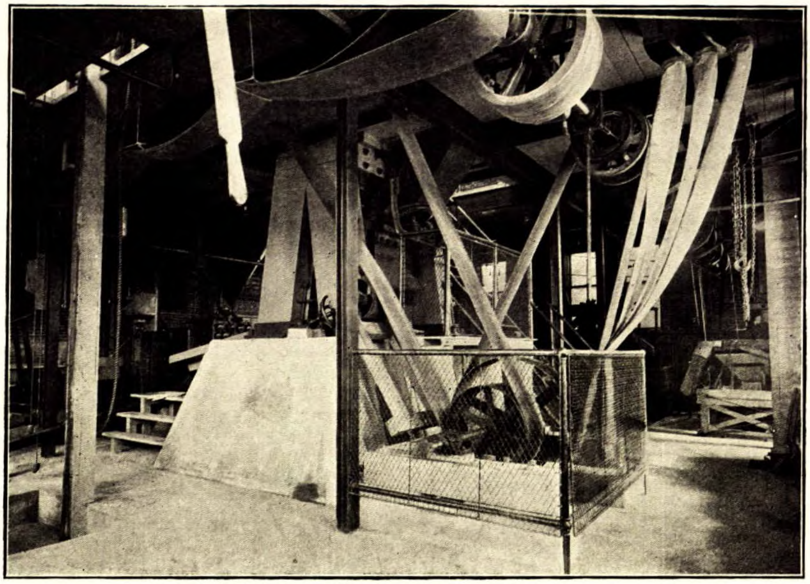
Ore dressing laboratory: Richards pulsator jig, and classifier.

PLATE XXXVIII.



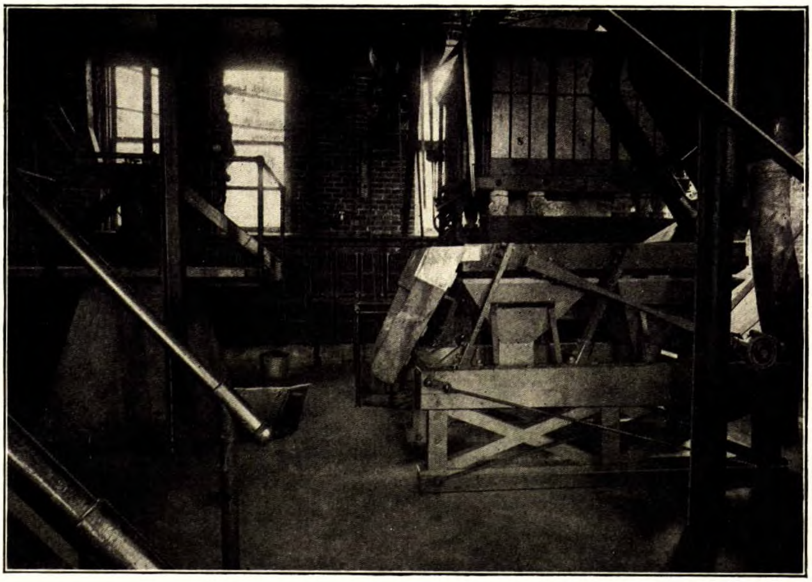
Ore dressing laboratory: crushing rolls.

PLATE XXXIX.



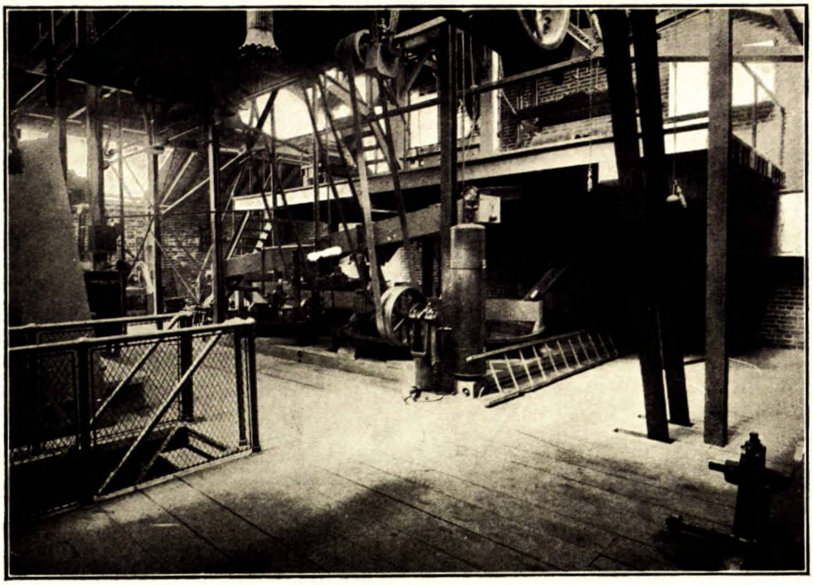
Ore dressing laboratory: rear of stamp battery.

PLATE XL.



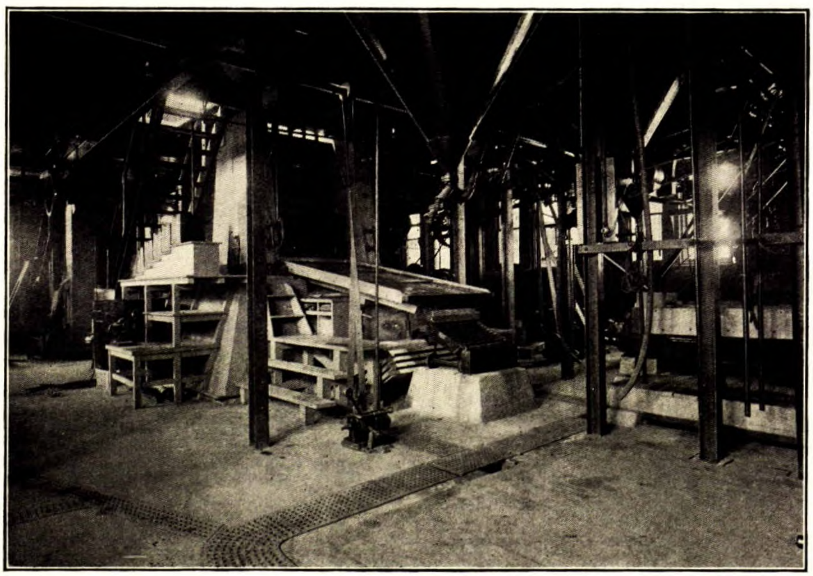
Ore dressing laboratory: Ferraris screen for coarse sizing in foreground; Keedy screen for fine sizing in background.

PLATE XLI.



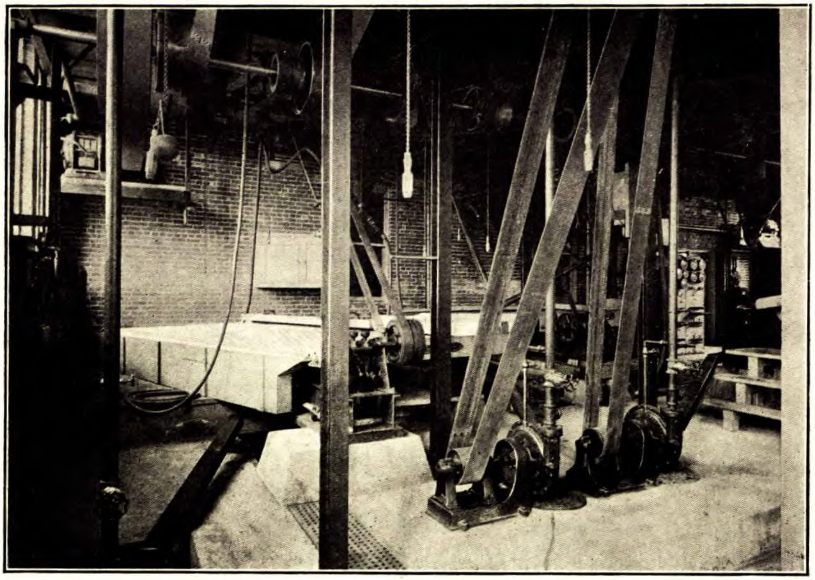
Ore dressing laboratory: Richards launder, pulsator, classifiers, Callow screens, and tanks.

PLATE XLII.



Ore dressing laboratory: view on first floor, Callow tanks, stamp battery cyanide zinc boxes.

PLATE XLIII.

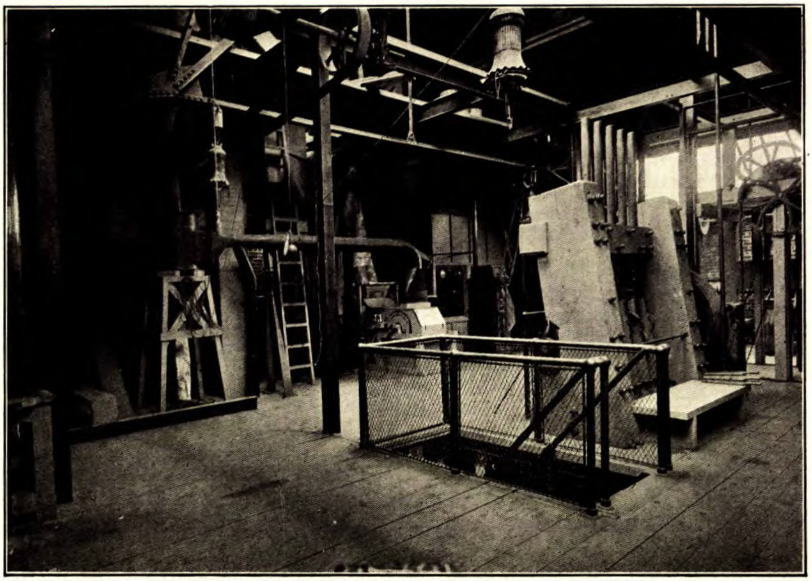


Ore dressing laboratory: Overstrom and Deister tables, sand pumps in foreground.

PLATE XLIV.

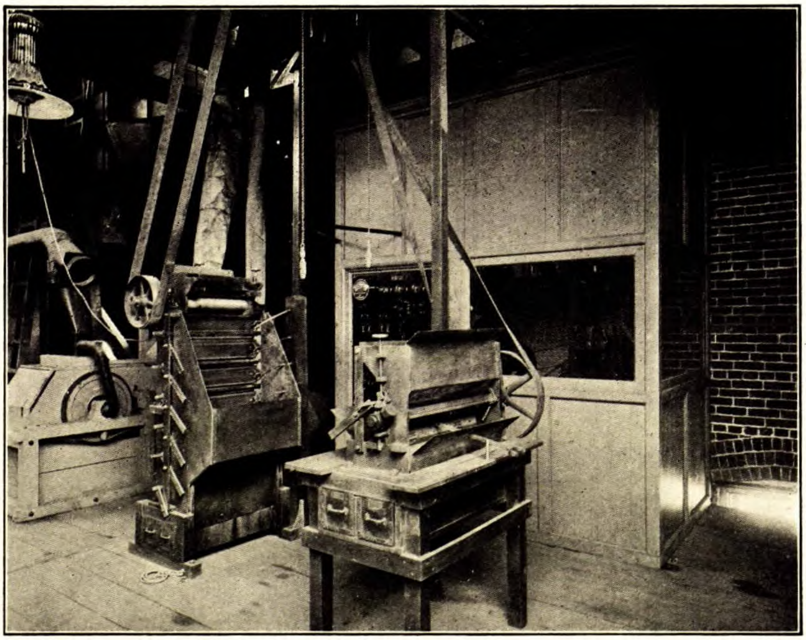
Ore dressing laboratory: Ulrich magnetic separator, left; Richards pulsator jig, right.

PLATE XLV.



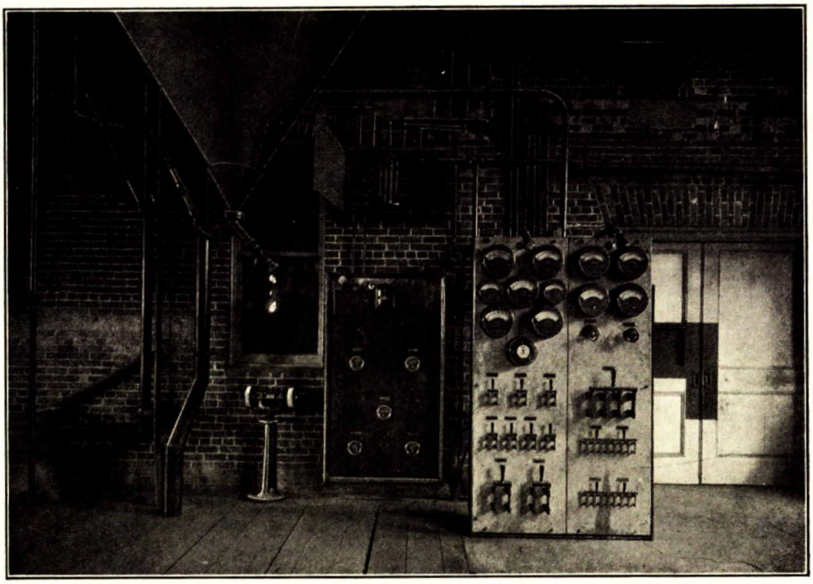
Ore dressing laboratory: view on second floor, Huff machines, stamp battery, Gröndal cobber.

PLATE XLVI.

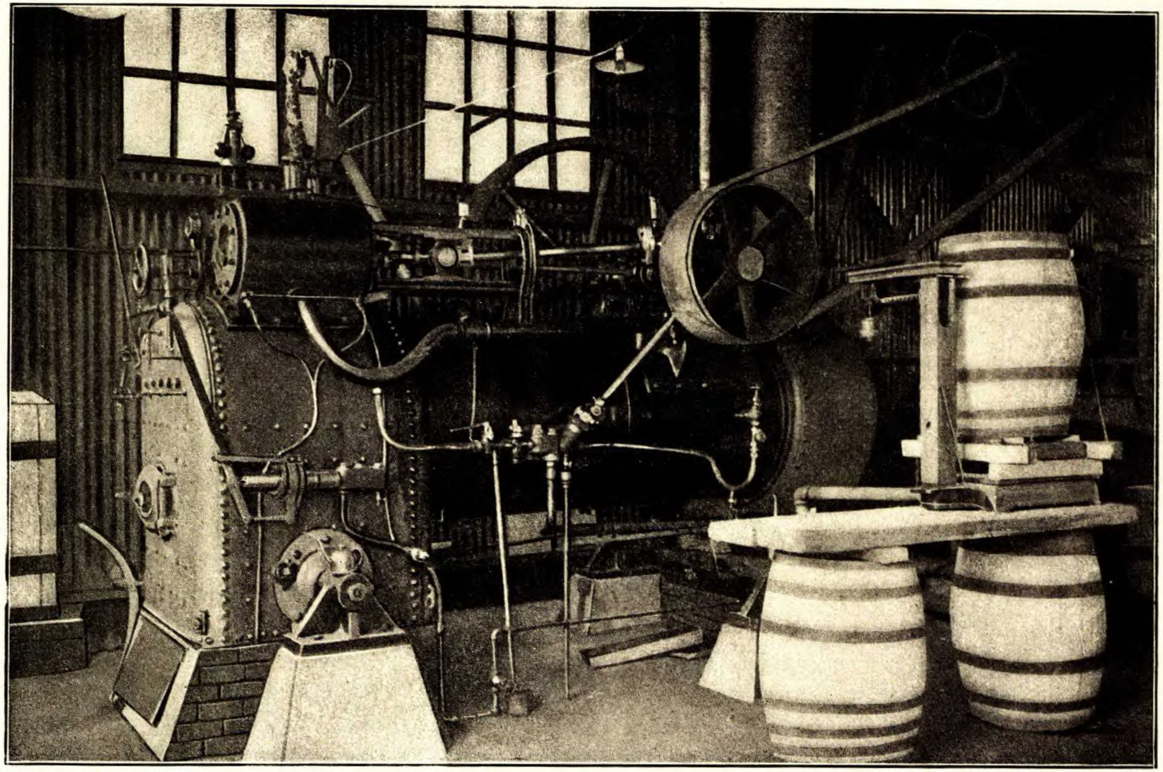


Ore dressing laboratory: Huff electrostatic laboratory separators; generating apparatus in case in background.

PLATE XLVII.



Ore dressing laboratory: switchboard and rheostat board.



Ore dressing laboratory: roaster building—locomobile engine and boiler.

## CERAMIC LABORATORY AND ITS EQUIPMENT.

Experimental work was begun in October 1915, in the Ceramic Laboratory at the Mines Branch building. Three rooms in the basement were fitted up for this purpose, with a very complete equipment, enabling the staff to obtain and furnish information required regarding the character and uses of raw materials.

The moulding room, shown on Plate LI, contains work tables fitted with slate slabs for tempering, moulding, and preparing test pieces by hand from small samples of clay or shale, also the following apparatus:—

Hand press, worked by lever, for making bricklets by the dry pressed process.

Hand plunger press with 3″ round die; used for making field drain tile tests, from small samples of clay.

Electric oven of 3 cubic feet capacity, with temperature range of 120 to 250 degrees Fahr., for testing the fast drying qualities of clays.

One enamelling muffle kiln, with gas and air blower for the burning trials of glazes and enamels.

One round, down-draft gas furnace, similar to the Seger rund-ofen, only larger, and capable of reaching a temperature of 1,300 to 1,400 degrees C., with natural draft. This furnace is used principally for determining the softening points of easily fusible clays.

A reverberatory type of gas fired kiln, which works on the same principle as the round furnace, but with a larger chamber in which the clay wares are exposed to the gas flame.

The kiln room proper (Plates LIII and LIV) which adjoins the moulding room, is at the rear end of the George Street wing of the building, outside of the main wall. It is the largest room of the three used by the Ceramic Division; and as the ceiling is very high, is well adapted for kiln work where burning is kept up for long periods.

The kiln equipment consists of:—

One down-draft kiln lined throughout with firebrick, having a setting chamber of 15 cubic feet capacity, and a fire box in which coal, coke, or peat, can be used when firing. This kiln is designed to give results closely approximating those obtained in burning commercial clay ware of the ordinary structural variety, such as brick, hollow-ware, drain tile, etc.

One Caulkin's special pottery kiln, 18″ X 20″ X 33″ inside measurement, for burning clay wares without contact with fire gases, or for glaze and enamel work. This kiln is used at temperatures varying from 960 to 1,200 degrees C., but is capable of reaching higher temperatures if necessary. The time of burning varies from 9 to 12 hours, the fuel used being kerosene oil, with natural draft. Both pyrometric cones and pyrometers are used for control of temperature while burning. The pyrometer equipment consists of platinum-rhodium thermo-couples, enclosed in alundum and drawn-quartz tubes, and two portable millivoltmetres, graduated to 1,400 and 1,600 degrees Centigrade, respectively.

The kiln room also accommodates some of the larger machinery and apparatus as follows:—

One 3-foot dry pan, the bottom of which is provided with two sets of removable plates, one set perforated, and the other solid, so that it can be used for the dry grinding of shales and hard clays, or for wet grinding, and tempering. Alongside the grinding pan stands a small experimental auger machine. This machine is built on the same principle as all stiff mud machines used in commercial plants. It is fitted with a take-off or hand-cutting table, and a series of dies for making full-sized brick, hollow-ware, drain tile, roofing tile, promenade tile, etc.

Both the grinding pan and auger machine are belt-driven by a 5 H.P. motor.

A hand plunger press using the same dies as the auger machine is provided for making tests from samples of clay which are not large enough to be moulded in the latter.

A hand screw press, made at the machine shop of the Mines Branch, turns out dry pressed floor and wall tile.

The clay washing apparatus consists of plunger, troughs and settling tanks, made of galvanized iron.

The room is lighted by skylights during the day, and by 3 400 watt nitrogen bulbs by night.

The third room of the Ceramic Laboratory, Plates XLIX and L contains the following pieces of apparatus:

An electric resistance furnace, with its transformer and switchboard. This furnace is used for testing refractory clays or those which require a temperature of 1,500 to 1,800 degrees C. before softening, and for burning small test bricklets of various mixtures designed for refractory purposes.

One two-jar porcelain pebble mill, for grinding the raw materials of glazes and enamels, either wet or dry.

One two-cylinder cast iron pebble mill for grinding cement clinker or paint materials.

One eight-tube centrifuge for determining fineness of grain of pottery or paper clays.

One elutriating apparatus for washing small samples of kaolins or pottery clays.

In addition to the laboratories described above, a sample room, Plate LII, in connexion with the offices of the staff, is used for displaying various clay wares made in Canadian and foreign plants.

The object of this collection is, to have a series of standard commercial clay wares with which to compare the results of tests made in the laboratory.

The room is also used for weighing, measuring, and recording, which forms a large part of the experimental work and testing of clays.

**Testing of Clays and Shales.**—

Material for examination or testing comes to the laboratory from four sources:—

1. Samples collected in the field by the members of the staff of the division while carrying on a systematic investigation of the clay and shale resources of the Dominion. The examination of these constitutes the largest part of the laboratory work.

2. Samples collected in the field by various members of the Mines Branch and Geological Survey.

3. Samples from Provincial Bureaus of Mines or Agriculture.

4. Samples from outside sources, such as industrial firms, or private individuals.

Up to the present time, no charge has been made for testing clays, and a considerable amount of free work has been done. Considering the present status of the clay industry in Canada, it seems advisable to continue this policy, so as to give all the assistance possible in the search for clays suitable for the various needs. There are instances, however, in which charges for tests must be made, and prices for the work will then be sent on application to the Director.

Physical tests only, are undertaken by the Ceramic Division. These tests give all the information that clayworkers require to know regarding the properties and uses of clays and shales.

If a chemical analysis is considered necessary by the individual sending clay samples, it will be made by the Division of Chemistry, the charges being 10 to 25 dollars, payable in advance.

The following instructions should be observed by those sending clay or shale samples for examination. The exact locality from which the sample was taken should be given. The quantity of clay sent should not be less than one pound—but two to four pounds would be better for a preliminary test. A complete test in which it is desirable to make full sized wares requires at least 200 pounds. The samples should be sent by parcel post, prepaid express, or prepaid freight, to the Mines Branch Ceramic Laboratory, Sussex Street, Ottawa.

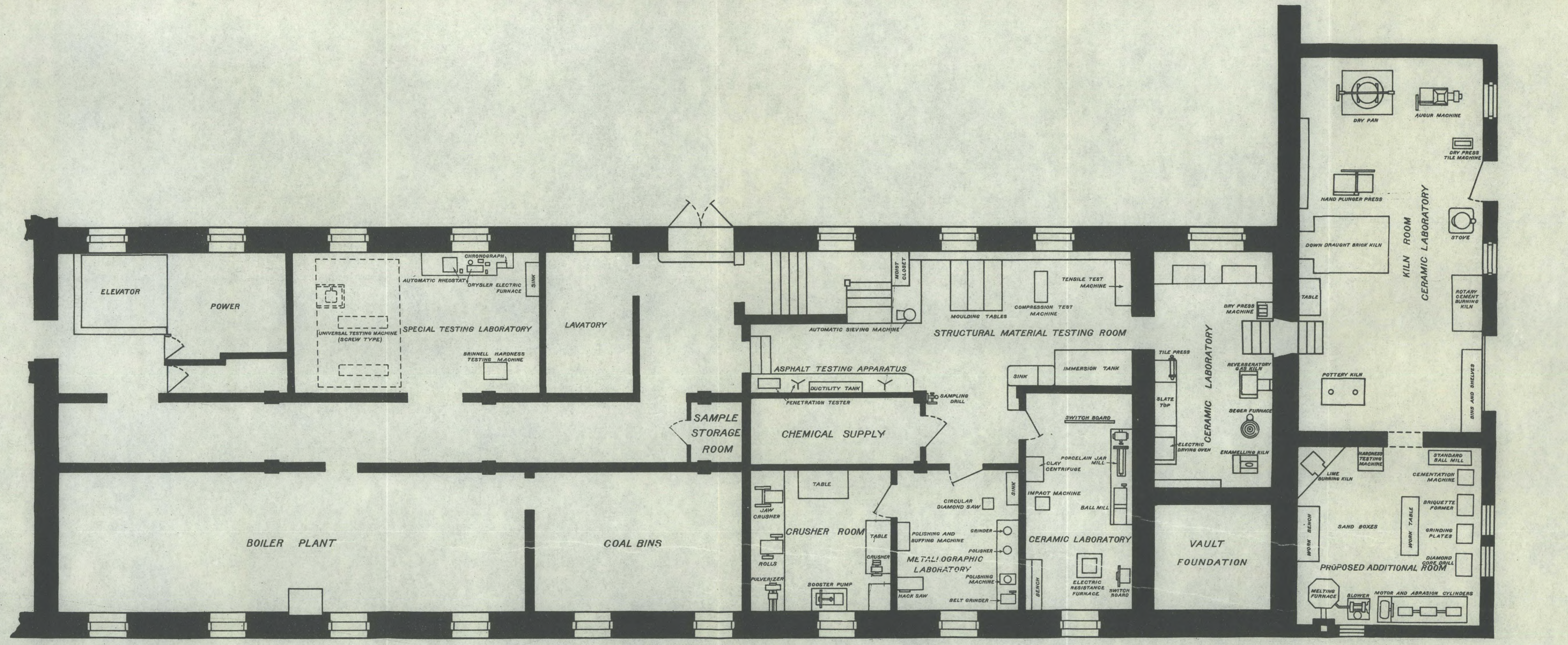
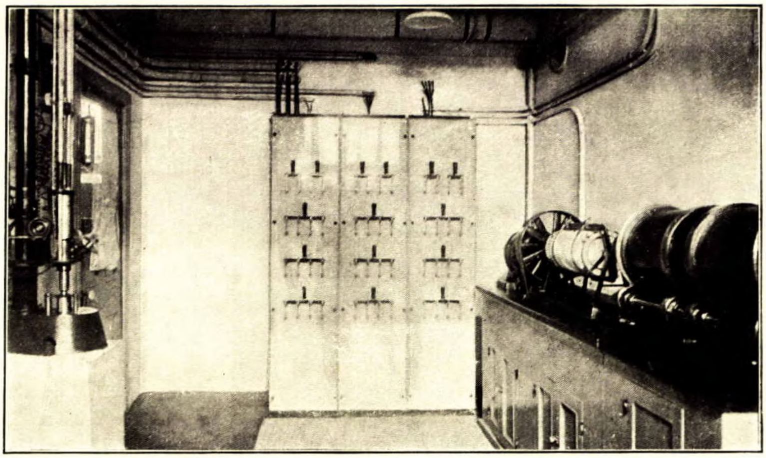
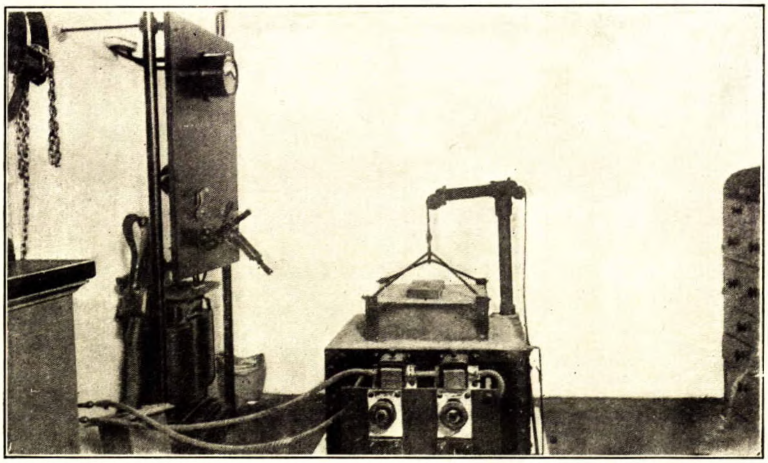



Fig. 12, Plan of Ceramic and Structural Materials Testing Laboratories, Mines Building, Sussex Street, Ottawa.



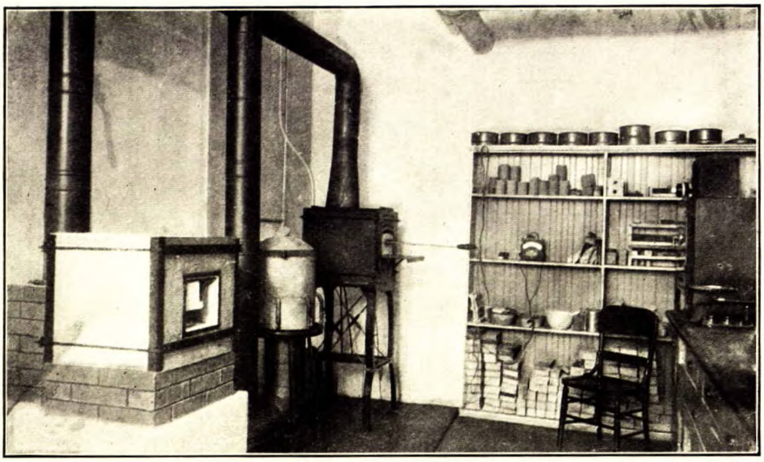
Ceramic laboratory: pebble grinding mills, switchboard and impact machine.





Ceramic laboratory: Hoskins electric furnace for testing refractory clays.

PLATE LI.

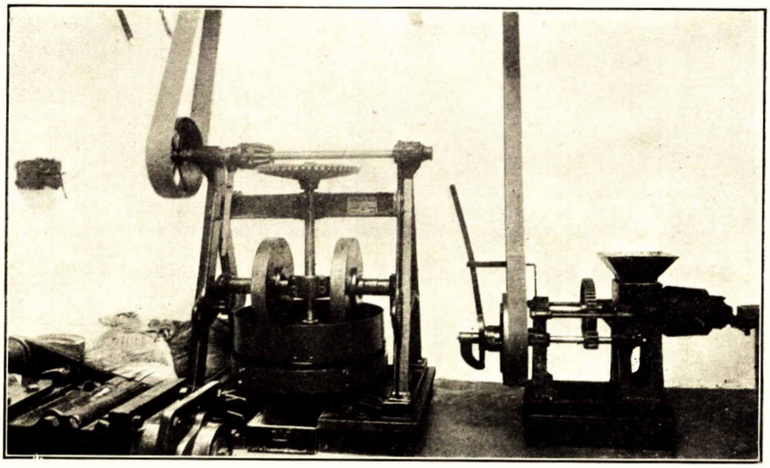


Ceramic laboratory: gas kilns.

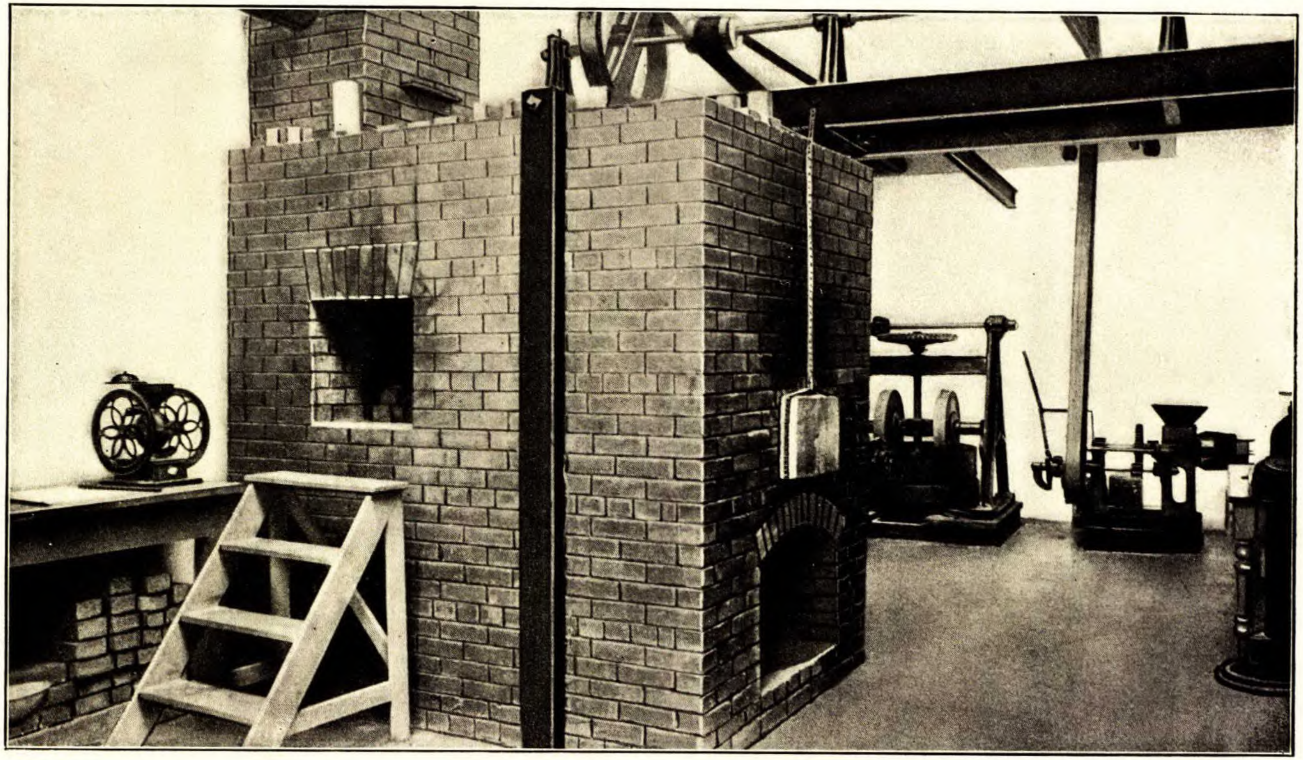
PLATE LII.

Ceramic laboratory: finished clay products exhibit.

PLATE LIII.



Ceramic laboratory: dry grinding pan and experimental auger machine.



Ceramic laboratory: kiln room, showing cement and brick kilns.

## STRUCTURAL MATERIALS TESTING LABORATORY.

The steadily growing appreciation of the value of properly conducted tests of the concrete making materials employed in large construction work, is already producing good results; although there is still much need of more systematic work. The Public Works Department of the Dominion Government issues a definite specification to which the sand, etc., used in all Government buildings must comply; also keeps a staff engaged making the required tests on all materials employed. Many of the large contractors in Canada have general tests run on the different aggregates they utilize; and they readily admit the advantage derived from the results obtained.

A laboratory for the proper testing of the materials required in concrete, etc., has recently been established in the basement of the Mines Branch building and the following apparatus installed. Plates LV and LVI.

One Olsen, Automatic, Cement Testing Machine, of 2,000 lbs. capacity, motor driven, in which the load can be applied at a regular rate as may be desired, *i.e.*, at either 400, 600, 800 lbs. per minute or any rate as specified. The reading is automatically recorded on beam and dial vernier. This machine can also be used for making compression and transverse tests.

One Olsen, Hydraulic, Compression Testing Machine, 200,000 lbs. capacity, for compressive tests on cement, concrete, and brick specimens.

One Olsen, three-gang, Soapstone Immersion Tank, size 6 × 3 feet, with provision for hot and cold water.

One cement mixing double table, with slate tops, and provision for waste bin in centre.

One Olsen, Soapstone moist closet, with glass shelves, for storing cement briquets.

One complete set, 8″ Tyler, Standard Screen Sieves.

One electrically operated Per Se Testing Sieve Agitator, with semi-rotary and undulatory motion, to take sieves 8″ diameter and under.

Two electric hot plates 8″ × 13″, to be used on cement mixing table.

One Olsen standard vicat needle.

One washing apparatus for determining silt in sands.

One set Fairbanks platform scales, capacity 1,000 pounds.

One set Fairbanks agate bearing scales, capacity 15 pounds.

Necessary cement briquet standard gang moulds, and cube moulds.

One rotary, laboratory, cement burning kiln, 3 feet long by 5″ diameter inside, with automatic feed, fired by gasolene; for testing the cement making qualities of raw materials. This machine is erected in the kiln room of the Ceramic Laboratory.

*Apparatus for Testing Asphalts:* (Plate LVII).—

The following equipment is available for testing bitumens and samples of asphalt pavements:—

Sommers patent hydrometers.

Pycnometers (Hubbard type).

Asphalt viscosimeter.

N. Y. State Board of Health oil tester.

Extraction apparatus (Soxhlets).

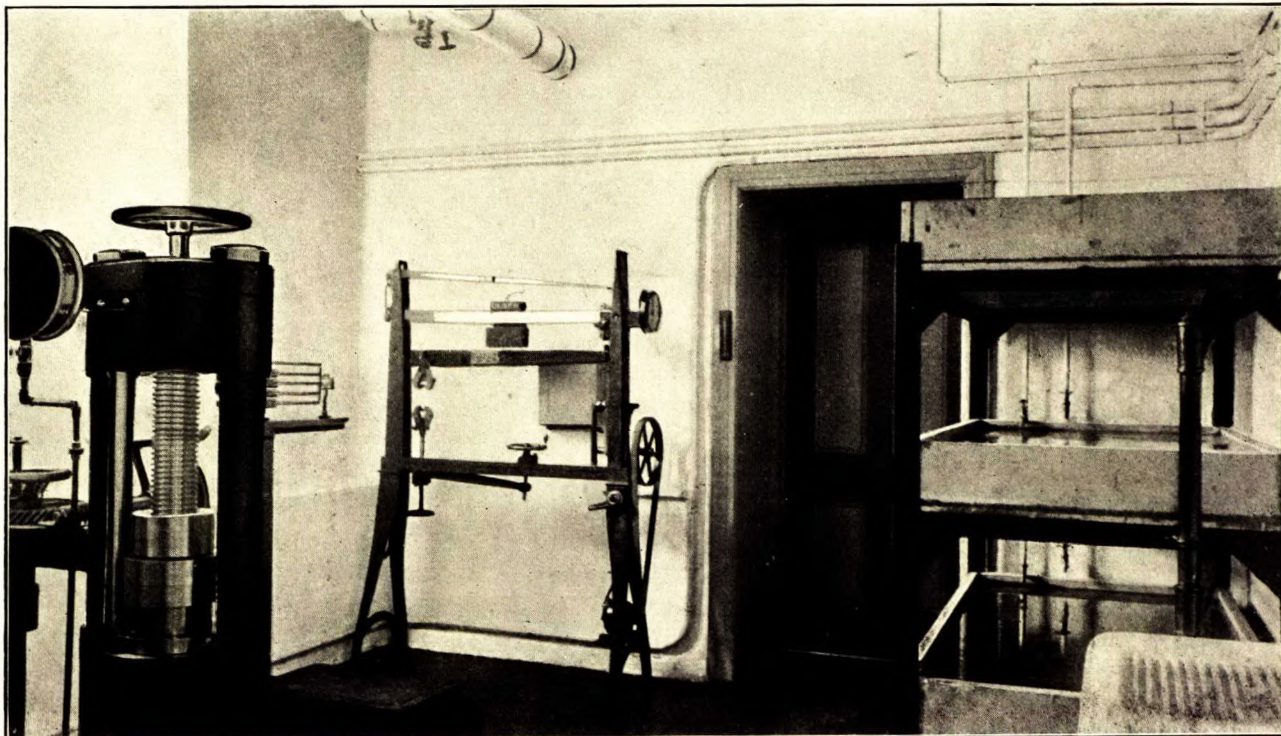
Standard sieves.

Chew electrically controlled ductility machine.

Electrically controlled penetrometer.

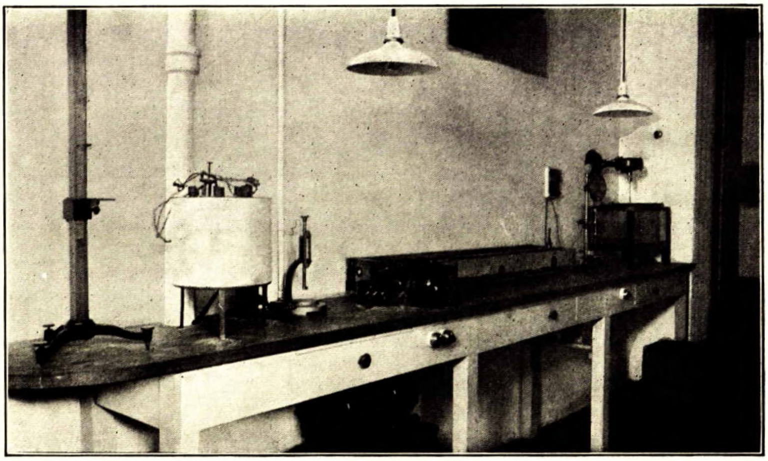
N. Y. Testing Laboratory oven.

Structural materials laboratory: mixing table, sieve agitator, moist closet, and asphalt testing apparatus



Structural materials laboratory: showing compression and tension machines.

PLATE LVII.



Structural materials laboratory: ductility machine, penetrometer, etc. for testing asphalts.

## METALLOGRAPHIC LABORATORY.

*Preparatory Room:—*

The room devoted to the preparation of specimens of steels, alloys, etc., for micrographic examination, contains the following apparatus:—

One circular diamond, say 8″ diameter.

One power hack saw.

One Sauveur and Boyston grinder and polisher, directly attached to motor.

One belt polisher, with interchangeable belts.

Two circular disc polishers with vertical shaft.

*Photomicrography Room:—*

This room contains:—

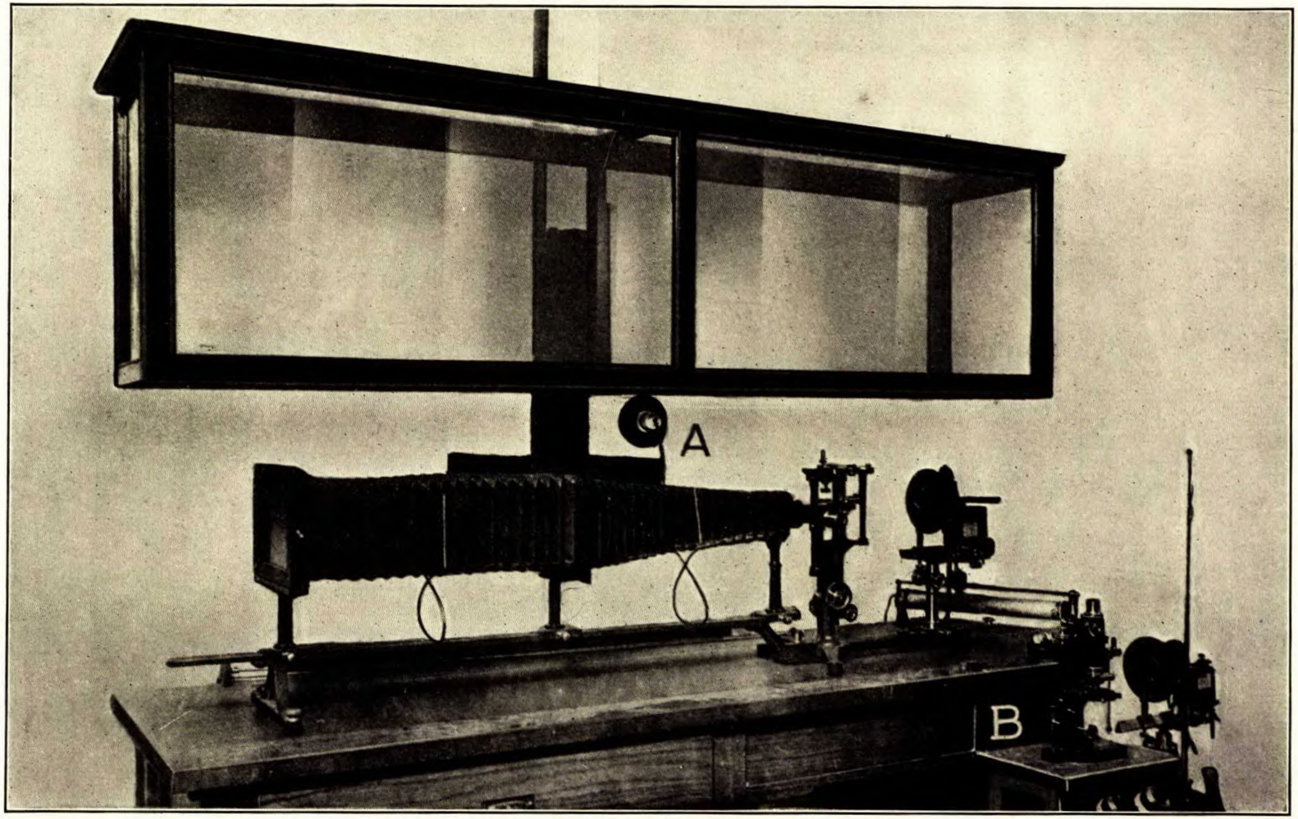
One micro-metallograph, of Leitz: construction completely equipped with photo-micrographic camera, and all needed accessories.

One metallurgical microscope and accessories: designed by Albert Sauveur, and constructed by Bausch and Lomb.

One polishing motor.

One cabinet for specimens.

Apparatus for etching specimens for micrographic analyses.




Photomicrographic room:—(a) Micro-metallograph; (b) Metallographic microscope.

**PHYSICAL TESTING ROOM.—**

This room contains:—

One Olsen, 200,000 lbs., "3-Screw Type" Universal Testing Machine with dial vernier automatic Screw Beam, variable speed cone drive, operated by a motor and silent chain drive. This machine is equipped for compression, tensile, and transverse testing, and is suited for steel, alloys, and building stone tests.

One Brinell Hardness Testing Machine.

One Scimatco Apparatus for the accurate and convenient determination of transformation or "critical" points in iron, steel and alloys.

**CRUSHER ROOM.—**

In the crusher room provision is made to crush and prepare all samples for the chemical laboratory, as well as any other crushing work required. The apparatus consists of:—

One 6″ Jaw crusher.

One 3″ Jaw crusher.

One set rolls.

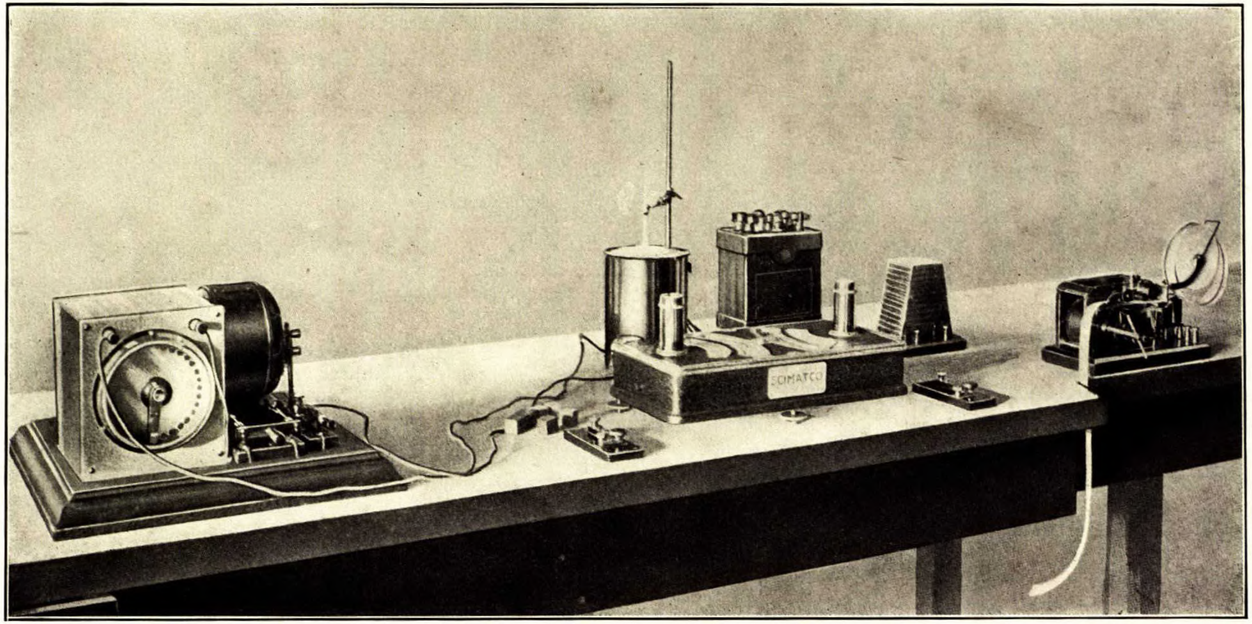
One disc pulverizer.

Cupel making machine.

**CARPENTER'S SHOP.—**

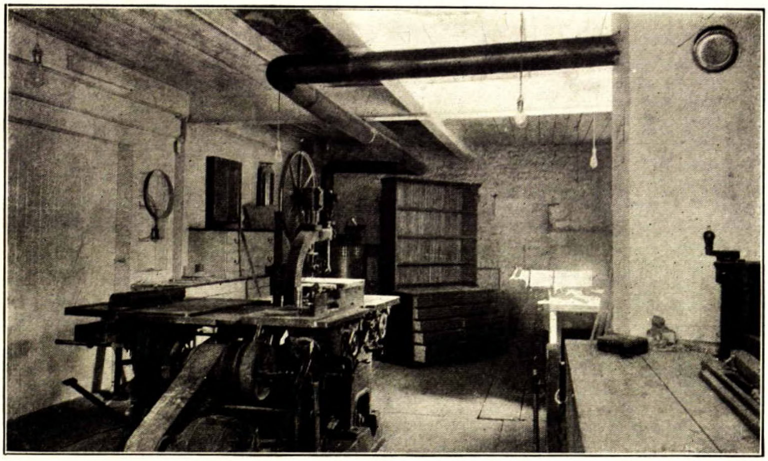
A carpenter shop (Plate LX)—equipped with motor driven, universal woodworking or joiner's machine—occupies an out-building of the Mines Branch Building, Sussex Street, This enables carpentry for new apparatus, etc., required by the various laboratories, to be executed with the least possible delay.

PLATE LIX.




Complete Scimatco outfit for the determination of transformation points.

PLATE LX.



Carpenter shop, Mines Branch Building, Sussex street.

# CATALOGUE OF MINES BRANCH PUBLICATIONS

# CANADA

## DEPARTMENT OF MINES

HON. LOUIS CODERRE, MINISTER; R. G. McCONNELL, DEPUTY MINISTER.

## MINES BRANCH

EUGENE HAANEL, PH.D., DIRECTOR.

REPORTS AND MAPS

PUBLISHED BY THE

MINES BRANCH

### REPORTS.

1. Mining conditions in the Klondike, Yukon. Report on—by Eugene Haanel, Ph.D., 1902.

†2. Great landslide at Frank, Alta. Report on—by R. G. McConnell, B.A., and R. W. Brock, M.A., 1903.

†3. Investigation of the different electro-thermic processes for the smelting of iron ores and the making of steel, in operation in Europe. Report of Special Commission—by Eugene Haanel, Ph.D., 1904.

5. On the location and examination magnetic ore deposits by magnetometric measurements—by Eugene Haanel, Ph.D., 1904.

†7. Limestones, and the lime industry of Manitoba. Preliminary report on—by J. W. Wells, M.A., 1905.

†8. Clays and shales of Manitoba: their industrial value. Preliminary report on—by J. W. Wells, M.A., 1905.

†9. Hydraulic cements (raw materials) in Manitoba; manufacture and uses of. Preliminary report on—by J. W. Wells, M.A., 1905.

†10. Mica: its occurrence, exploitation, and uses—by Fritz Cirkel, M.E., 1905. (See No. 118.)

†11. Asbestos: its occurrence, exploitation, and uses—by Fritz Cirkel, M.E., 1905. (See No. 69.)

†12. Zinc resources of British Columbia and the conditions affecting their exploitation. Report of the Commission appointed to investigate—by W. R. Ingalls, M.E., 1905.

†16. *Experiments made at Sault Ste. Marie, under Government auspices in the smelting of Canadian iron ores by the electro-thermic process. Final report on—by Eugene Haanel, Ph.D., 1907.

†17. Mines of the silver-cobalt ores of the Cobalt district: their present and prospective output. Report on—by Eugene Haanel, Ph.D., 1907.

† Publications marked thus † are out of print.

†18. Graphite: its properties, occurrences, refining, and uses—by Fritz Cirkel, M.E., 1907.

†19. Peat and lignite: their manufacture and uses in Europe—by Erik Nystrom, M.E., 1908.

†20. Iron ore deposit of Nova Scotia. Report on (Part I)—by J. E. Woodman, D.Sc.

21. Summary report of Mines Branch, 1907-8

22. Iron ore deposits of Thunder Bay and Rainy River districts. Report on—by F. Hille, M.E.

†23. Iron ore deposits along the Ottawa (Quebec side) and Gatineau rivers. Report on—by Fritz Cirkel, M.E.

24. General report on the mining and metallurgical industries of Canada, 1907-8.

†25. The tungsten ores of Canada. Report on—by T. L. Walker, Ph.D. (Out of print.)

26. The mineral production of Canada, 1906. Annual report on—by John McLeish, B.A.

†27. The mineral production of Canada, 1907. Preliminary report on—by John McLeish, B.A.

†27a. The mineral production of Canada, 1908. Preliminary report on—by John McLeish, B.A.

†28. Summary report of Mines Branch, 1908.

29. Chrome iron ore deposits of the Eastern Townships. Monograph on—by Fritz Cirkel. (Supplemenatry section: Experiments with chromite at McGill University—by J. B. Porter, E.M., D.Sc.)

30. Investigation of the peat bogs and peat fuel industry of Canada, 1908. Bulletin No. 1—by Erik Nystrom, M.E., and A. Anrep, Peat Expert.

32. Investigation of electric shaft furnace, Sweden. Report on—by Eugene Haanel, Ph.D.

47. Iron ore deposits of Vancouver and Texada islands. Report on—by Einar Lindeman, M.E.

†55 The bituminous, or oil-shales of New Brunswick and Nova Scotia; also on the oil-shale industry of Scotland. Report on)—by W. R. Ells, LL.D.

58. The mineral production of Canada, 1907 and 1908. Annual report on—by John McLeish, B.A.

† Publications marked thus † are out of print.

NOTE.—*The following parts were separately printed and issued in advance of the Annual Report for 1907-8.*

†31. Production of cement in Canada, 1908.

†42. Production of iron and steel in Canada during the calendar years 1907 and 1908.

43. Production of chromite in Canada during the calendar years 1907 and 1908.

44. Production of asbestos in Canada during the calendar years 1907 and 1908.

†45. Production of coal, coke, and peat in Canada during the calendar years 1907 and 1908.

46. Production of natural gas and petroleum in Canada during the calendar years 1907 and 1908.

59. Chemical analyses of special economic importance made in the laboratories at the Department of Mines, 1906-7-8. Report on—by F. G. Wait, M.A., F.C.S. (With Appendix on the commercial methods and apparatus for the analyses of oil-shales—by H. A. Leverin, Ch.E.)

Schedule of charges for chemical analyses and assays.

†62. Mineral production of Canada, 1909. Preliminary report on—by John McLeish, B.A.

63. Summary report of Mines Branch, 1909.

67. Iron deposits of the Bristol mine, Pontiac county, Quebec. Bulletin No. 2—by Einar Lindeman, M.E., and Geo. C. Mackenzie, B.Sc.

†68. Recent advances in the construction of electric furnaces for the production of pig iron, steel, and zinc. Bulletin No. 3—by Eugene Haanel, Ph.D.

69. Chrysotile-asbestos: its occurrence, exploitation, milling, and uses. Report on—by Fritz Cirkel, M.E. (Second edition, enlarged.)

†71. Investigation of the peat bogs and peat industry of Canada, 1909-10; to which is appended Mr. Alf. Larson's paper on Dr. M. Ekenberg's wet-carbonizing process: from Teknisk Tidskrift, No. 12, December 26, 1908—translation by Mr. A. Anrep, Jr.; also a translation of Lieut. Ekelund's pamphlet entitled 'A solution of the peat problem,' 1909, describing the Ekelund process for the manufacture of peat powder, by Harold A. Leverin, Ch.E. Bulletin No. 4—by A. Anrep. (Second edition, enlarged.)

82. Magnetic concentration experiments. Bulletin No. 5—by Geo. C. Mackenzie, B.Sc.

† Publications marked thus † are out of print.

83. An investigation of the coals of Canada with reference to their economic qualities: as conducted at McGill University under the authority of the Dominion Government. Report on—by J. B. Porter, E.M., D.Sc., R. J. Durley, Ma.E., and others.
Vol. I—Coal washing and cooking tests.
Vol. II—Boiler and gas producer tests.
†Vol. III—(Out of print.)
Appendix I
Coal washing tests and diagrams.
†Vol. IV—
Appendix II
Boiler tests and diagrams.
†Vol. V—(Out of print.)
Appendix III
Producer tests and diagrams.
†Vol. VI—
Appendix IV
Coking tests.
Appendix V
Chemical tests.

†84. Gypsum deposits of the Maritime provinces of Canada—including the Magdalen islands. Report on—by W. F. Jennison, M.E. (See No. 245.)

88. The mineral production of Canada, 1909. Annual report on—by John McLeish, B.A.

NOTE.—*The following parts were separately printed and issued in advance of the Annual Report for 1909.*

†79. Production of iron and steel in Canada during the calendar year 1909.
†80. Production of coal and coke in Canada during the calendar year 1909.
85. Production of cement, lime, clay products, stone, and other structural materials during the calendar year 1909.

89. Proceedings of conference on explosives. (Fourth edition).

90. Reprint of presidential address delivered before the American Peat Society at Ottawa, July 25, 1910. By Eugene Haanel, Ph.D.

92. Investigation of the explosives industry in the Dominion of Canada, 1910. Report on—by Capt. Arthur Desborough. (Fourth edition.)

†93. Molybdenum ores of Canada. Report on—by Professor T. L. Walker, Ph.D.

100. The building and ornamental stones of Canada: Building and ornamental stones of Ontario. Report on—by Professor W. A. Parks, Ph.D.

102. Mineral production of Canada, 1910. Preliminary report on—by John McLeish, B.A.

† Publications marked thus † are out of print.

†103. Summary report of Mines Branch, 1910.

104. Catalogue of publications of Mines Branch, from 1902 to 1911; containing tables of contents and lists of maps, etc.

105. Austin Brook iron-bearing district. Report on—by E. Lindeman, M.E.

110. Western portion of Torbrook iron ore deposits, Annapolis county, N.S. Bulletin No. 7—by Howells Frechette, M.Sc.

111. Diamond drilling at Point Mamainse, Ont. Bulletin No. 6—by A. C. Lane, Ph.D., with introductory by A. W. G. Wilson, Ph.D.

118. Mica: its occurrence, exploitation, and uses. Report on—by Hugh S. de Schmid, M.E.

142. Summary report of Mines Branch, 1911.

143. The mineral production of Canada, 1910. Annual report on—by John McLeish, B.A.

NOTE.—*The following parts were separately printed and issued in advance of the Annual Report for 1910.*

†114. Production of cement, lime, clay products, stone, and other materials in Canada, 1910.
†115. Production of iron and steel in Canada during the calendar year 1910.
†116. Production of coal and coke in Canada during the calendar year 1910.
†117. General summary of the mineral production of Canada during the calendar year 1910.

145. Magnetic iron sands of Natashkwan, Saguenay county, Que. Report on—by Geo. C. Mackenzie, B.Sc.

†150. The mineral production of Canada, 1911. Preliminary report on—by John McLeish, B.A.

151. Investigation of the peat bogs and peat industry of Canada, 1910-11. Bulletin No. 8—by A. Anrep.

154. The utilization of peat for fuel for the production of power, being a record of experiments conducted at the Fuel Testing Station, Ottawa, 1910-11. Report on—by B. F. Haanel, B.Sc.

167. Pyrites in Canada: its occurrence, exploitation, dressing and uses. Report on—by A. W. G. Wilson, Ph.D.

170. The nickel industry: with special reference to the Sudbury region, Ont. Report on—by Professor A. P. Coleman, Ph.D.

184. Magnetite occurrences along the Central Ontario railway. Report on—by E. Lindeman, M.E.

201. The mineral production of Canada during the calendar year 1911. —Annual report on—by John McLeish, B.A.

† Publications marked thus † are out of print.

NOTE.—*The following parts were separately printed and issued in advance of the Annual Report for 1911.*

181. Production of cement, lime, clay products, stone, and other structural materials in Canada during the calendar year 1911. Bulletin on—by John McLeish, B.A.

†182. Production of iron and steel in Canada during the calendar year 1911. Bulletin on—by John McLeish, B.A.

183. General summary of the mineral production in Canada during the calendar year 1911. Bulletin on—by John McLeish, B.A.

†199. Production of copper, gold, lead, nickel, silver, zinc, and other metals of Canada, during the calendar year 1911. Bulletin on—by C. T. Cartwright, B.Sc.

†200. The production of coal and coke in Canada during the calendar year 1911. Bulletin on—by John McLeish, B.A.

203. Building stones of Canada—Vol. II: Building and ornamental stones of the Maritime Provinces. Report on—by W. A. Parks, Ph.D.

209. The copper smelting industry of Canada. Report on—by A. W. G. Wilson, Ph.D.

216. Mineral production of Canada, 1912. Preliminary report on—by John McLeish, B.A.

222. Lode mining in Yukon: an investigation of the quartz deposits of the Klondike division. Report on—by T. A. MacLean, B.Sc.

224. Summary report of the Mines Branch, 1912.

227. Sections of the Sydney coal fields—by J. G. S. Hudson, M.E.

†229. Summary report of the petroleum and natural gas resources of Canada, 1912—by F. G. Clapp, A.M. (See No. 224.)

230. Economic minerals and mining industries of Canada.

245. Gypsum in Canada: its occurrence, exploitation, and technology. Report on—by L. H. Cole, B.Sc.

254. Calabogie iron-bearing district. Report on—by E. Lindeman, M.E.

259. Preparation of metallic cobalt by reduction of the oxide. Report on—by H. T. Kalmus, B.Sc., Ph.D.

262. The mineral production of Canada during the calendar year 1912. Annual report on—by John McLeish, B.A.

NOTE.—*The following parts were separately printed and issued in advance of the Annual Report for 1912.*

238. General summary of the mineral production of Canada, during the calendar year 1912. Bulletin on—by John McLeish, B.A.

† Publications marked thus † are out of print.

†247. Production of iron and steel in Canada during the calendar year 1912. Bulletin on—by John McLeish, B.A.

†256. Production of copper, gold, lead, nickel, silver, zinc, and other metals of Canada, during the calendar year 1912—by C. T. Cartwright, B.Sc.

257. Production of cement, lime, clay products, stone, and other structural materials during the calendar year 1912 Report on—by John McLeish, B.A.

†258. Production of coal and coke in Canada, during the calendar year 1912. Bulletin on—by John McLeish, B.A.

266. Investigation of the peat bogs and peat industry of Canada, 1911 and 1912. Bulletin No. 9—by A. Anrep.

279. Building and ornamental stones of Canada—Vol. III: Building and ornamental stones of Quebec. Report on—by W. A. Parks, Ph.D.

281. The bituminous sands of Northern Alberta. Report on—by S. C. Ells. M.E.

283. Mineral production of Canada, 1913. Preliminary report on—by John McLeish, B.A.

285. Summary report of the Mines Branch, 1913.

291. The petroleum and natural gas resources of Canada. Report on—by F. G. Clapp, A.M., and others:—
Vol. I—Technology and Exploitation.
Vol. II—Occurrence of petroleum and natural gas in Canada.
Also separates of Vol. II, as follows:—
Part 1, Eastern Canada.
Part 2, Western Canada.

299. Peat, lignite, and coal: their value as fuels for the production of gas and power in the by-product recovery producer. Report on—by B. F. Haanel, B.Sc.

303. Moose Mountain iron-bearing district. Report on—by E. Lindeman, M.E.

305. The non-metallic minerals used in the Canadian manufacturing industries. Report on—by Howells Fréchette, M.Sc.

309. The physical properties of cobalt, Part II. Report on—by H. T. Kalmus, B.Sc., Ph.D.

320. The mineral production of Canada during the calendar year 1913. Annual report on—by John McLeish, B.A.

NOTE.—*The following parts were separately printed and issued in advance of the Annual Report for 1913.*

315. The production of iron and steel during the calendar year 1913. Bulletin on—by John McLeish, B.A.

† **Publications marked thus † are out of print.**

316. The production of coal and coke during the calendar year 1913. Bulletin on—by John McLeish, B.A.

317. The production of copper, gold, lead, nickel, silver, zinc, and other metals, during the calendar year 1913. Bulletin on—by C. T. Cartwright, B.Sc.

318. The production of cement, lime, clay products, and other structural materials, during the calendar year 1913. Bulletin on—by John McLeish, B.A.

319. General summary of the mineral production of Canada during the calendar year 1913. Bulletin on—by John McLeish, B.A.

322 Economic minerals and mining industries of Canada. (Revised Edition).

323. The Products and by-products of coal. Report on—by Edgar Stansfield, M Sc., and F. E. Carter, B.Sc., Dr. Ing.

325. The salt industry of Canada. Report on—by L. H. Cole, B.Sc.

331. The investigation of six samples of Alberta lignites. Report on—by B. F. Haanel, B.Sc., and John Blizard, B.Sc.

333. The mineral production of Canada, 1914. Preliminary report on—by John McLeish, B.A.

334. Electro-plating with cobalt and its alloys. Report on—by H. T Kalmus, B.Sc., Ph.D.

336. Notes on clay deposits near McMurray, Alberta. Bulletin No. 10—by S. C. Ells, B.A., B.Sc.

344. Electrothermic smelting of iron ores in Sweden. Report on—by Alfred Stansfield, D.Sc., A.R.S.M., F.R.S.C.

346. Summary report of the Mines Branch for 1914.

348. Production of coal and coke in Canada during the calendar year, 1914. Bulletin on—by J. McLeish, B.A.

349. Production of iron and steel in Canada during the calendar year, 1914. Bulletin on—by J. McLeish, B.A.

350. Production of copper, gold, lead, nickel, silver, zinc, and other metals, during the calendar year, 1914. Bulletin on—by J. McLeish, B.A.

383. The production of cement, lime, clay products, stone and other structural materials, during the calendar year 1914. Bulletin on—by John McLeish, B.A.

385. Investigation of a reported discovery of phosphate at Banff, Alberta. Bulletin No. 12—by H. S. de Schmid, M.E., 1915.

406. Description of the laboratories of the Mines Branch of the Department of Mines, 1916. Bulletin No. 13.

*The Division of Mineral Resources and Statistics has prepared the following lists of mine, smelter, and quarry operators: Metal mines and smelters, Coal mines, Stone quarry operators, Manufacturers of clay products, and Manufacturers of lime. Copies of the lists may be obtained on application.*

IN THE PRESS.

338. Coals of Canada: Vol. VII. Weathering of coal. Report on—by J. B. Porter, E.M., D.Sc., Ph.D.

351. Investigation of the peat bogs and the peat industry of Canada, 1913-1914. Bulletin No. 11—by A. Anrep.

384. The mineral production of Canada during the calendar year 1914. Annual Report on—by John McLeish, B.A.

## FRENCH TRANSLATIONS.

†4. Rapport de la Commission nominée pour étudier les divers procédés électro-thermiques pour la réduction des minerais de fer et la fabrication de l'acier employés en Europe—by Eugene Haanel, Ph.D. (French Edition), 1905.

26a. The mineral production of Canada, 1906. Annual report on—by John McLeish, B.A.

†28a. Summary report of Mines Branch, 1908.

56. Bituminous or oil-shales of New Brunswick and Nova Scotia; also on the oil-shale industry of Scotland. Report on—by R. W. Ells, LL.D.

81. Chrysotile-asbestos, its occurrence, exploitation, milling, and uses. Report on—by Fritz Cirkel, M.E.

100a. The building and ornamental stones of Canada: Building and ornamental stones of Ontario. Report on—by W. A. Parks, Ph.D.

149. Magnetic iron sands of Natashkwan, Saguenay county, Que. Report on—by Geo. C. Mackenzie, B.Sc.

155. The utilization of peat fuel for the production of power, being a record of experiments conducted at the Fuel Testing Station, Ottawa, 1910-11. Report on—by B. F. Haanel, B.Sc.

†156. The tungsten ores of Canada. Report on—by T. L. Walker, Ph.D.

169. Pyrites in Canada: its occurrences, exploitation, dressing, and uses. Report on—by A. W. G. Wilson, Ph.D.

179 The nickel industry: with special reference to the Sudbury region, Ont. Report on—by Professor A. P. Coleman, Ph.D.

180. Investigation of the peat bogs, and peat industry of Canada, 1910-11. Bulletin No. 8—by A. Anrep.

195. Magnetite occurrences along the Central Ontario railway. Report on—by E. Lindeman, M.E.

† Publications marked thus † are out of print.

† Publications marked thus † are out of print.

307. Catalogue of French publications of the Mines Branch and of the Geological Survey, up to July, 1914.

308. An investigation of the coals of Canada with reference to their economic qualities: as conducted at McGill University under the authority of the Dominion Government. Report on—by J. B. Porter, E.M., D.Sc., R. J. Durley, Ma.E., and others—
 Vol. I—Coal washing and coking tests.
 Vol. II—Boiler and gas producer tests.
 Vol. III—
 Appendix I
 Coal washing tests and diagrams.

314. Iron ore deposits, Bristol mine, Pontiac county, Quebec, Report on—by E. Lindeman, M.E.

321. Annual mineral production of Canada, during the calendar yeaı 1913. Report on—by J. McLeish, B.A.

## IN THE PRESS.

204. Building stones of Canada—Vol. II: Building and ornamental stones of the Maritime Provinces. Report on—by W. A. Parks, Ph.D.

223. Lode Mining in the Yukon: an investigation of quartz deposits the Klondike division. Report on—by T. A. MacLean, B.Sc.

246. Gypsum in Canada: its occurrence, exploitation, and technology. Report on—by L. H. Cole, B.Sc.

260. The preparation of Metallic cobalt by reduction of the oxide. Report on—by H. T. Kalmus, B.Sc., Ph.D.

280. The building and ornamental stones of Canada, Vol. III; Province of Quebec. Report on—by Professor W. A. Parks, Ph.D.

306. The non-metallic minerals nued in the Canadian manufacturing industries Report on—by Howells Fréchette, M.Sc.

308. An investigation of the coals of Canada with reference to their economic qualities: as conducted at McGill University under the authority of the Dominion Government. Report on—by J. B. Porter, E.M., D.Sc., R. J. Durley, Ma.E., and others—
 Vol. IV—
 Appendix II
 Boiler tests and diagrams.

## MAPS.

†6. Magnetometric survey, vertical intensity: Calabogie mine, Bagot township, Renfrew county, Ontario—by E. Nystrom, 1904. Scale 60 feet to 1 inch. Summary report 1905. (See Map No, 249.)

†13. Magnetometric survey of the Belmont iron mines, Belmont township, Peterborough county, Ontario—by B. F. Haanel, 1905. Scale 60 feet to 1 inch. Summary report, 1906. (See Map No. 186.)

†14. Magnetometric survey of the Wilbur mine, Lavant township, Lanark county, Ontario—by B. F. Haanel, 1905. Scale 60 feet to 1 inch. Summary report, 1906.

†33. Magnetometric survey, vertical intensity: lot 1, concession VI, Mayo township, Hastings county, Ontario—by Howells Fréchette, 1909. Scale 60 feet to 1 inch. (See Maps Nos. 191 and 191A.)

†34. Magnetometric survey, vertical intensity: lots 2 and 3, concession VI, Mayo township, Hastings county, Ontario—by Howells Fréchette, 1909. Scale 60 feet to 1 inch. (See Maps Nos. 191 and 191A.)

†35. Magnetometric survey, vertical intensity: lots 10, 11, and 12 concession IX, and lots 11 and 12, concession VIII, Mayo township, Hastings county. Ontario—by Howells Fréchette, 1909. Scale 60 feet to 1 inch. (See Maps Nos. 191 and 191A).

*36. Survey of Mer Bleue peat bog, Gloucester township, Carleton county, and Cumberland township, Russell county, Ontario—by Erik Nystrom, and A. Anrep. (Accompanying report No. 30.)

*37. Survey of Alfred peat bog. Alfred and Caledonia townships, Prescott county, Ontario—by Erik Nystrom and A. Anrep. (Accompanying report No. 30.)

*38. Survey of Welland peat bog, Wainfleet and Humberstone townships, Welland county, Ontario—by Erik Nystrom and A. Anrep. (Accompanying report No. 30.)

*39. Survey of Newington peat bog, Osnabruck, Roxborough, and Cornwall townships, Stormont county, Ontario—by Erik Nystrom and A. Anrep. (Accompanying report No. 30.)

*40. Survey of Perth peat bog, Drummond township, Lanark county, Ontario—by Erik Nystrom and A. Anrep. (Accompanying report No. 30.)

†41. Survey of Victoria Road peat bog, Bexley and Carden townships, Victoria county, Ontario—Erik Nystrom and A. Anrep. (Accompanying report No. 30.)

*48. Magnetometric survey of Iron Crown claim at Nimpkish (Klaanch) river, Vancouver island, B.C.—by E. Lindeman. Scale 60 feet to 1 inch. (Accompanying report No. 47.)

Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

*49. Magnetometric survey of Western Steel Iron claim, at Sechart, Vancouver island, B.C.—By E. Lindeman. Scale 60 feet to 1 inch. (Accompanying report No. 47.)

*53. Iron ore occurrences, Ottawa and Pontiac counties, Quebec, 1908—by J. White and Fritz Cirkel. (Accompanying report No. 23.)

*54. Iron ore occurrences, Argenteuil county, Quebec, 1908—by Fritz Cirkel. (Accompanying report No. 23.) (Out of print.)

†57. The productive chrome iron ore district of Quebec—by Fritz Cirkel. (Accompanying report No. 29.)

†60. Magnetometric survey of the Bristol mine, Pontiac county, Quebec—by E. Lindeman. Scale 200 feet to 1 inch. (Accompanying report No. 67.)

†61. Topographical map of Bristol mine, Pontiac county, Quebec—by E. Lindeman. Scale 200 feet to 1 inch. (Accompanying report No. 67.)

†64. Indexmap of Nova Scotia: Gypsum—by W. F. Jennison.
†65. Index map of New Brunswick: Gypsum—by W. F. Jennison.
†66. Map of Magdalen islands: Gypsum—by W. F. Jennison.
(Accompanying report No. 84.)

†70. Magnetometric survey of Northeast Arm iron range, Lake Timagami, Nipissing district, Ontario—by E. Lindeman. Scale 200 feet to 1 inch. (Accompanying report No. 63.)

†72. Brunner peat bog, Ontario—by A. Anrep.
†73. Komako peat bog, Ontario— " "
†74. Brockville peat bog, Ontario— " "
†75. Rondeau peat bog, Ontario— " "
†76. Alfred peat bog, Ontario— " "
†77. Alfred peat bog, Ontario main ditch profile—by A. Anrep.
(Accompanying report No. 71.) (Out of print.)

†78. Map of asbestos region, Province of Quebec, 1910—by Fritz Cirkel. Scale 1 mile to 1 inch. (Accompanying report No. 69.)

†94. Map showing Cobalt, Gowganda, Shiningtree, and Porcupine districts—by L. H. Cole. (Accompanying Summary report, 1910.)

†95. General map of Canada, showing coal fields. (Accompanying report No. 83—by Dr. J. B. Porter.)

†96. General map of coal fields of Nova Scotia and New Brunswick. (Accompanying report No. 83—by Dr. J. B. Porter.)

†97. General map showing coal fields in Alberta, Saskatchewan, and Manitoba. (Accompanying report No. 83—by Dr. J. B. Porter).

Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procuredse parately by applicants.

†98. General map of coal fields in British Columbia. (Accompanying report No. 83—by Dr. J. B. Porter.)

†99. General map of coal field in Yukon Territory. (Accompanying report No. 83—by Dr. J. B. Porter.)

†106. Geological map of Austin Book iron-bearing district, Bathurst township, Gloucester county, N.B.—by E. Lindeman. Scale 400 feet to 1 inch. (Accompanying report No. 105.)

†107. Magnetometric survey, vertical intensity: Austin Book iron-bearing district—by E. Lindeman. Scale 400 feet to 1 inch. (Accompanying report No. 105.)

†108. Index map showing iron-bearing area at Austin Brook—by E. Lindeman. (Accompanying report No. 105.)

*112. Sketch plan showing geology of Point Mamainse, Ont.—by Professor A. C. Lane. Scale 4,000 feet to 1 inch. (Accompanying report No. 111.)

†113. Holland peat bog Ontario—by A. Anrep. (Accompanying report No. 151.)

*119-137. Mica: township maps, Ontario and Quebec—by Hugh S. de Schmid. (Accompanying report No. 118.)

†138. Mica: showing location of principal mines and occurrences in the Quebec mica area—by Hugh S. de Schmid. Scale 3·95 miles to 1 inch. (Accompanying report No. 118.)

†139. Mica: showing location of principal mines and occurrences in the Ontario mica area—by Hugh S. de Schmid. Scale 3·95 miles to 1 inch. (Accompanying report No. 118.)

†140. Mica: showing distribution of the principal mica occurrences in the Dominion of Canada—by Hugh S. de Schmid. Scale 3·95 miles to 1 inch. (Accompanying report No. 118.)

†141. Torbrook iron-bearing district Annapolis county, N.S.—by Howells Fréchette. Scale 400 feet to 1 inch. (Accompanying report No. 110.)

†146. Distribution of iron ore sands of the iron ore deposits on the north shore of the River and Gulf of St. Lawrence, Canada—by Geo. C. Mackenzie. Scale 100 miles to 1 inch. (Accompanying report No. 145.)

†147. Magnetic iron sand deposits in relation to Natashkwan harbour and Great Nataskwan river, Que. (Index Map)—by Geo. C. Mackenzie. Scale 40 chains to 1 inch. (Accompanying report No. 145.)

†148. Natashkwan magnetic iron sand deposits, Saguenay county, Que.—by Geo. C. Mackenzie. Scale 1,000 feet to 1 inch. (Accompanying report No. 145.)

Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

†152. Map showing the location of peat bogs investigated in Ontario—by A. Anrep. (See Map No. 354.)

†153. Map showing the location of peat bog as investigated in Manitoba—by A. Anrep.

†157. Lac du Bonnet peat bog, Manitoba—by A. Anrep.

†158. Transmission peat bog, Manitoba— " "

†159. Corduroy peat bog, Manitoba— " "

†160. Boggy Creek peat bog, Manitoba— " "

†161. Rice Lake peat bog, Manitoba— " "

†162. Mud Lake peat bog, Manitoba— " "

†163. Litter peat bog, Manitoba— " "

†164. Julius peat litter bog, Manitoba— " "

†165. Fort Frances peat bog, Ontario— " "

(Accompanying report No. 151.)

*166. Magnetometric map of No. 3 mine, lot 7, concessions V. and VI, McKim township, Sudbury district, Ont.—by E. Lindeman. (Accompanying Summary report, 1911.)

†168. Map showing pyrites mines and prospects in Eastern Canada, and their relation to the United States market—by A. W. G. Wilson. Scale 125 miles to 1 inch. (Accompanying report No. 167.)

†171. Geological map of Sudbury nickel region, Ont.—by Prof. A. P. Coleman. Scale 1 mine to 1 inch. (Accompanying report No. 170.)

†172. Geological map of Victoria mine—by Prof. A. P. Coleman.

†173. " Crean Hill mine—by Prof. A. P. Coleman.

†174. " Creighton mine—by Prof. A. P. Coleman.

(Accompanying report No. 170.)

†175. " showing contact of norite and Laurentian in vicinity of Creighton mine—by Prof. A. P. Coleman. (Accompanying report No. 170.)

†176. " Copper Cliff offset—by Prof. A. P. Coleman. (Accompanying report No. 170.)

†177. " No. 3 mine—by Prof. A. P. Coleman. (Accompanying report No. 170.)

†178. " showing vicinity of Stobie and No. 3 mines—by Prof. A. P. Coleman. (Accompanying report No. 170.)

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2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

†185. Magnetometric survey, vertical intensity: Blairton iron mine, Belmont township, Peterborough county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†185a. Geological map, Blairton iron mine, Belmont township, Peterborough county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†186. Magnetometric survey, Belmont iron mine, Belmont township, Peterborough county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†186a. Geological map, Belmont iron mine, Belmont township, Peterborough county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†187. Magnetometric survey, vertical intensity: St. Charles mine, Tudor township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†187a. Geological map, St. Charles mine, Tudor township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†188. Magnetometric survey, vertical intensity: Baker mine, Tudor township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†188a. Geological map, Baker mine, Tudor township, Hastings county Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†189. Magnetometric survey, vertical intensity: Ridge iron ore deposits, Wollaston township, Hastings county Ontario—by E. Lindeman. 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†190. Magnetometric survey, vertical intensity: Coehill and Jenkins mines, Wollaston township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†190a. Geological map, Coehill and Jenkins mines, Wollaston township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†191 Magnetometric survey, vertical intensity: Bessemer iron ore deposits, Mayo township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†191a. Geological map, Bessemer iron ore deposits, Mayo township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†192. Magnetometric survey, vertical intensity: Rankin, Childs, and Stevens mines, Mayo township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

†192a. Geological map, Rankin, Childs, and Stevens mines, Mayo township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†193. Magnetometric survey, vertical intensity: Kennedy property, Carlow township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†193a. Geological map, Kennedy property, Carlow township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†194. Magnetometric survey, vertical intensity: Bow Lake iron ore occurrences, Faraday township, Hastings county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 184.)

†204. Index map, magnetite occurrences along the Central Ontario railway—by E. Lindeman, 1911. (Accompanying report No. 184.)

†205. Magnetometric map, Moose Mountain iron-bearing district, Sudbury district, Ontario: Deposits Nos. 1, 2, 3, 4, 5, 6, and 7—by E. Lindeman, 1911. (Accompanying report No 303.)

†205a. Geological map, Moose Mountain iron-bearing district, Sudbury district, Ontario, Deposits Nos. 1, 2, 3, 4, 5, 6, and 7—by E. Lindeman. (Accompanying report No. 303.)

†206. Magnetometric survey of Moose Mountain iron-bearing district, Sudbury district, Ontario: northern part of deposit No. 2—by E. Lindeman, 1912. Scale 200 feet to 1 inch. (Accompanying report No. 303.)

†207. Magnetometric survey of Moose Mountain iron-bearing district, Sudbury district, Ontario: Deposits Nos. 8, 9, and 9A—by E. Lindeman, 1912. Scale 200 feet to 1 inch. (Accompanying report No. 303.)

†208. Magnetometric survey of Moose Mountain iron-bearing district, Sudbury district, Ontario: Deposit No. 10—by E. Lindeman, 1912. Scale 200 feet to 1 inch. (Accompanying report No. 303.)

†208a. Magnetometric survey, Moose Mountain iron-bearing district, Sudbury district, Ontario: eastern portion of Deposit No. 11—by E Lindeman, 1912. Scale 200 feet to 1 inch. (Accompanying report No. 303.)

†208b. Magnetometric survey, Moose Mountain iron-bearing district, Sudbury district, Ontario: western portion of deposit No. 11—by E. Lindeman, 1912. Scale 200 feet to 1 inch. (Accompanying report No. 303.)

†208c. General geological map, Moose Mountain iron-bearing district, Sudbury district, Ontario—by E. Lindeman, 1912. Scale 800 feet to 1 inch. (Accompanying report No. 303.)

Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

†210. Location of copper smelters in Canada—by A. W. G. Wilson. Scale 197·3 miles to 1 inch. (Accompanying report No. 209.)

†215. Province of Alberta: showing properties from which samples of coal were taken for gas producer tests, Fuel Testing Division, Ottawa. (Accompanying Summary report, 1912.)

†220. Mining districts, Yukon. Scale 35 miles to 1 inch—by T. A. MacLean. (Accompanying report No. 222.)

†221. Dawson mining district, Yukon. Scale 2 miles to 1 inch—by T. A. MacLean. (Accompanying report No. 222.)

*228. Index map of the Sydney coal fields, Cape Breton, N.S. (Accompanying report No. 227.)

†232. Mineral map of Canada. Scale 100 miles to 1 inch. (Accompanying report No. 230.)

†239. Index map of Canada showing gypsum occurrences. (Accompanying report No. 245.)

†240. Map showing Lower Carboniferous formation in which gypsum occurs in the Maritime provinces. Scale 100 miles to 1 inch. (Accompanying report No. 345.)

†241. Map showing relation of gypsum deposits in Northern Ontario to railway lines. Scale 100 miles to 1 inch. (Accompanying report No. 245.)

†242. Map, Grand River gypsum deposits, Ontario. Scale 4 miles to 1 inch. (Accompanying report No. 245.)

†243. Plan of Manitoba Gypsum Co.'s properties. (Accompanying report No. 245.)

†244. Map showing relation of gypsum deposits in British Columbia to railway lines and market. Scale 35 miles to 1 inch. (Accompanying report No. 245.)

†249. Magnetometric survey, Caldwell and Campbell mines, Calabogie district, Renfrew county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 254.)

†250. Magnetometric survey, Black Bay or Williams mine, Calabogie district, Renfrew county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 254.)

†251. Magnetometric survey, Bluff Point iron mine, Calabogie district, Renfrew county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 254.)

†252. Magnetometric survey, Culhane mine, Calabogie district, Renfrew county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch (Accompanying report No. 254.)

Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

†253. Magnetometric survey, Martel or Wilson iron mine, Calabogie district, Renfrew county, Ontario—by E. Lindeman, 1911. Scale 200 feet to 1 inch. (Accompanying report No. 254.)

†261. Magnetometric survey, Northeast Arm iron range, lot 339 E.T.W. Lake Timagami, Nipissing district, Ontario—by E. Nystrom. 1903. Scale 200 feet to 1 inch.

†268. Map of peat bogs investigated in Quebec—by A. Anrep, 1912.

†269. Large Tea Field peat bog, Quebec " "

†270. Small Tea Field peat bog, Quebec " "

†271. Lanoraie peat bog, Quebec " "

†272. St. Hyacinthe peat bog, Quebec " "

†273. Rivière du Loup peat bog " "

†274. Cacouna peat bog " "

†275. Le Parc peat bog, Quebec " "

†276. St. Denis peat bog, Quebec " "

†277. Rivière Ouelle peat bog, Quebec " "

†278. Moose Mountain peat bog, Quebec " "

†284. Map of northern portion of Alberta, showing position of outcrops of bituminous sand. Scale 12½ miles to 1 inch. (Accompanying report No. 281.)

†293. Map of Dominion of Canada, showing the occurrences of oil, gas, and tar sands. Scale 197 miles to 1 inch. (Accompanying report No. 291.)

†294. Reconnaissance map of part of Albert and Westmorland counties New Brunswick. Scale 1 mile to 1 inch. (Accompanying report No. 291.)

†295. Sketch plan of Gaspé oil Fields, Quebec, showing location of wells. Scale 2 miles to 1 inch. (Accompanying report No. 291.)

†296. Map showing gas and oil fields and pipe-lines in southwestern Ontario. Scale 4 miles to 1 inch. (Accompanying report No. 291.)

†297. Geological map of Alberta, Saskatchewan, and Manitoba. Scale 35 miles to 1 inch. (Accompanying report No. 291.)

†298. Map, geology of the forty-ninth parallel, 0·9864 miles to 1 inch (Accompanying report No. 291.)

Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

†302. Map showing location of main gas line, Bow Island, Calgary. Scale 12½ miles to 1 inch. (Accompanying report No. 291.)

†311. Magnetometric map, McPherson mine, Barachois, Cape Breton county, Nova Scotia—by A. H. A. Robinson, 1913. Scale 200 feet to 1 inch.

†312. Magnetometric map, iron ore deposits at Upper Glencoe, Inverness county, Nova Scotia—by E. Lindeman, 1913. Scale 200 feet to 1 inch.

†313. Magnetometric map, iron ore deposits at Grand Mira, Cape Breton county, Nova Scotia—by A. H. A. Robinson, 1913. Scale 200 feet to 1 inch.

†327. Map, showing location of Saline Springs and Salt Areas in the Dominion of Canada. (Accompanying Report No. 325).

†328. Map, showing location of Saline Springs in the Maritime Provinces. Scale 100 miles to 1 inch. (Accompanying Report No. 325).

†329. Map of Ontario-Michigan Salt Basin, showing probable limit of productive area. Scale 25 miles to 1 inch. (Accompanying Report No. 325).

†330. Map showing location of Saline Springs in Northern Manitoba. Scale 12½ miles to 1 inch. (Accompanying Report No. 325).

†340. Magnetometric Map of Atikokan Iron-Bearing district, Atikokan Mine and Vicinity. Claims Nos. 10E., 11E., 12E., 24E., 25E. and 26E., Rainy River district, Ontario. By A. H. A. Robinson, 1914. Scale 400 feet to 1 inch.

†340a. Geological map of Atikokan Iron-Bearing district, Atikokan mine and vicinity. Claims Nos. 10E, 11E, 12E, 24E, 25E and 26E Rainy River district, Ontario. By A. H. A. Robinson, 1914. Scale 400 feet to 1 inch.

†341. Magnetometric Map of Atikokan Iron-Bearing district, Sheet No. 1, Claims Nos. 400R., 401R., 402R., 112X. and 403R. Rainy River district, Ontario. By E. Lindeman, 1914. Scale 400 feet to 1 inch.

†341a. Geological map of Atikokan Iron-Bearing district. Sheet No. 1. Claims Nos. 400R, 401R, 402R, 112X and 403R, Rainy River district, Ontario. By E. Lindeman, 1914. Scale 400 feet to 1 inch.

†342. Magnetometric Map of Atikokan Iron-Bearing district. Sheet No. 2. Claims Nos. 403R., 404R., 138X., 139X. and 140 X. Rainy River district, Ontario. By E. Lindeman, 1914. Scale 400 feet to 1 inch.

†342a. Geological map of Atikokan Iron-Bearing district. Sheet No. 2. Claims Nos. 403R, 404R, 138X, 139X and 140X. Rainy River district, Ontario. By E. Lindeman, 1914. Scale 400 feet to 1 inch.

† Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

†343. Magnetometric Map of Atikokan Iron-Bearing district. Mile Post No. 140, Canadian Northern railway, Rainy River district, Ontario. By E. Lindeman, 1914. Scale 400 feet to 1 inch.

†343a. Geological map, Atikokan Iron-Bearing district. Mile Post No. 140, Canadian Northern railway, Rainy River district, Ontario. By E. Lindeman, 1914. Scale 400 feet to 1 inch.

| | | |
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| †354. | Index Map, showing location of peat bogs investigated in Ontario— | by A. Anrep, 1913-14 |
| †355. | Richmond peat bog, Carleton county, Ontario. | " " |
| †356. | Luther peat bog, Wellington and Dufferin counties, Ontario— | " " |
| †357. | Amaranth peat bog, Dufferin county, Ontario— | " " |
| †358. | Cargill peat bog, Bruce county, Ontario— | " " |
| †359. | Westover peat bog, Wentworth county, Ontario— | " " |
| †360. | Marsh Hill peat bog, Ontario county, Ontario— | " " |
| †361. | Sunderland peat bog, Ontario county, Ontario— | " " |
| †362. | Manilla peat bog, Victoria county, Ontario— | " " |
| †363. | Stoco peat bog, Hastings county, Ontario— | " " |
| †364. | Clareview peat bog, Lennox and Addington counties, Ontario— | " " |
| †365. | Index Map, showing location of peat bogs investigated in Quebec— | " " |
| †366. | L'Assomption peat bog, L'Assomption county, Quebec— | " " |
| †367. | St. Isidore peat bog, La Prairie county, Quebec— | " " |
| †368. | Holton peat bog, Chateauguay county, Quebec— | " " |
| †369. | Index Map, showing location of peat bogs investigated in Nova Scotia and Prince Edward Island— | " " |
| †370. | Black Marsh peat bog, Prince county, Prince Edward Island— | " " |
| †371. | Portage peat bog, Prince county, Prince Edward Island— | " " |
| †372. | Miscouche peat bog, Prince county, Prince Edward Island— | " " |
| †373. | Muddy Creek peat bog, Prince county, Prince Edward Island— | " " |
| †374. | The Black Banks peat bog, Prince county, PrinceEdward Island— | " " |

† Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.

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| †375. | Mermaid peat bog, Queens county, Prince Edward Island— | by A. Anrep, 1913-14 |
| †376. | Caribou peat bog, Kings county, Prince Edward Island— | " " |
| †377. | Cherryfield Peat bog, Lunenburg County, Nova Scotia— | " " |
| †378. | Tusket peat bog, Yarmouth county, Nova Scotia— | " " |
| †379. | Makoke peat bog, Yarmouth county, Nova Scotia— | " " |
| †380. | Heath peat bog, Yarmouth county, Nova Scotia— | " " |
| †381. | Port Clyde peat bog, Shelburne county, Nova Scotia— | " " |
| †382. | Latour peat bog, Shelburne county, Nova Scotia— | " " |
| †383. | Clyde peat bog, Shelburne county, Nova Scotia— | " " |

†387. Geological map Banff district, Alberta, showing location of phosphate beds. By Hugh S. deSchmid, 1915: accompanying report No. 385.

†390. Christina river map showing outcrops of bituminous sand along Christina valley; contour intervals of 20 feet—by S. C. Ells, 1915. Scale 1,000 feet to inch.

†391. Clearwater river map, showing outcrops of bituminous sand along Clearwater valley; contour intervals of 20 feet—by S. C. Ells, 1915. Scale 1,000 feet to 1 inch.

†392. Hangingstone-Horse rivers, showing outcrops of bituminous sand along Hangingstone and Horse River valleys: contour intervales of 20 feet—by S. C. Ells, 1915. Scale 1,000 feet to 1 inch.

†393. Steepbank river, showing outcrops of bituminous sand along Steepbank valley; contour intervals of 20 feet—by S. C. Ells, 1915. Scale 1,000 feet to 1 inch.

†394. McKay river, 3 sheets, showing outcrops of bituminous sand along McKay valley; contour intervals of 20 feet—by S. C. Ells, 1915. Scale 1,000 feet to 1 inch.

†395. Moose river, showing outcrops of bituminous sand along Moose valley; contour intervals of 20 feet—by S. C. Ells, 1915. Scale 1,000 feet to 1 inch.

*Address all communications to—*

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Note.—1. Maps marked thus * are to be found only in reports.
2. Maps marked thus † have been printed independently of reports, hence can be procured separately by applicants.