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. The Central . .
Railway and Engineering Club . . . .
of Canada

OFFICIAL PROCEEDINGS

Vol. 3. No. 9. TORONTO, CAN., December 21, 1909. $1.00 per year 15c. per copy

OFFICERS, 1909.

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C. A. JEFFERIS, Master Mech., Con. Gas Co., Toronto.

1st Vice-President:

J. DUGUID, General Forman, G.T.R., Toronto.

2nd Vice-President:

H. G. FLETCHER, Rep. Garlock Packing Co., Toronto.

Executive Committee:

J. BANNON, Chief Engineer, City Hall, Toronto.

R. PATTERSON, Master Mechanic, G.T.R., Stratford.

GEO. BALDWIN, Yardmaster, Can. Foundry Co., Toronto.

J. MARKEY, Master Mechanic, G.T.R., Toronto.

GEO. BLACK, Road Foreman, G.T.R., Stratford

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C. L. WORTH, Sec.-Treas., Room 409 Union Station, Toronto.

PROCEEDINGS OF THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA MEETING.

Prince George Hotel, TORONTO, December 21, 1909.

The President, Mr. Jefferis, occupied the chair.

Chairman,—

The first order of business is reading the minutes of the previous meeting. You have all had a copy of the minutes of the previous meeting and it is in order for someone to move their adoption as read.

Proposed by Mr. Baldwin, seconded by Mr. I. Jefferis, that the minutes of the previous meeting be adopted as read. Carried.

Chairman,—

The next order of business is the remarks of the President.

As my term of office expires with this meeting, I wish to say a few words about the Club.

I think you will all agree with me when I say that the past year has been a very successful one and the outlook for the Club is splendid.

Words fail me in expressing my appreciation of the support I have received at the hands of the officers and members of the committees, and for the benefit of any members who do not know, I wish to say, that there have been times during the past year when some members of our Reception Committee have laid their business aside to work for the success of the social side of this Club, which you will readily understand, means time and money to them. Personally, I feel very grateful to them for their loyalty and support.

Our Secretary has been untiring in his efforts to get good papers, and I believe you will all agree that he has succeeded. The papers have been very good and varied and have brought out some good discussions, especially when one considers the cosmopolitan nature of the Club. Our Journals have always been interesting and instructive, thanks to the genial secretary and his able assistant, Mr. Hyde.

You, of course, are all familiar with Mr. Worth's battle cry, —"More Members."

I have tried to think out the reason for the phenomenal success of this Club, and I attribute it in a very large measure to the absence of cliques and factions and the disposition on the part of its members to work for the success of the Club, as a whole, rather than to stand in the limelight as individuals.

Let us keep these points before us for our future guidance, and if you will give the same support and loyalty to my successor that you have given to me, and I believe you will, then I have no fear for the future welfare of the Central Railway and Engineering Club of Canada.

With these few remarks, which are brief but I think to the point, let me urge that we all strive to maintain the same spirit of sociability and friendliness amongst the members that now exists.

As this is the last meeting of the year, let me wish you, one and all, a very Merry Christmas and a Happy and Prosperous New Year.

Secretary,—

The President has asked me what is the next business.

Last month I thought I would take my holidays, in consequence of which I was not at the last meeting, and I was told the previous month I did not have a smile. I wish to say to the members present that I have got a smile once in a while. There were thirty-one new members brought in at the last meeting. Everyone was pretty near doing his duty.

I get requests from a great many people, not only in Canada, but in the United States, for copies of the papers read before the Club to be sent to them. We have got a pretty fair Club, and the papers must be good when outsiders ask me for copies of the papers which have been published in our Journal to republish them in their own.

Although we have some good papers yet in store, I wish to say it is up to the members of the Club to come forward and offer to give a paper, or give me the name of a friend who will do so.

Chairman,—

The next order of business is the announcement of new members.

NEW MEMBERS.

Mr. R. McIntosh, Engineer, Grand Trunk Railway, Stratford.

Mr. R. Kellog, Manager, Kellogg & Co., Toronto.

Mr. E. L. Rilling, Manager, Hollands Mfg. Co., Erie, Pa.

Mr. G. P. Beswick, Casting Inspector, Consumers' Gas Co., Toronto.

Mr. G. H. Dyer, Proprietor, Brighton Laundry Co., Toronto.

Mr. W. A. Manion, General Manager, British American Oil Co., Toronto.

Mr. E. J. Friend, Engineer, Canada Foundry Co.

Mr. J. P. Law, Engineer, Consumers' Gas Co., Toronto.

MEMBERS PRESENT.

G. A. Young.
J. Bannon.
R. Pearson.
W. Philpotts.
H. Ellis.
F. A. Corns.
H. O. R. Horwood.
D. Campbell.
J. M. Clements.
H. G. Fletcher.
I. Jefferis.
W. E. Archer.
A. Taylor.
J. C. Donald
A. B. Walker.
E. Logan.
F. Hardisty.
C. De Gruchy.
C. A. Jefferis.
L. S. Hyde.
W. R. McRae.
A. E. Till.
W. J. Commins.
W. Dony.
E. Blackstone.
J. Cave.
J. Mauldey.
G. Shand.
J. F. Campbell.
J. H. Herriot.
W. E. Cane.
G. Bernard.
J. O. B. Latour.
E. J. Friend.
A. Hallamore.
J. Adam.
G. Black.
R. Fish.
H. Eddrup.
C. L. Worth.
L. Salter.
T. Walsh.
G. Baldwin.
J. R. Armer.
A. T. Cowpersmith.
G. H. Boyd.
O. A. Cole.
H. Cross.
J. McWater.
J. S. Grassick.
A. H. Kirby.
J. Barker.
W. J. Bird.
J. F. Alexander.
A. W. Carmichael.
E. A. Wilkinson.
E. B. Al'en.
J. Duguid.
C. G. Herring.
G. Cooper.

Chairman,—

To show you how the Club is growing and is thought of by members who are uable to attend, I will read the following letter:

Dill, Ont., Dec. 17, 1909.

MR. C. L. WORTH,
Sec.-Treas. C. R. & E. Club,
Toronto.

Dear Sir:—

Enclosed please find $2.00 which, if I remember correctly, is the Club's annual membership fee.

Though I am not living near enough to attend the meetings of the Club, I am still much interested in same; due mainly to the prompt manner in which the announcements and the book of proceedings have been coming forward to me.

For a man out in a mining camp, about twenty miles from the nearest settlement, it is a great treat to follow the proceedings month by month.

Thanking you, I remain, yours truly,

N. D. WATMOUGH.

I have also another letter from Mr. Acton Burrows.

120 Bedford Road,
Toronto, December 2, 1909.

Dear Mr. Worth :—

Will you please convey to Mr. Jefferis and my other fellow members of the Club my heartfelt thanks for the kind resolution of sympathy which was so thoughtfully passed at the last meeting, and which I can assure you I very deeply appreciate.

Yours faithfully,
ACTON BURROWS.

I may say for the benefit of the members who were not at the last meeting that this letter is in acknowledgment of a resolution of sympathy passed at the last meeting by the members on account of the loss of Mr. Burrows' daughter.

I think the next order of business had better be the election of officers.

You have all, I believe, a list of the officers proposed by the Nominating Committee, for the year 1910.

Mr. Fletcher,—

I think that the list, as presented by the Nominating Committee, has been well thought out, and I do not see that we can improve on it in any way, and I would propose that a standing vote be taken on the list as it stands.

This proposal was seconded by Mr. J. F. Campbell, and carried unanimously.

The following members were elected as officers for the year 1910.

PRESIDENT.

Mr. J. Duguid, General Foreman, G. T. Ry., Toronto.

1ST VICE-PRESIDENT.

Mr. G. Baldwin, General Yardmaster, Canada Foundry Co., Toronto.

2ND VICE PRESIDENT.

Mr. J. Bannon, Chief Engineer, City Hall, Toronto.

EXECUTIVE COMMITTEE.

Mr. C. A. Jefferis, Master Mechanic, Consumers Gas Co., Toronto.

Mr. W. R. McRae, Master Mechanic, Toronto Railway Co., Toronto.

Mr. O. A. Cole, Manager, Philip Carey Mfg. Co., Toronto.

Mr. R Patterson, Master Mechanic, G. T. Ry., Stratford.

Mr. A. M. Wickens, Chief Engineer, Canada Casualty & Boiler Co., Toronto.

Mr. A. E. Till, Foreman, C. P. Ry., Toronto.

Mr. A. Taylor, Foreman, Boiler Shop, Polson Iron Works, Limited, Toronto.

AUDITORS.

Mr. D. Campbell, Storeman, Consumers' Gas Co., Toronto.

Mr. F. G. Tushingham, Chief Engineer, Toronto Railway Co., Toronto.

Mr. J. W. McLintock, Accountant, Master Mechanic's Office, G. T. R., Toronto.

RECEPTION COMMITTEE.

Mr. A. J. Lewkowiez, Mechanical Engineer, Toronto.
Mr. E. Logan, Machinist, G. T. Ry., Toronto.
Mr. H. Ellis, Machinist, Consumers' Gas Co., Toronto.
Mr. J. Herriott, Storeman, Canada Coundry Co., Toronto.
Mr. A.W. Carmichael, Rep. H.W. Johns-Manville Co.,Toronto
Mr. H. E. Rowell, Rep. Philip Carey Mfg. Co., Toronto.
Mr. H. G. Fletcher, Rep. Garlock Packing Co., Toronto.
Mr. R. Pearson, Machinist, Consumers' Gas Co., Toronto.
Mr. H. Cowan, Foreman, Motor Shops, Toronto Ry. Co., Toronto.
Mr. J. F. Campbell, Rep. Elaterite Paint Co., Toronto.
Mr. E. A. Wilkinson, Rep. Lockenheimer Co., Toronto.
Mr. W. H. Bowie, Mechanical Expert, Toronto.
Mr. C. H. Scott, Rep. Gutta Percha & Rubber Co., Toronto.
Mr. E. Durnan, Rep. Rice Lewis & Son, Toronto.

Mr. Fletcher,—

I would like to move a vote of thanks to Mr. Cole, who acted as Chairman of the Nominating Committee, for the very able and effective way in which he has looked over the prospective candidates for the position of officers, and for the way in which he has handled the nominations generally.

Proposed by Mr. Fletcher, seconded by Mr. I. Jefferis, that a vote of thanks be tendered to Mr. Cole and his associates, for the very able manner in which they have selected the officers for the coming year. Carried.

Mr. Cole,—

As chairman of the Nominating Committee, I beg to thank you on behalf of the members of this Committee for your hearty vote of thanks, and we are very pleased that our nominations have been acceptable to you.

Chairman,—

The next order of business is the reading of papers, and discussion thereof.

We have with us to-night Mr. Herring, Chief Draughtsman of the Consumers' Gas Co., who is a member of the Club, and who has very kindly consented to give us a paper. I think we are all very much interested in this subject, and it is very kind of Mr. Herring to give us this paper, as I know that he has given a great deal of time and labor to the preparation of this paper and the making of drawings, I have great pleasure in calling on Mr. Herring.

Mr. Herring,—

Mr. Chairman and gentlemen, I thank you very much for the kind applause, and hope I shall deserve it at the end of the proceedings.

I have endeavored in this paper to bring to your notice how gas is manufactured. I may say that this paper is more in the nature of a lecture or a reading than other papers have been, but I want to bring to your notice, as I said before, that the manufacturing of gas as it stands to-day, not only in Canada, the United States, and the United Kingdom, but all over the world, is one of the highest arts of engineering at the present time.

I wish to say that I am greatly indebted to my assistant, Mr. J. T. Fellows, who is a member of the Club, for his assistance in the preparation of the drawings I am using to illustrate the paper.

GAS MANUFACTURE.

BY MR. CHAS. G. HERRING, CHIEF DRAUGHTSMAN, CONSUMERS' GAS CO., TORONTO.

If not in years but in the practical application as an art, from the days of Wm. Murdoch to the present time seems a large call. It was in the year 1792 that Wm. Murdoch, of Redruth, in Cornwall, Eng., carried gas making into practical operation in so far as storing, conveying, purifying and burning it, although a Frenchman named Lavoisier was the first inventor of the gas holder as it is now, but in those days the apparatus was most primitive. Murdoch made the first practical attempt at interior lighting, for, having set up a small plant, he conveyed the gas a distance of seventy feet to light up the rooms in his house. He also used a portable gas lamp to serve as a lantern in travelling backwards and forwards between the mines and his house.

The first public display of gas lighting was at the old Soho Engine Works, Birmingham, Eng., of Boulton & Watt, in the year 1802, in commemoration of peace, when all the front of the works were ornamented with various forms. Birmingham, Eng., being my home, I have had the opportunity of looking over the old original plant as erected by Murdoch for Boulton & Watt, and up till some ten years or so ago was still in use. The strides from this date in the elaborating and perfecting of the apparatus for distilling, purifying, and distributing the gas began apace.

The first account of street lighting by gas was in the year 1807 when, in honor of the birthday of King George III, a part of Pall Mall, London, was lighted by means of gas. Even in those days competition in lighting was very keen, and perhaps, as now, some of the statistics for the various claims of gas over candle light might have been a bit over-drawn, for instance, taking a comparative cost of lighting an establishment Murdoch says: "Taking an average of two hours per day throughout the year, the expense of candles would be £2,000 ($10,000), while the cost of gas, including wear and tear and interest, would not exceed £600 ($3,000) a year.

It is said "there is nothing new under the sun," and the longer you live how true this becomes, for in the days of Murdoch various forms of retorts were tried and settings of all angles were experimented with, and the earliest apparatus was with retorts of vertical type. To-day there are patents in every country for retorts on the vertical principle, all claiming to be original?

The manufacture of gas by the distillation of coal has grown to such importance, until at the present time it has become one of the largest manufactures of the country, the annual consumption of coal for gas making in the United Kingdom is about 14,500,000 tons annually, and the capital embarked may be set down at about £70,000,000 ($350,000,000) from the sale of gas, and the receipts for the sale of gas and residuals about £20,000,000 ($100,000,000). In the United States, the total value of raw material is about $37,000,000, and the coal for carbonizing, about 4,500,000 tons.

Gas making, or the process of coal distillation, is called carbonization, and the operations of gas making are the carbonization of the coal in retorts, the separation of tar and ammoniacal liquor in the various parts of the plant. There is also the collection and storage of coke, tar, ammoniacal liquor, the measurement and storage of gas in the holder, and lastly, the distribution of the gas by means of mains and pipes to the consumers. By means of the drawings, the various apparatus is shown through which the gas has to pass ere it is delivered into the distributing mains, viz:

- Setting of Retorts.
- Hydraulic Main.
- Foul Main.
- Condensers.
- Exhauster.
- Washers.
- Washer Scrubbers.
- Purifyers.
- Station Meter.
- Gas Holder.
- Governor.

One feature of gas making which would strike the uninitiated is, that it is a hand-to-mouth business; a twenty-four hours' supply when the consumption is at its maximum is all the gas that is kept ready made in the generality of gas works.

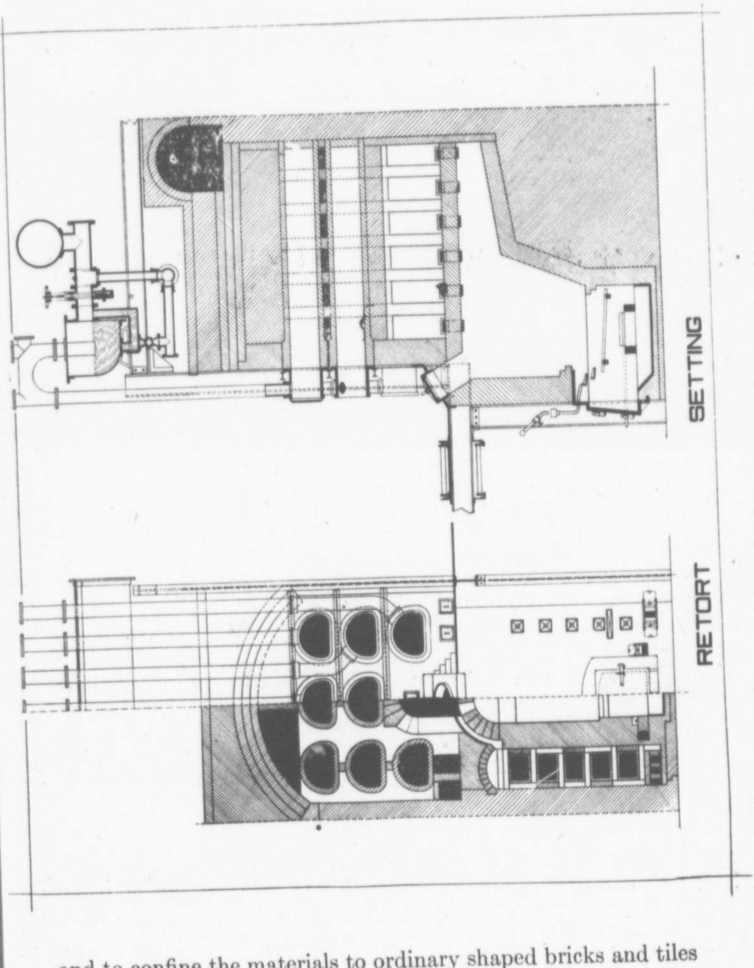
In the past before the gas cooking stove was in vogue, gas works had their periods of inactivity or comparatively so. In winter the demand for artificial light was greatest, and the gas works had to put forth all its energies to meet the demands made upon it. Four times as much gas was burned as in midsummer. Summer, when little gas was used, was the time for structural alterations, and repairs of all kinds to the plant. Now, through the universal use of the gas cooking stove, incandescent lighting, etc., there is very little difference in the make of gas the year round, and the peak loads have assumed more of a straight line. The raw material of the gas is coal, mostly caking or bituminous, sometimes cannel coal is used as an enricher to the illuminating power, but more often, especially on this continent, the carburetted water gas plant is used for this purpose instead of cannel coal.

The operation of carbonization is as follows: the coal is brought into the works in cars, in some cases in boats, and dumped into chutes or hoppers over breakers that break the coal up into convenient size to be handled by the charging machines: from the breakers it goes into the stores and thence as required to overhead hoppers in the retort house, from which it is fed as required into the charging machines. The charge delivered into the retort is usually about 300 pounds for a ten foot long retort. I might add here, that the type of retort charging and discharging machines are many, each claim some distinction over the other. The motive powers working them are various, such as steam, pneumatic, hydraulic and electric, and in these days of monoplanes, biplanes and the other aerial wonders, the possibility of charging and drawing machines being worked on the wireless system is not at all unfeasible.

The charge now being all delivered into the retort, the lid is closed and the distillation or carbonization goes on. The aim in the retort house of all gas works is to impart to the retorts just sufficient heat to economically carbonize a given quantity of coal in a given time, having regard to the quantity of gas made and the illuminating value. The average bituminous coal requires a temperature in the retort of 2,000 deg. F., above or below this is not good practice, for if above, the great bugbear of lamp black is produced along with its consequent evils of stopped ascension pipes, or if below, the charges of coal in the retorts are not thoroughly burnt off, hence loss of gas and a bad coke.

The charge of coal now being burned off, the coke is drawn out of the retort by the discharging machine, quenched, sorted and graded, and stored ready for sale.

Just a few words now on the type of furnace mostly used in gas works to heat the retorts. The usual place for the furnace is central with the setting at a certain distance below the bottom tier of retorts. The number of retorts in a setting is from one to twenty, the usual number are eight and nine, that shown on the drawing being a setting of eight. The most usual type of furnaces are on the regenerative principle, only the smaller works employ direct fired or simple generator furnaces. The one shown on the drawing is what is called a full depth regenerator producer furnace, fed with the hot coke direct from the retorts. The aim in this being to economically make a good quality and quantity of producer gas, and also to construct the furnace as simple in working and construction as possible, to do away with as many special shaped bricks as possible



and to confine the materials to ordinary shaped bricks and tiles wherever possible. I herewith give you a table of the composition of the gas made in this producer.

COMPOSITION OF PRODUCER GAS.

Carbon Dioxide CO_2	5%
Carbon Monoxide C O	24%
Hydrogen	3%
Nitrogen	68%

The charging and clinking doors on the furnaces are air tight and the primary air is admitted under the fire bars and is usually preheated. The combustion of the carbon (in the coke) combined with the oxygen of the primary air produces carbonic acid gas (CO_2) and in passing through the upper portion of the coke fuel it becomes converted into Carbonic oxide gas (CO).

It then passes through nostrils into the combustion chamber as producer gas, here it meets a stream of highly heated secondary air (that has been admitted at the bottom of the furnace, and zig zags through the tubes heated by the spent gases to a temperature of about 1,800 F.). At the meeting of the producer gas and secondary air, combustion is formed. After doing their duty in heating the retorts, the gases descend through the flues or regenerators (heating the secondary air in their journey) into the main flue to chimney. Below is a table of the composition of flue or spent gases.

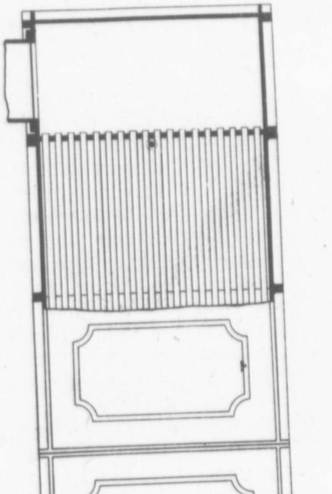
COMPOSITION OF FLUE OR SPENT GASES.

CO_2	15 or 16%
O	not more than 2%
Nitrogen	80 to 82%
C O	Trace

You will quite see by this system a considerable saving of fuel, owing to the regular heats affected, and a saving in that department alone can be made of about 50% over the direct fired type.

We will now trace the gas as it leaves the retort up the ascension pipe and into the hydraulic main by way of the dip pipes. These are shown sealed in the liquid contained in the main to prevent the gas getting back in the retort when the lid should be open for charging. The liquid is kept at one level by means of a weir overflow valve. The thick tar, as fast as it forms, falls to the bottom by reason of its high specific gravity, and is constantly flowing away in a downward direction into the tar and liquid well, from where the gas flows into the foul main. It is in these two mains the gas first receives its purifying process, for the cooling effect of the liquid in contact with the gas flowing into the mains, tends to condense the liquids or to break up the larger liquid globules and release the gas.

The gas in the retorts is at a slight pressure, about 5-10″ or .018 pounds to the square inch. Should it exceed this, the



CONDENSER

gas is liable to escape through the semi-porous sides of the retort. Should it be less or a vacuum formed, the liabilities are you would draw furnace gases into the coal gas to the detriment of the illuminating power.

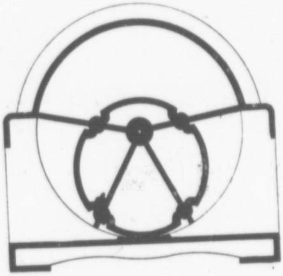
You must know that the various apparatus of which I am giving you a short description are only one of the many various types, all more or less good in the estimation of their respective makers, but not all capable of suiting themselves to a particular plant, like many mechanical contrivances such as steam engines, pumps, boilers, etc. One particular type is often preferred by one and not by another.

Of condensers, the most common in this country is the tubular, where a current of air is made to pass upwards through the tubes. Also the water tube type where the medium of cooling is water, and so cool the gas, and also condense the liquid impurities contained therein. The aim in cooling the gas is to make the operation as gradual as possible in order that the light giving hydrocarbons in the gas are not condensed, but go forward to do the work of lighting and heating.

A constant pull is maintained on this part of the plant and a pressure on the rest of the plant following, by means of the exhauster.

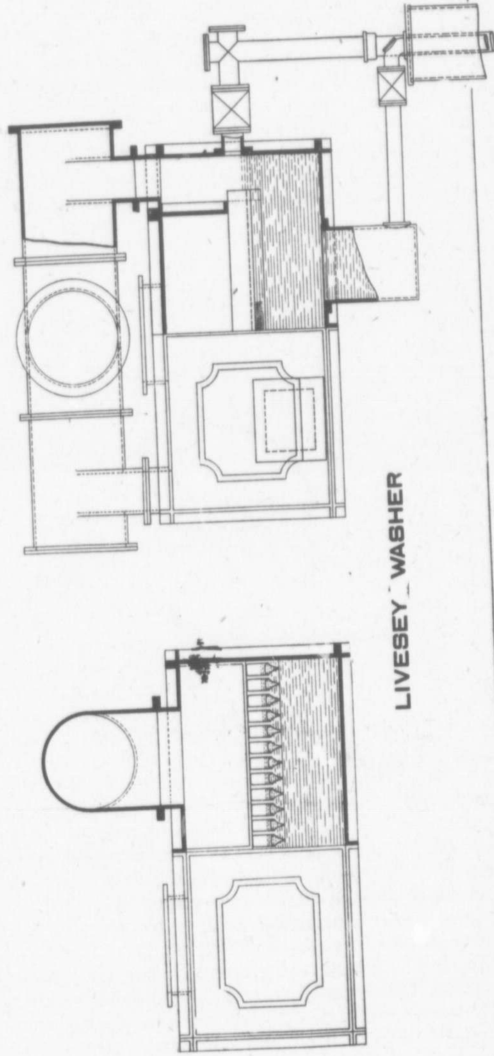
There are various types of this machine mostly of the rotary or reciprocating kind. The type generally used is the rotary, and the one mentioned is a Waller. It consists of a cylindrical cast iron outer case with inlet and outlet ports, and with a smaller internal drum, the ends of which are carried in a recess at each end cover of the outer case. It is also attached to a shaft projecting through a stuffing box one end and coupled to a steam engine. Through the center of the outer case is a fixed spindle to which is hinged four blades radiating from the spindle and passing througn four small rolls fitted in holes in the per.phery of the inner drum. These holes are bored perfectly true. The rolls are given an oscillating motion in order to give the necessary movement to their blades as they open and close in their travel. The outer end of the inner drum is fitted with a ring which is bored out at the proper distances apart in order to take up the projecting ends of the smaller rolls. In this type of exhauster the center spindle ensures that the blades are kept in constant contact with the per phery of the outer case. This exhauster is claimed that while the cubic content between the blades is less than in the two type machines, each revolution makes four deliveries instead of two, and the increased efficiency is claimed about 50%. First class workmanship is most necessary in the making and fitting of these machines, as with a clearance of only 0.031 of an inch, and exhauster working against a back pressure of 20 inches, slip would occur of the whole of the gas.

From the exhauster the next apparatus is the tar extractor, and it acts up to its name and extracts the tar in a very ingenious manner, the gas being wire drawn as it were. The apparatus consists of cast iron casing cylindrical in shape of three chambers, the lower being the inlet, the middle the drum seal, and the upper the outlet chamber. A seal column is fixed on top of the outlet chamber through which a rod is carried, one end being attached to the drum, the other, by means of a wire rope, which passed round a pulley and fastened to the counter balance weights, enabling the drum to rise and fall



EXHAUSTER

according to the make of the gas, without variation of the pressure. The drum is formed of one or more rows of perforated and slotted plates, so spaced and proportioned as to give the proper amount of surface for the mechanical extract of the tar and tar fog. The bundle of perforated plates are made easily removable through the manholes for cleaning purposes. The machine is also supplied with an automatic bye-pass and relief valves which are normally closed by springs, but which engage with stops and are opened thereby should the drums descend too far and the resistance of the springs be overcome by the unbalanced weight of the drum, as, for example, when the supporting rope should break.

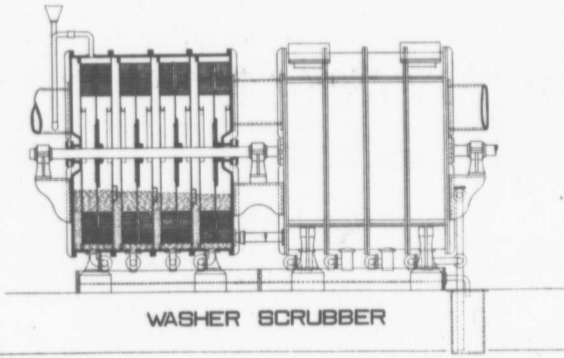

LIVESEY WASHER

The following apparatus is called the Livesey Washer, an invention of the late Sir Geo. Livesey, Chief of the South Metropolitan Gas Co., London, Eng. It is a vessel through which the gas has to pass through liquid in a finely state, which completely removes all trace of tar, and in addition removes a portion of the foul gasses contained. The Livesey Washer affects the greatest possible subdivision of the gas into minute bubbles in contact with liquor. The gas is made to pass through wrought iron perforated plates with holes 1-20″ in diameter, placed so that there are about thirty to the superficial inch. One would imagine that these small holes would get made up, or by the corrosive action of ammonia, made larger. These washers have been in successful use for years and the plates remain in as good condition as when first put into use. The illustration will give a good idea of the method of construction of these washers.

The washer consists of a rectangular box, the upper part formed into an inlet chamber, the outlet chamber is formed by the remainder of the top part of the box, and the inlet chamber has securely fastened to it a series of wrought iron tubes formed as shown in detail. The interior of the tubes are in free communication at the ends with the outer chamber but the spaces between the tubes are closed up. The gas has free access from the inlet chamber to these spaces, passing down them and depressing the liquid until the gas escapes through the inclined portion of the perforated plate into the first space which is filled with liquor, up through which it bubbles until it comes into contact with the horizontal part of the perforated plate, carrying some of the liquor with it to the upper surface of the plates. The bubbles of gas pass through the liquor into the tube space and forms foam on the surface, which flows along with the gas to the outer chamber.

The liquor overflow is arranged to give one inch of liquor above the horizontal plates.

The apparatus following the Livesey washer is the washer scrubber. This apparatus differs somewhat from the before mentioned, as the gas, instead of being forced through the liquid is brought into contact with surfaces of a large area in a wetted condition. The machine which most fulfils this condition is the mechanical washer scrubber, one of many which I will now describe, is in the form of a cast iron cylinder divided by diaphragms into a number of water tight compartments in each of which is a sheaf or revolving brush. Each sheaf is composed of segments of Brazillian brass, arranged to present a projecting surface to the gas. The sheaves are fixed as shown, to a shaft which is rotated by means of a small engine. Each sheaf is immersed to about half its depth in one of the water tight compartments, each of which is arranged with the overflow a little higher than the preceeding one from the gas inlet to the outlet end, so that the clean water entering the last or outlet gas chamber flows from one compartment to another until it finally overflows to the well. The gas enters at the strong liquor chamber, and proceeds in the direction as shown in the sketch. The shaft being constantly rotated at about

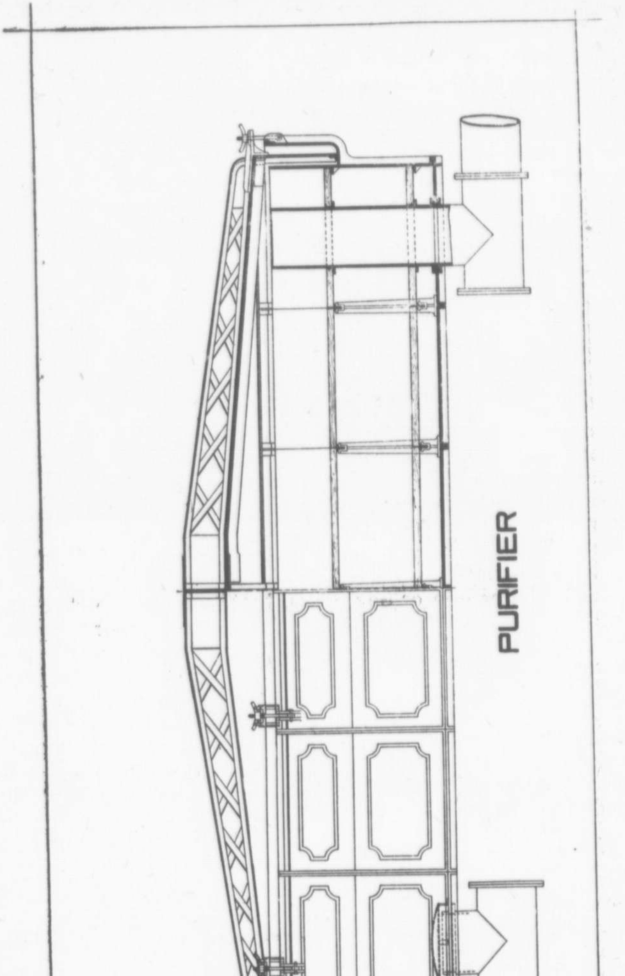


WASHER SCRUBBER

four revolutions per minute, present to the gas a large and perfectly wetted surface. The usual method is to have at least two of these machines and work them in series, the first fed with weak liquor and the second as a finisher with clean water. In this way the ammonical liquor can be worked up to any desired strength and thus command a higher price commercially.

Water at ordinary barometric pressure and atmospheric temperature will absorb ammonia in gas about 783 times its own volume, the power of absorption decreasing with an increase of temperature. Other impurities partly removed in the washer scrubber along with the ammonia are, carbonic acid gas and sulphureted hydrogen, a larger quantity of the former being removed on account of its stronger affinity for ammonia. Below I give the composition of the gas leaving the scrubbers:

H_2S—500 to 800 grains
CO_2—700 to 1,100 grains
CS_2—30 to 45 grains
} per 100 cubic feet.


PURIFIER

Part of the carbonic acid and sulphureted hydrogen being removed in the foregoing apparatus, the purifyers are brought into requisition to do the remainder of the purification. The purifyer shown in the section is what is called water luted, that is, the covers are sealed in water. Other types called the lutless, are made tight by means of an India rubber joint instead of a water seal. The box part of the purifyers are made of cast iron plates with lugs and ledges to carry the wooden grids or trays that carry the purifying material. This consists of natural bog ore found in Quebec, the composition of which is as follows:

H_2 O	50%
Hydrated oxide or iron	32%
Vegetable matter	18%

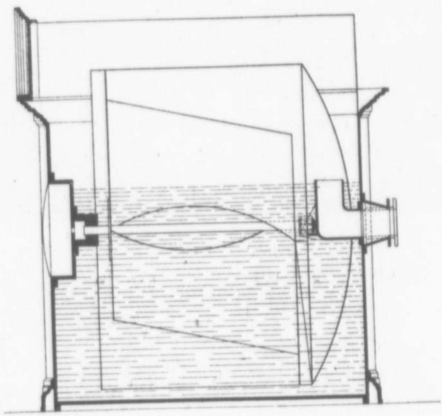
Should contain only 25% of moisture when put into purifyers.

Also artificial oxide of iron called iron sponge, and the residue of chlorine used in bleaching works called Weldon mud. These three are all capable of removing sulphuretted hydrogen; also lime (caustic lime) is used with water added or slaked. This removes sulphuretted hydrogen, carbonic acid and carbon bisulphide. Where the complete elimination of sulphuretted hydrogen is necessary, lime must be used. The advantage of using oxide of iron or bog ore is, that they can be revivified and used over and over again until they have absorbed about 50% of free sulphur. The spent material is sold to chemical works, who extract the sulphur for the manufacture of sulphuric acid.

Before the gas is stored in the gas holder, it is measured in the station meter. This enables a check to be kept on the make of gas, and also the difference of the total quantity sold in the district and that registered on the station meter at the works, represents the unaccounted for gas and leakage.

These meters are of the wet description, and in works of any size are quite artistically or ornamentally designed. The outside casing is of cast iron: within this about half way immersed in water is the meter drum of wrought iron sheet mounted on a shaft. This drum is divided longitudinally, with vanes or blades placed diagonally or screw fashion, one end of the drum is open, the other closed. The closed end is made to take the inlet pipe. Now the drum is made to revolve by the pressure of the gas acting in the blades or vanes: the shaft is geared to a train of wheels which register say from one hundred to one hundred million cubic feet per revolution. The water in the meter is kept at the same level by means of an overflow. You will quite see that by taking the reading of this meter say every hour, a good check can be had in the make of gas during any part of the day or night.

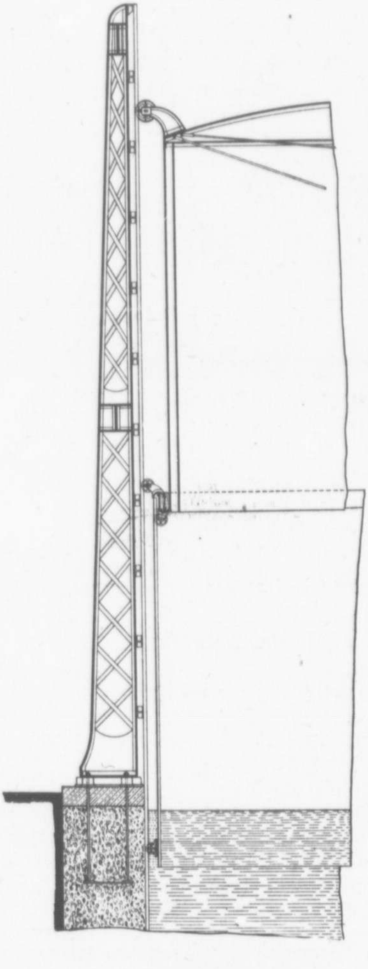
The gas is now ready for distribution, it being in a commercially pure condition, and is stored in the gas holders for distribution. Now a word as to the gas holders. As I mentioned in the first part of my paper, the gas holder as used to-day was first invented by a Frenchman, but the size in use then has been magnified many times, the largest in the world being in Astoria, New York, and holding fifteen million cubic feet. London, England, also has one of twelve million capacity, and Birmingham one of eight and a quarter million capacity.



STATION METER

These structures are tremendous and demand great engineering skill in the design and erection. This city will have the honor soon of having the largest in the Dominion, a five million capacity holder being put up by the Consumers' Gas Co.

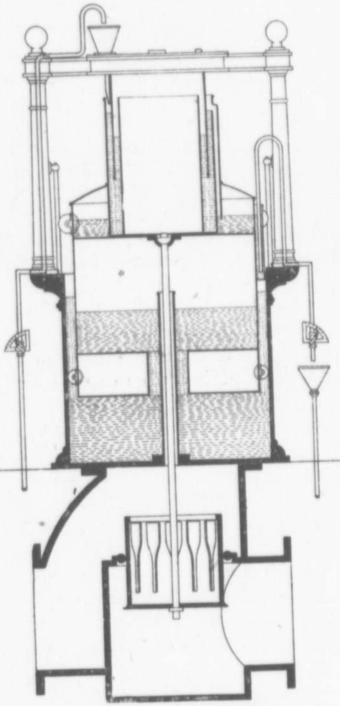
The gas as it leaves the holders is at too high a pressure to be conveniently handled in the distribution mains and services, therefore the pressure is reduced in the governor. This works practically as an engine governor. It is set to give any desired pressure by means of iron weights, water or mercury. A water or mercury loaded governor is preferable to an iron weighted one, on account of being able to add or reduce any desired pressure imperceptibly, a water loaded type of governor being shown in the drawing. Seven to thirteen tenths is generally



GASHOLDER

given in the day time, and twenty to thirty tenths as required during the first few hours of darkness.

Just a word now as to the distribution. This in a gas works of any size is a department quite apart from the manufacturing



GOVERNOR

plant, and is usually under the supervision of a qualified engineer conversant with main laying in all its branches. The fall and size of the mains have to be thought out, and a watch kept on leakage and renewals, besides the constant pumping out of the condensed liquor that falls to the lowest points in the mains to drip boxes provided for that purpose.

Then, again, the lighting and heating branch of the work is looked after separately, as this is where the advertisement comes in.

I think I have given you a fairly general summary of the methods of producing coal gas for commercial use, and the various plant used.

It would not be out of place now to finish up with a short illustration of the usefulness of gas as an illuminant, and one of the by-products of gas called coke as a fuel. Do not think this is an advertisement, but as a worker amongst gas plants and gas works all my life, I find it necessary for my conscience, perhaps, to give gas, especially as an illuminant, all the honor due to it. Although I do not claim to be a lighting expert in any sense of the word, a little thought and common sense will often show you that the difference between right and wrong is. Sometime ago I saw some advertising literature of a well known electrical firm who are represented all over the world. It was in the nature of a post card with skull and cross bones in one corner calling attention to large storekeepers who burn gas that, "although they had a fair show of light they were slowly poisoning their customers and clerks by vitiating the atmosphere they breathed." Now this sounds very well on paper, but if you put it into practice it is all rot, for if a building is totally lit with electric light and has no proper mechanical means of ventilating, in a given number of hours the atmosphere will be more impure than if gas had been burned.

I quote from an article or report from an eminent professor in his experiments made in a City Museum or Art Gallery, with a view of ascertaining whether its artificial lighting by electric arc lamps or by incandescent gas lamps respectively is preferable, from the point of view of possible pollution of air damage to pictures and objects of art exhibited there. These experiments show clearly that under the conditions of ventilation prevailing at the time:—

(*a*) In the absence of any artificial illumination there is a slight increase in the percentage of carbonic acid in the air during the course of the day.

(*b*) With the electric arc lamp illumination the increase in the percentage of carbonic acid is distinctly marked.

(*c*) With the incandescent gas illumination on the other hand, instead of there being any increase there is a distinct diminution in the percentage of carbonic acid in the air.

The explanation of this diminution is not far to seek, it being obviously due to the more efficient ventilation which is caused by the great draught of heated air through the ventilating shafts in the roof. The circumstances that the percentage of carbonic acid actually diminishes during the use of the incandescent gas burners conclusively proves that the products of combustion from which damage to the pictures, etc., and inconvenience to the public might be apprehended, are completely carried off by the ventilation which is promoted by these burners. Now mind you, although an electric arc does not give rise to sulphur compounds, they do generate ozone and oxides of nitrogen, which are calculated to act prejudicially on pictures and like works of art. The air in any room solely lighted by electricity is always stagnant, hence the yawning and gaping in most public halls, churches, etc., during the time they are occupied, caused by the vitiating of the air by the carbonic acid given off from the people. The only cure, if electricity is used, is good mechanical ventilation of pure air, or to have one or more open gas jets burning in a high part of the building under a ventilating shaft, which will cause a current of air to be drawn upwards.

As regards the effects of different illuminants on the air in a room, we are indebted to Dr. Max West, Ph.D., investigator for the U. S. Government, who made an inyestigation on this subject. The comparisons taken are for 16 c.p. lights, except in the case of the regenerative and Welsbach burners, which actually give more powerful light.

	Quantity Consumed per hour.	*C.P.*	*Oxygen consumed cu. ft.*	*Heat produced calories*	*Vitiation equal to adults.*
Tallow candle .	2200 gr.	16	10.7	1400	12.0
Sperm.........	1740 gr.	16	9.6	1137	11.0
Parafin Oil.....	992 gr.	16	6.2	1030	7.5
Kerosene Oil...	909 gr.	16	5.9	1030	7.0
Coal Gas—					
Batswing.....	5.5 cu. ft	16	6.5	1194	5.0
Argandé....	4.8 cu. ft	16	5.8	1240	4.3
Regenerative	3.2 cu. ft	32	3.6	760	2.8
Welsbach...	3.5 cu. ft.	50	4.1	763	3.0

It is rather startling to learn that an ordinary kerosene or gas light vitiates the air as much as the breath of half a dozen people breathing, and that even incandescent gas lights are equal to the breathing of two or three persons, but these are facts which it is well to remember when making provision for the ventilation. Undoubtedly the last word in gas lighting for houses is the inverted burner.

As regards cost of lighting, you can reckon that the electric incandescent light is about seven times as much as incandescent gas light, unit for unit, therefore, the cheapest light in every way is the incandescent gas and the dearest is the electric.

Now, as regards fuels, coke is the most convenient and by far the cheapest, say coke at $5 per ton per month, while anthracite would cost $7 per ton per month. Coke is a convenient fuel superior to hard coal; it is comparatively clean, ignites easily, makes a hot fire, and being almost pure carbon leaves a very small percentage of ash. Indeed, for ordinary purposes, coke is almost too efficient a fuel, that is, it makes so intense a fire that damage to the fire box is the result. To avoid this and keep a fire in all day or over night, when the fire is well started it should be banked with cinders or fine coal.

I have spoken of the usefulness of gas for lighting and heating, also the by-products, coke as a fuel. There are other by-products equally as useful. Tar for instance, is put to many uses; as a water proofing medium it is well known. The various oils obtained in the fractional distillation of tar are most useful, such as benzine, benzol the basis of aniline dyes also an enricher for poor quality gas, carbolic acid, creosot oil for preserving timber, and as a source of lamp black, anthracite oil, a basis of alizain used in dyeing, and many other products. The ammon acal liquor is sold and turned to good use by the chemical works in making the salts of Ammonia, also the spirit. A good fertilizer is also made from this, called sulphate of ammonia. I have spoken previously in this paper on the extraction of sulphur from the oxide used in purification. There is also a compound in gas called cyanogen. This can also be extracted in suitable apparatus, and is used on the refining of silver, gold, etc.

Mr. Ellis,—

I would like to understand why in some gas works they use dry seals and in others wet seals, in the hydraulic mains?

Mr. Herring,—

Wet seals are used to prevent the gas in the hydraulic mains from getting back into the retorts; when dry seals are used they have a valve fixed on the hydraulic main in place of dip pipes. This valve is opened and closed automatically, and prevents the gas getting back into the retort.

One of the advantages of the dry seals is that the gas has not to bubble through any liquid, especially tar, at this part of the apparatus.

In cooling gas the idea is not to cool the gas too quickly, if the gas is cooled suddenly the result is, we lose all the light-giving hydro-carbons, which would impair the illuminating power of the gas.

Mr. Lewkowiez,–

I would like to ask Mr. Herring in the case of the dry seal and the high temperature of the gas coming up the intake pipes, does not this have a tendency to create lamp-black?

Another feature is in the matter of the dry seal it is not very desirable to dave to depend on human agency, not of the highest class at that, to close these valves before they open the retort, if they fail to close the valves the result would be the losing of the gas until it was discovered that the valves had not been closed.

Mr. Herring,—

In answer to the first question, I may say that lamp-black is not caused by the use of dry seals, the real cause of any lamp-black being deposited in the pipes at this part of the apparatus is on account of the retorts being at too high a heat for the quality of the coal that is being used. You will find that in nine cases out of ten where dry seals are used, no lamp-black is deposited—that is with the average coal. I am speaking more especially now of works that use English coal, I have not got quite used to American coal, and am not quite familiar with its qualities. I have been used to dry seals, and have always found them turn out well.

In reference to the human agency that is necessary to open and close this valve. The man has to put his arm forward to open the door of the retort, he has to put his arm forward to reach his shovel, and while he is doing that it is a very small call to reach 24 inches more to close the valve before he opens the door of the retort to put in a new charge, and after putting in the new charge he closes the door, which must be done to complete his work, and of course he mechanically opens the valve.

Mr. Lewkowiez,—

But still it is quite possible for the man to forget to close the valve and the result would be the loss of gas, and in the other case it is absolutely automatic.

Mr. Grassick,—

Do you not think it possible to get an even pressure so as to prevent the gas carbonizing and blacking the mantles?

Mr. Herring,—

I am not a lighting expert by any means. I think the blacking of the mantles is often caused by the alteration in the pressure of the gas, but this can be overcome by altering the air and thus overcome the variation in pressure. Another case is that the type of burner is not always suitable for the gas to be burned. They say that the richer the gas the more difficult it is to get proper combustion. Gas of a low illuminating power can be much more easily dealt with.

Mr. Grassick,—

As long as the pressure is good we have good lights, but as soon as the pressure starts to go down the mantles begin to blacken.

Mr. Herring,—

As I said before, as soon as the pressure begins to go down, the only way to overcome the blacking of the mantles is to alter the air supply. The altering of the air supply will very often burn the carbon off the mantles.

Mr. Grassick,—

That is all very well in a house where you have only a few lights, but you cannot do that in a store where there are so any lights.

Mr. Herring,—

I am sorry I cannot tell you any other way, as I am not a lighting expert, I can only give you my opinion.

Mr. Phillpots,—

Mr. Lewkowiez spoke about the valves in the intake pipe. I believe in the Old Country they have a butterfly valve fixed in the bridge pipe. This valve is opened and closed by manipulating a rod which is attached to the mouthpiece. Immediately the stoker opens the lid of the retort the valve is automatically closed. This prevents gas from getting back to the retort or air entering the ascension pipe.

Mr. Ellis,—

Where does the napthaline extractor do its work in the hydraulic main or after.

Mr. Herring,—

Extraction of napthaline takes place after the condensing. Napthaline is rather a troublesome factor in gas, and the gas engineer usually likes to keep it from getting into the mains.

Napthaline is usually extracted after the gas has passed through the condensers by means of either light oils that are got from the carburetted water gas plant or anthracine. If the napthaline is not extracted before the gas passes into the mains it is likely to be left there, with dire results, as it stops up the mains and services.

Mr. Baldwin,—

I would like to move a very hearty vote of thanks to Mr. Herring for the excellent paper which he has given us to-night. Seconded by Mr. Ellis. Carried.

Chairman,—

Mr. Herring on behalf of the Club, I beg to tender you a very hearty vote of thanks for the paper which you have given us to-night, and which, I am sure, we have all appreciated very much. If it is not too late I would like to call on Mr. Duguid.

Mr. Duguid,—

I am not in very good shape to-night to say very much. I have worked right through since yesterday morning, and do not feel like making a speech to-night.

I thank the members for electing me President, and I hope they will not be sorry they have done so. Although there is no doubt there are other members who are more fitted to occupy the chair, but as one officer follows another, I suppose, that is the real reason I have been elected Chairman for this year. I will, however, use my best endeavors to keep you straight.

I intended to sit down last night and write a speech, but was prevented from doing so. I will however write up a speech for the next meeting that will make your hair curl, and I hope you will excuse me from saying any more now.

Mr. Baldwin,—

Mr. Duguid has told you that he has been up for several nights, and that is the reason he cannot make a speech, and as I intend to be up for several nights this week, that is the reason that I cannot make a speech to-night.

I think our friends have made a mistake in electing me First Vice-president. However, they have made the mistake and they will have to put up with it for the next twelve months anyway, and I shall endeavor to do my best in the interests of the Club, and I shall back Mr. Duguid up in keeping you straight.

Chairman,—

The next on the list is also one of our old and much respected members, Mr. Bannon. He is not only going to be Second Vice-president, but is going to give us a paper at the next meeting on how to keep cool.

Mr. Bannon,—

Unlike the rest of the speakers I came late, in the hope that I would get out of making a speech. I wish to say however that I belong to several other organizations of this kind, but I like this better than them all. There is a class of men here that you do not find in any other organization that I know of, men who are in different walks of life, and who are experts in their own line.

I thank you very much for electing me Second Vice-president, and I will give my best efforts to further the interests of the Club, and I will be on the job all the time.

Mr. McCrae,—

I thank you very much for the honor which you have done me in the past by placing me on the Executive.

I thought next year I would be relegated to the back benches, but I see you are going to make me work.

I was going to speak after the paper was given to-night, and eulogise the paper, but I was forestalled.

I think that the paper given to-night was the most concise of any paper which has been given before this Club. The drawings are very elaborate, and yet simple and easily understood, and I would make a motion that every paper which is going to be given should be illustrated, as they are better understood when illustrated, by the average man.

Mr. Cole,—

I appreciate the honor very much of being on the Executive Committee. Being a peddler I did not expect to be on the Executive; I suppose I put myself there, as I was Chairman of the Nominating Committee.

I enjoy this Club very much. I have not been to all the meetings, but I will certainly come to all I possibly can in future, and do all I can to help the Club along.

Mr. Taylor,—

I thought you would go down the list in rotation, and let us hear from the experienced members of the Executive. All I can say is, judging by the past, the new members will have to go some to keep up. This being the first experience of my troubles, but I will do my best to keep up, and I thank you very much.

It was proposed by Mr. Baldwin, seconded by Mr. Lewkowiez, and carried, that a small book be got up containing the names and occupations of all the members of the Club, the book to be for the use of members only.

After some discussion, it was decided to leave the matter in the hands of the Executive Committee in reference to the form in which the book should be g t up.

Proposed by Mr. Fletcher, seconded by Mr. I Jefferis, that the meeting be adjourned. Carried.