

Chlorine in sufficient quantity is an absolute sterilizing agent but owing to the fact that raw water may vary materially and rapidly in quantity of matter in suspension and organic content a varying proportion of free chlorine is consumed in the oxidation of these substances. It therefore becomes necessary, in order to ensure the continuous destruction of all bacteria, to treat the water with an excess of chlorine and this excess may become apparent in taste and smell. It follows therefore that so far as concerns the supply of water for domestic purposes, the use of chlorine is best employed after preliminary treatment of the water in filters since the rate of dosing should be restricted to a maximum which does not make the water at all objectionable to taste or smell.

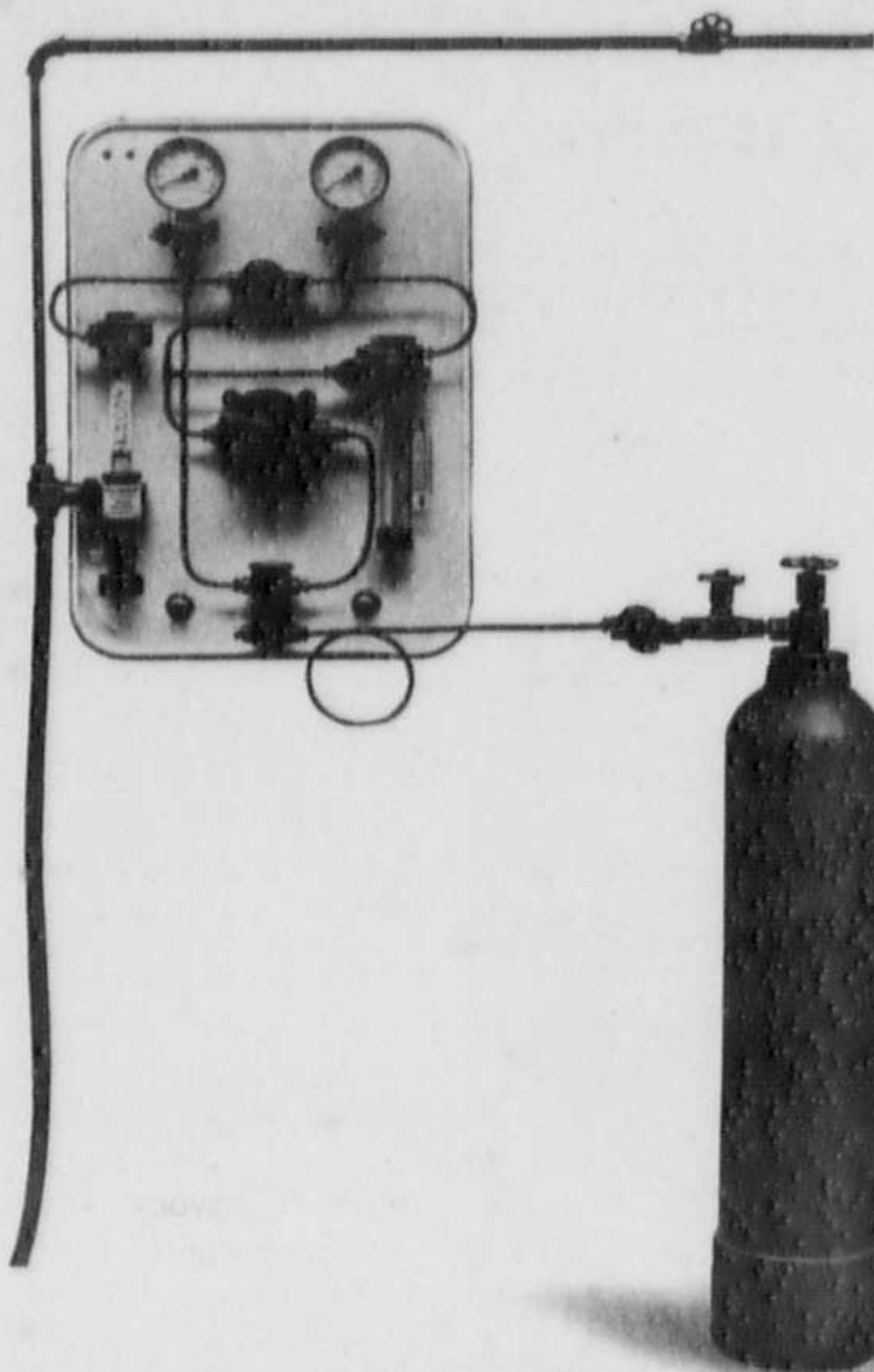
The small quantity of chlorine necessary to effect the requisite degree of final purification necessitates very careful proportioning to obtain the best results ; and the difficulties attendant upon the efficient use of chloride of lime, the comparatively large storage accommodation required, its deterioration during storage, its smell and lack of uniformity in constitution, and the disposal of its residual sludge, have resulted in the introduction of free chlorine compressed in cylinders to liquid form.

Chlorine in this form is more easily and accurately controlled and of lower cost, and the advantages attending its use are perhaps best illustrated by the fact that in many instances, under practical working conditions, as many as from 3 to 4 pounds of chloride of lime have to be provided to effect a reduction of bacterial content similar to that effected by one pound of chlorine in the same water.

Other methods, electrolytic and so on, have from time to time been evolved, but at the present time we can claim that the method we advocate—of using cylinders of compressed chlorine gas—is generally superior from every point of view to any of them.

These features gradually became very apparent during the Great War, and were turned to such advantage that lorry and barge outfits were enabled to filter and sterilize 1,200 and 6,000 gallons per hour, respectively, of badly polluted water.

Free chlorine compressed to liquid form is undoubtedly the best of all sterilizing agents for practical use in connection with water supplies.



DIRECT INJECTOR TYPE.

The above illustration depicts the Direct Injector Type Chlorinator, with manual control. This is the most generally used type as the only addition required to the plant itself is a supply of water to the injector at a sufficient pressure. The pressure will of course be dependent upon the pressure against which the Chlorine solution is to be injected.

PURIFICATION OF WATER FOR INDUSTRIAL PURPOSES

One of the essential differences between the treatment of water for human consumption, and the treatment of water for industrial purposes is that a slight overdose of chlorine, which is usually consequent upon such dosing as will absolutely ensure sterilization of water varying slightly in constitution from time to time, in the one case is open to objection, but in the other is usually quite unimportant. It follows therefore that complete sterilization of most industrial waters may, without resultant nuisance, be ensured by treatment with chlorine.

For many industrial purposes river or canal water is used in large quantities. In many cases the water before use is subjected to sedimentation in tanks, but this process is only partially successful in its operation as it cannot eliminate bacteria nor can it, without an undue period of storage, eliminate all the other very fine organic or inorganic matter in suspension.

Such water is unsatisfactory and often gives rise to trouble and avoidable expense. For example, if it be used for cooling surface condenser tubes a slight film of matter will generally be deposited upon the tubes and in time will be found to adhere so tightly as to necessitate the employment of stiff brushes for its removal. This film will prevent the maintenance of a good vacuum which is a matter of considerable importance as it has been found that a variation of one inch affects the steam consumption (and consequently the fuel consumption) in steam turbine work as much as nearly six per cent.

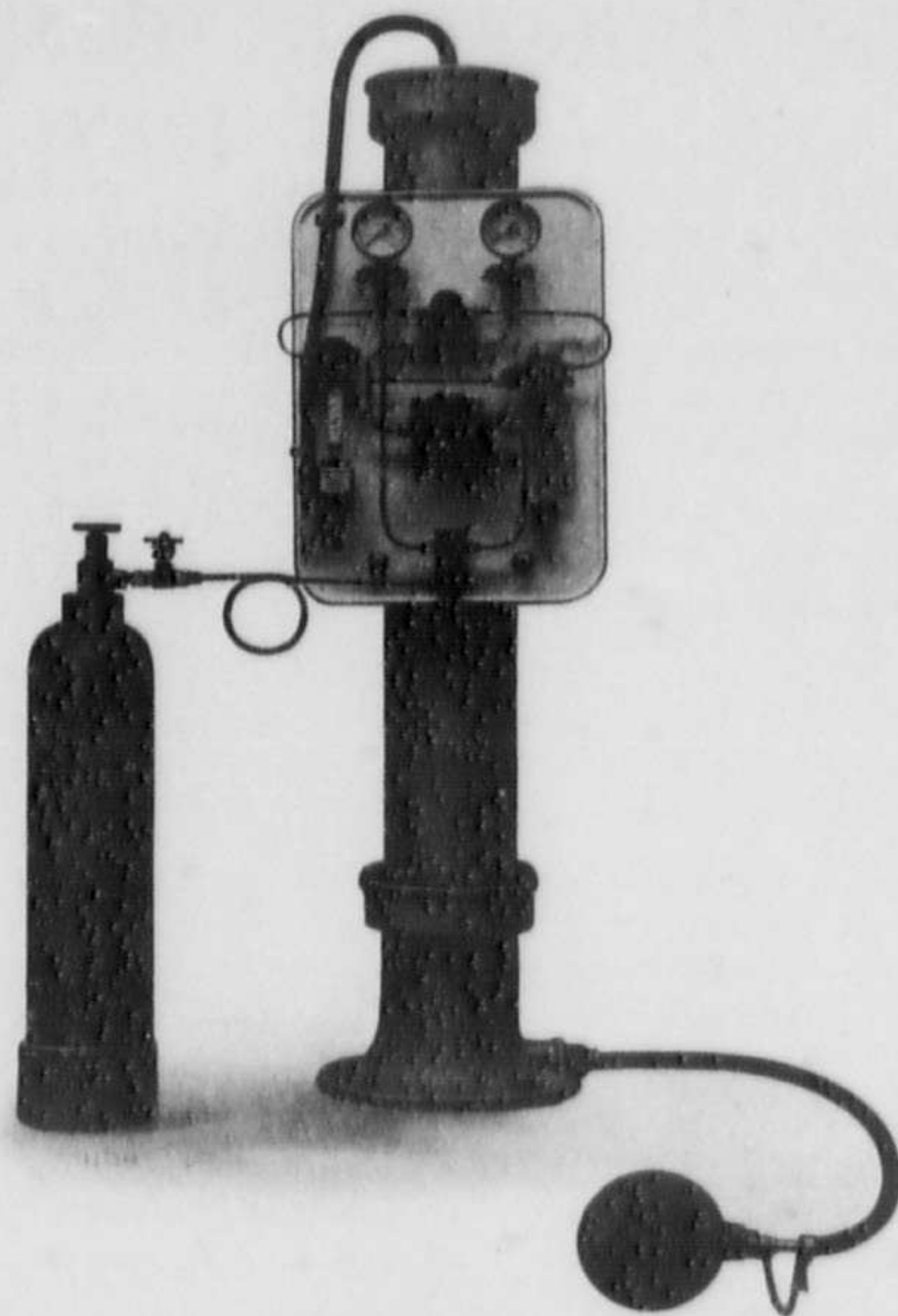
Examination has shown that the adhesive properties of the slimy deposited matter are due not so much to matter in suspension as to micro-organisms and that if these micro-organisms are sterilized the remaining mineral matter to a large extent ceases to be a cause of trouble.

In such cases as these chlorine has proved to be a clean, cheap, simply-admixed sterilizing agent and to have effected relatively enormous reductions in cleaning charges.

The elimination of risks of septic poisoning, the bleaching of materials used in textile and paper manufacture, the deodorizing of fats and oils, the treatment of water for public swimming baths are but a few of the increasing number of uses to which chlorination may with advantage be applied.

Used in connection with the sanitary services of Hospitals, Institutions, and on board ship, it has proved a reliable and convenient sterilizing agent. Its cheapness renders it an economical proposition for use in the sterilizing of farm buildings, and any place where disease producing matter is liable to collect.

Chlorination should be seriously considered by all users of water which is contaminated by organic pollution.



GRAVITY FEED TYPE.

In this instrument the Chlorine solution is made inside the porcelain tower, and is fed by gravity into the water to be treated. This instrument is generally used where the tower can be placed at a suitable height to provide sufficient head on the Chlorine solution to overcome a low pressure in the pipe line. The solution can also be fed into an open channel or into a pump suction well.

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(RG 10, Volume 6188, File 461-5, part 6)

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CHLORINATING PLANT

It is apparent that the chlorination of water for industrial purposes differs from the chlorination of water for domestic supply in little except the amount of chlorine used, and that a type of Plant which successfully admixes the chlorine for the treatment of the one is equally suitable for the treatment of the other.

A careful investigation of the problem of correct admixing has resulted in the production by us of a Plant which is designed to be completely self-contained and to occupy the minimum possible space.

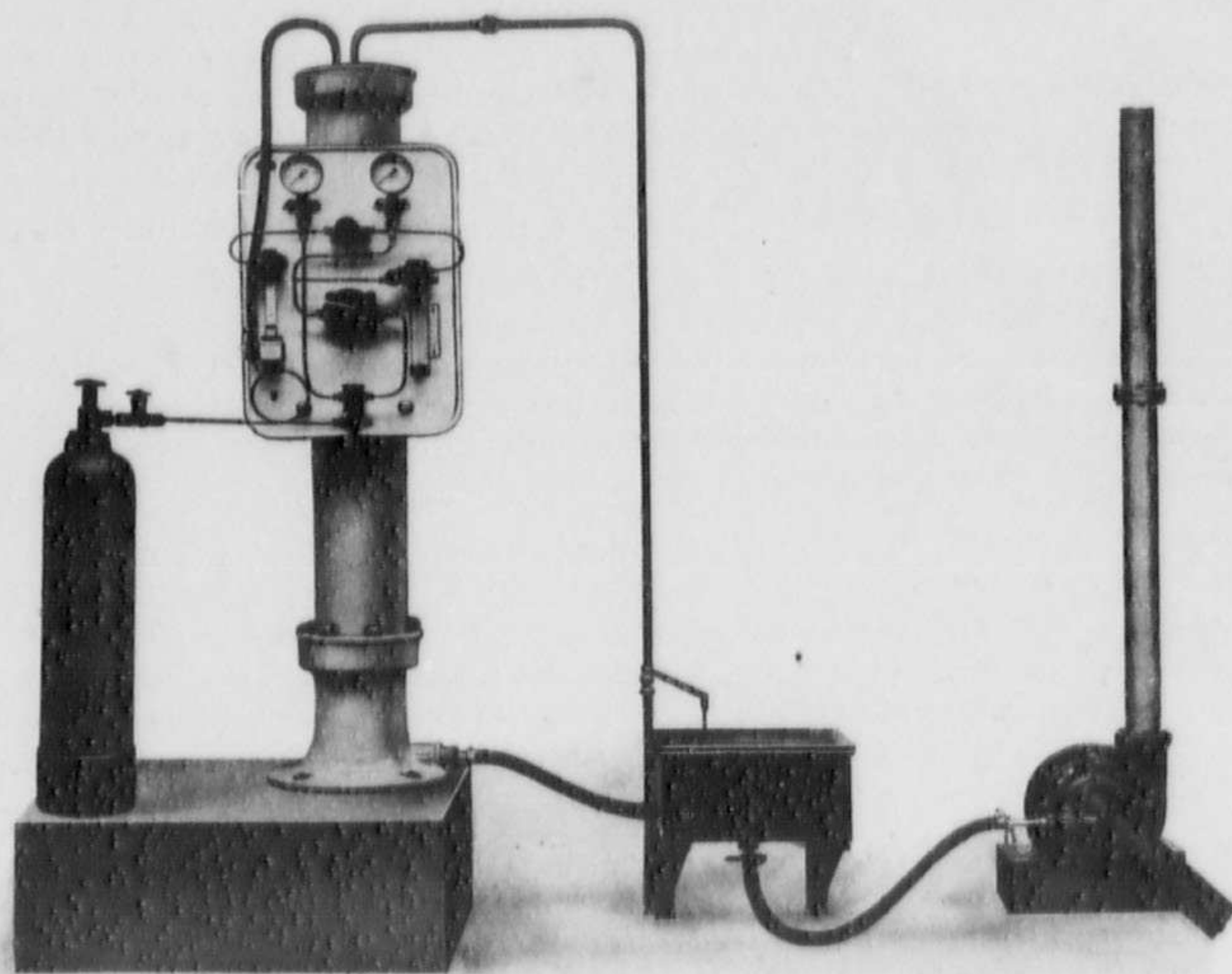
The principle upon which the Plant functions is usually that of the solution feed, as it has been found that chlorine is most easily and efficiently admixed in the required proportion if first dissolved in water and added as a solution.

The chlorine is delivered to the users of the Plant in steel cylinders containing, when fully charged, 70 lbs. of chlorine at 120 lbs. pressure per square inch. These cylinders are easily and safely handled and are readily recharged as and when required. It may also be obtained in 10 cwt. and 15 cwt. drums.

On page 11 is illustrated a plant capable of discharging up to 1 lb. of gas per hour when working with one cylinder only in actual use. When the first cylinder is exhausted, the position of the second enables the change-over to be effected with only a momentary cessation of the supply of gas. The empty first cylinder is then replaced by a full cylinder and in due course is recharged ready for future use.

With both cylinders in use the Plant is capable of discharging up to 2 lbs. of gas per hour. There are cases, however, where the few minutes' delay in the discharge of the chlorine, consequent upon the removal of the two cylinders when empty, would not be permissible, and in such cases the Plant must be considered as capable of discharging up to 1 lb. only of gas per hour.

The cylinders AA, stand together upon a platform-weighing machine, which may be supplied if required and which is provided with a suitable arrangement for holding the cylinders and with a visible scale by means of which the attendant is able to perceive when the cylinder in use at the time is about to become empty. The weighing also serves to check the consumption of chlorine as recorded by the meter J.



SUCTION FEED TYPE.

This instrument embodies the Gravity Feed Type Chlorinator with the addition of a closed solution tank from which the solution may be fed direct to the suction side of one or more pumps. A float valve is incorporated to control the supply of the water to the tower and keep the solution in the tank at constant level and prevent overflowing in the event of the pump being shut down.

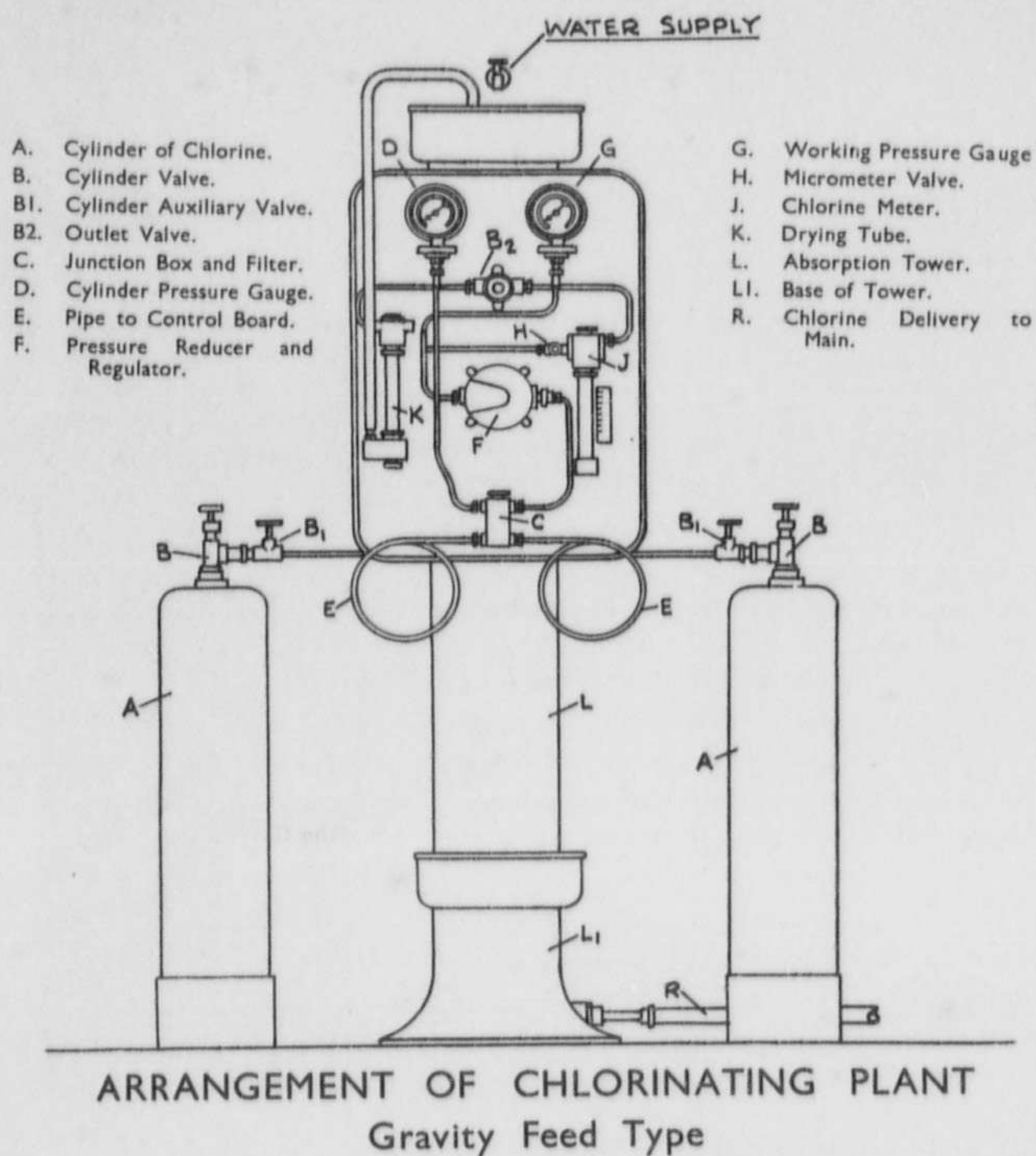
The chlorine is permitted to escape from the cylinder by the opening of the valve B, and the auxiliary valve B1, and, on issuing, passes through the pipe E to the combined junction-box and filter C, at the pressure indicated by the pressure gauge D, and thence to a pressure reducer F. The gas usually leaves the reducer at a pressure of $1\frac{1}{4}$ -lbs. per square inch, a second pressure gauge, G, being provided to indicate the reduced pressure. Both pressure gauges are specially arranged in such a way that their working parts are effectually isolated from direct contact with the gas.

From the pressure-reducer, F, the gas is admitted by the micrometer valve, H, to the meter, J, which upon a graduated scale gives a direct reading of the chlorine passing. The meter can be calibrated to give readings in terms of lbs. per 100,000 gallons of water treated or to indicate the quantity of gas passing per day or per hour. The amount of chlorine is adjusted, as and when necessary, by means of the micrometer valve, H. The details of the meters are shown on pages 12 and 13.

In the particular example illustrated the chlorine is passed from the meter through the outlet valve, B2, to an absorption-chamber, L, constructed in glazed acid-resisting stoneware. Water is introduced into the top of the absorption-chamber through a perforated plate designed to ensure effective distribution. The water flowing down through the chamber absorbs the chlorine and the resultant solution is finally passed from the bottom of the absorption-chamber through outlet pipe, R, into the main supply at the selected point.

A drying apparatus is provided at K in order to inhibit the passage of any moisture from the absorption-chamber to the control apparatus when the flow of gas ceases.

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CHLORINE METER

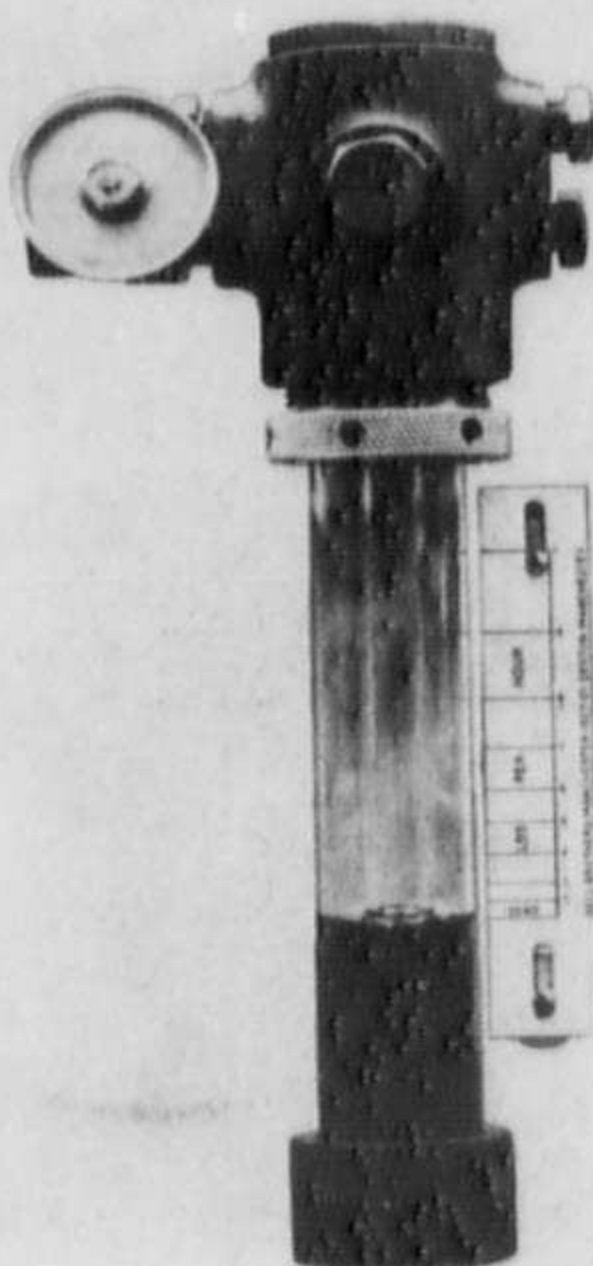
MANOMETER TYPE

The Manometer type meter consists of two tubes, one inside the other.

The centre tube is connected to one side of an orifice plate through which the gas passes and the annular space between the two tubes is connected to the other side of the orifice.

The tubes are filled with manometer liquid to the zero level on the scale provided. When the gas is turned on the difference in pressure on the two sides of the orifice causes the liquid to rise in the inner tube and the scale is calibrated to give a direct reading of the amount of gas passing in lbs. per hour or day or any other unit desired. The zero on scale is only set to level of liquid when no gas is passing and does not require adjustment for each individual reading.

The usual range for an orifice and scale is 10 to 1. The capacity of any instrument can be further altered in a few moments by inserting a different orifice and scale to correspond. For very small quantities of gas the pulsating meter is used, as the size of orifice with the Manometer type would not be practicable in actual practice.



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(RG 10, Volume 6188, File 461-5, part 6)

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CHLORINE METER PULSATING TYPE

The Pulsating Meter consists of two tubes placed one inside the other, the inner tube having a small syphon pipe fused inside it as shown in the illustration.

The gas passes down the outer tube and depresses the liquid therein until it reaches the bottom of the syphon when the gas rushes through to the centre tube the pressure is thus reduced in the outer tube and the liquid returns to its original level.

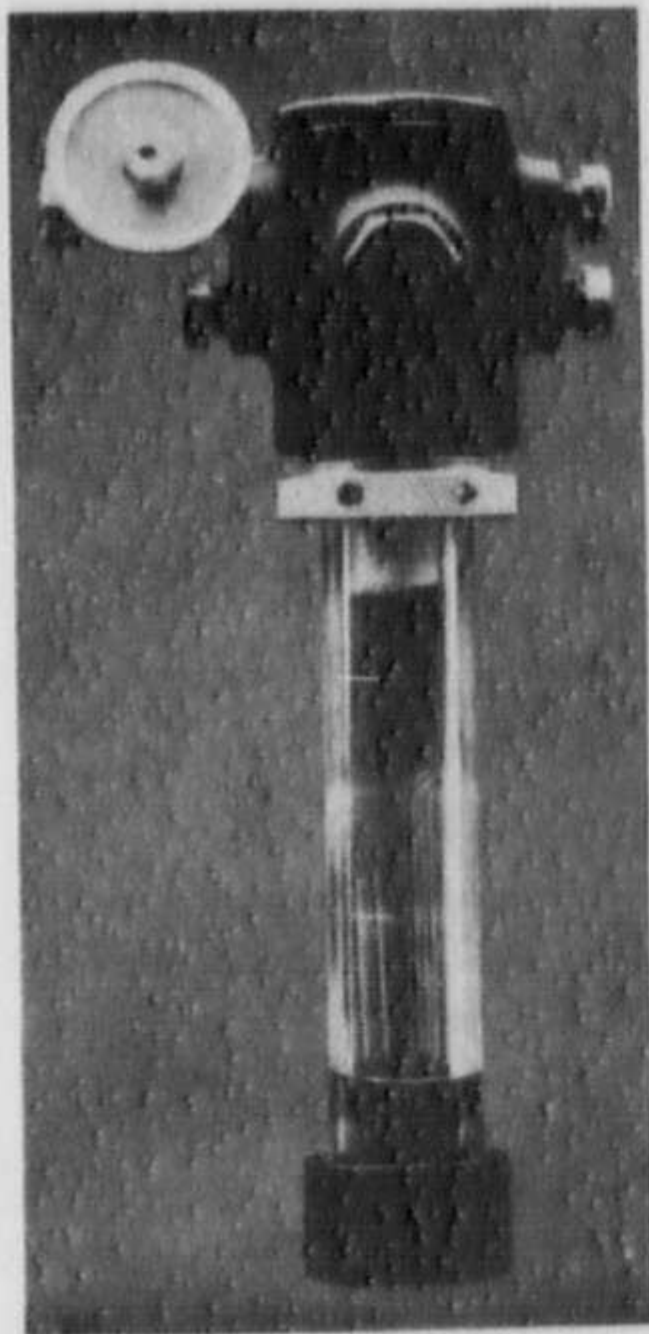


Fig. 2

The pressure then again builds up in the outer tube forcing down the liquid and the cycle is repeated. The number of pulsations per minute are counted and the amount of gas passing is given on a table according to the number of pulsations. The pulsating meter is capable of measuring very small volumes of gas and has a range of approximately 30 to 1. The volume of each pulsation is controlled by the syphon pipe and the capacity of the meter may be altered by inserting another centre tube with a longer or shorter syphon as may be desired. The illustrations show the meter at the commencement (Fig. 1) and at the end (Fig. 2) of the pulsation.

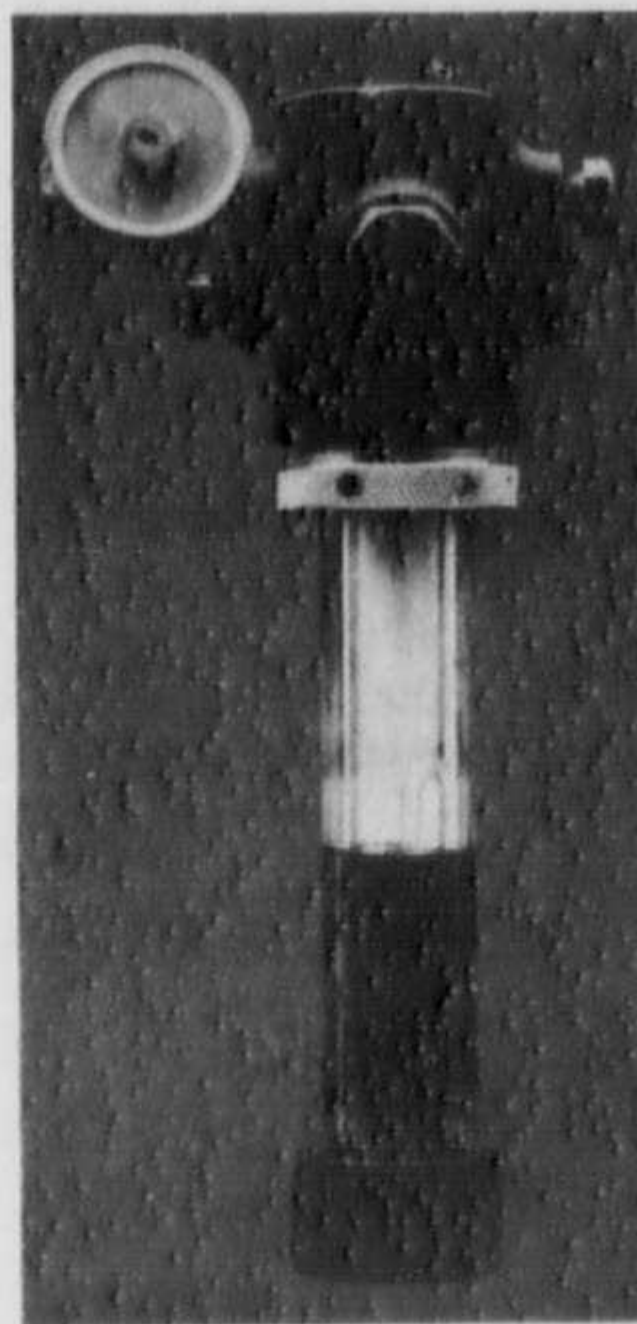


Fig. 1

POINT OF APPLICATION

The point of application of the chlorine solution should be determined only after a careful examination of the conditions obtaining. In the very usual case of a water containing a large and varying amount of organic matter preliminary sedimentation and filtration is very desirable in order that the variation, which otherwise would make the correct apportionment of chlorine a difficult matter, may be reduced to a minimum, and also this pre-treatment reduces the dose of chlorine necessary.

The position of the sedimentation tank or tanks and filtration where provided for Preliminary treatment must of necessity influence the choice of a site for the Chlorination Plant.

In the case of supply for domestic purposes where it is found impracticable to provide a suitably long period of contact, or otherwise necessary continuously to overdose the water in order to ensure complete safety to the consumers, it may be desirable subsequently to dechlorinate the water by the addition of the requisite small quantity of sulphur-dioxide or other approved means.

The fact that an overdose of chlorine leaves an objectionable taste is generally of no importance when the water is treated for use in connection with an industrial supply, but a continuous and unnecessary overdose is obviously to be avoided if only on the ground of cost.

The Plant should be enclosed in a dry warm room where the temperature should be maintained above 50° Fahrenheit (10° Centigrade) in order to prevent trouble resulting from the freezing of the chlorine in the cylinders through loss of heat by evaporation. This consideration also determines the maximum rate—never more than one pound per hour—at which the chlorine may be drawn from each cylinder.

The point where the chlorine solution is applied to the water under treatment should be as near as is practicable to the Chlorinating Plant. These general conditions will usually determine the selection of the best site for the Plant.

ESTIMATION OF CORRECT QUANTITY OF CHLORINE TO BE USED

The correct proportion of chlorine to be added to water for use in connection with supplies for human consumption may be, and generally is, a problem necessitating expert determination.

The method of bacteriological investigation usually adopted is directed to ascertain the smallest volume of the water in which are found traces of *B. coli*. and its congeners, and the results are usually expressed in terms of the minimum number of cubic centimetres of water in which these traces are discovered.

We can supply, if required, a simple laboratory apparatus and the necessary cultivation media to enable the determination to be made upon the site as and when necessary.

To enable us to consider the requirements of any particular case, it is desirable that we should be supplied with detailed information upon the following points :—

- (1) Source of water supply.
- (2) Constitution of the raw water (typical analyses).
- (3) Quantity of water to be treated per hour.
- (4) Purpose for which the water is to be used.
- (5) Present treatment if any.
- (6) Capacity of storage or settling tanks, if any.
- (7) Period of contact allowable.
- (8) Rate of pumping.
- (9) Diagram of water system.
- (10) Is there a separate supply of water for the feed to tower or injector ?
If so state pressure.
- (11) What is the pressure in main at point of application ?
- (12) Is the supply constant in quantity ? If not give max. and min. flows.

"BELL" AUTOMATIC CHLORINATOR

The "BELL" Automatic Chlorinator has been designed to meet the requirements of clients who desire to administer Chlorine Gas to Water Supplies in such a manner that the amount of gas being added will vary proportionately to the volume of water being treated.

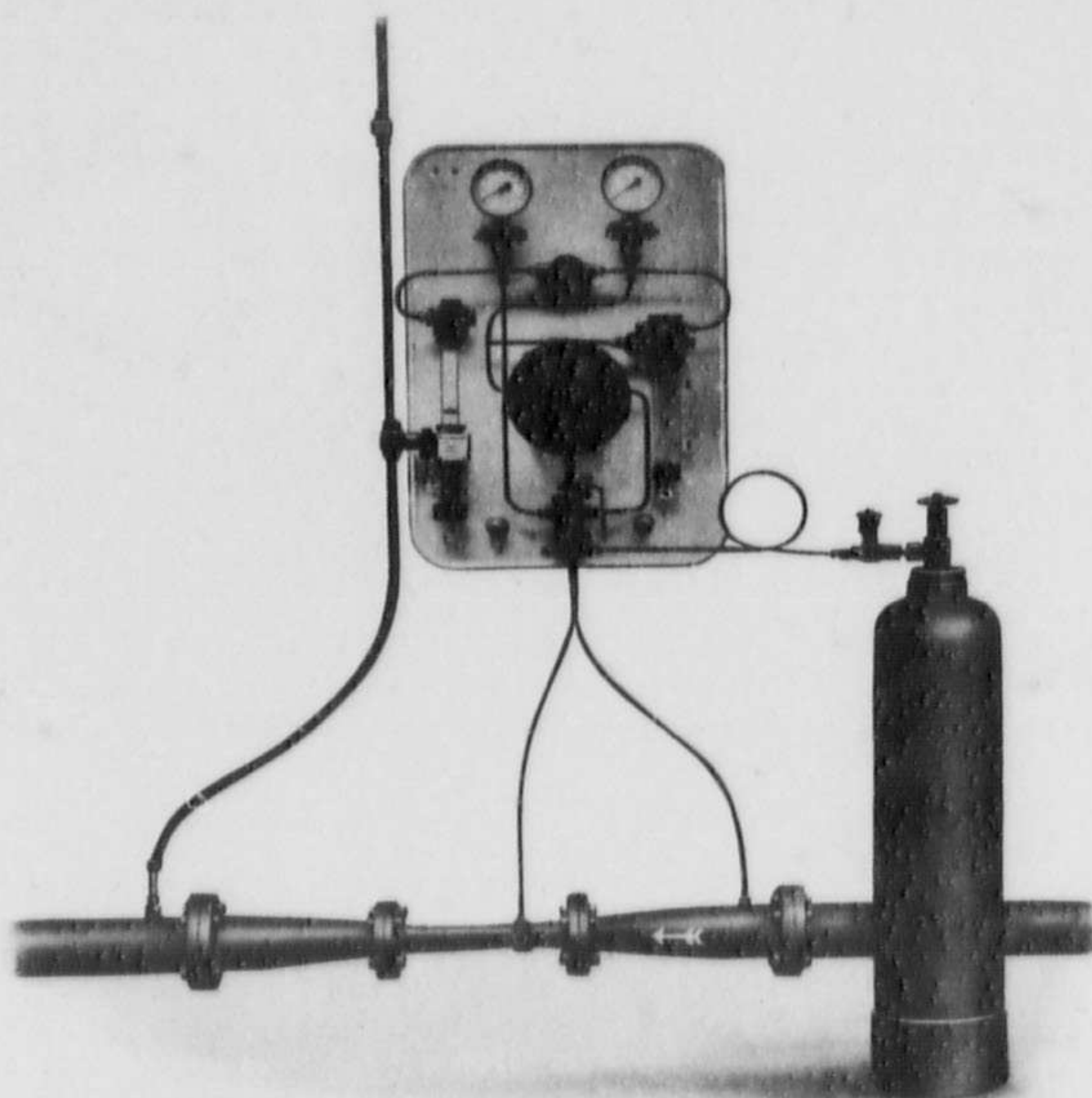
As will be seen from the illustration on Page 17, this instrument comprises a Standard Type Board on which is superimposed a specially designed Control Valve. This Valve, which is directly connected to the Pressure Reducing Valve on the Board, is operated by means of a Venturi Pipe or other suitable apparatus inserted in the pipe main carrying the water supply to be treated.

Suitable connections are made from the valve itself to the throat and up-stream of the Venturi, and the differential pressure, which under the Venturi Law varies with the volume of water passing, is used to operate the Valve so as to control the flow of gas through the instrument.

The whole Apparatus is extremely simple and efficient, and has worked extremely successfully under various working conditions.

The Apparatus can be supplied complete with Venturi Tube to suit the size of the existing pipe main, or if a Venturi Tube is already in existence particulars of these should be given with any enquiry in order that a Valve suitable to meet the conditions may be supplied.

The automatic type is usually supplied to cover a range of flows of 5 to 1, and can be fitted with either the manometer or pulsating meter according to the quantity of gas required.



AUTOMATIC INJECTOR FEED TYPE.

The above illustration depicts the Automatic Type Chlorinator and also shows in diagrammatic form the necessary connections from the Automatic Valve to the Venturi and the point of application of the Chlorine solution.

DRY OR DIRECT GAS FEED TYPE

Where it is possible the solution feed type is preferable, but in certain cases owing to there being insufficient head available, or no auxiliary supply to feed the gas absorption tower or injector with water, the Dry Gas Feed Type can be supplied.

This type of control board is similar to the solution type, but instead of a tower or injector being used to make a solution of the gas, the gas is led direct by a pipe to a diffuser which is immersed in the water to be treated at a depth of about 4 feet, or the diffuser may be inserted in a pipe line conveying the water.

The diffuser when inserted in a pipe line usually requires a special cock so that it may be withdrawn for examination without interfering with the supply.

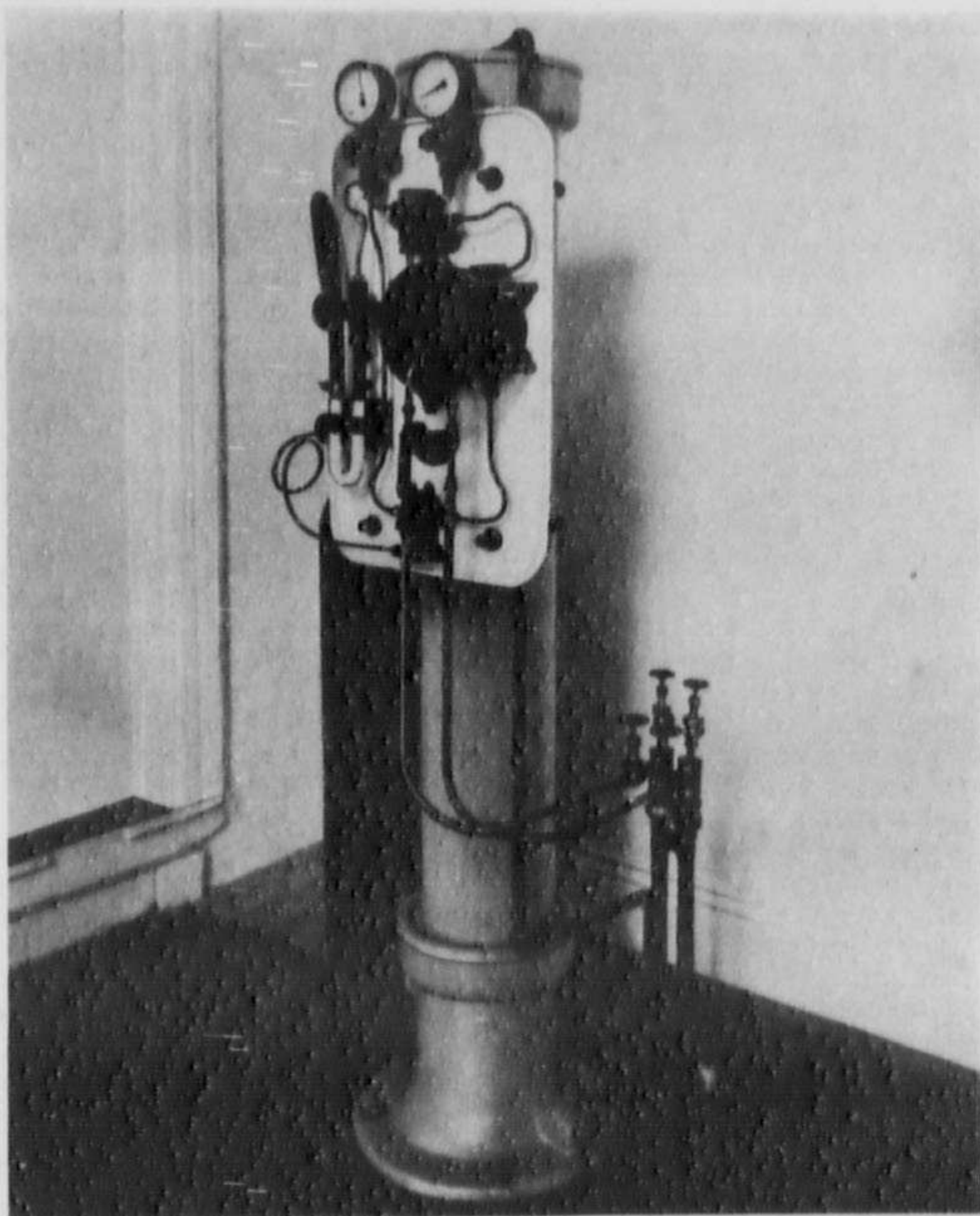
COST OF CHLORINATION

The cost of labour involved in operating the Chlorinating Plant is very low, as apart from the periodical examination and adjustment of the gas supply and the changing of the cylinders, the Plant requires practically no attention.

The actual amount of chlorine used in the treatment of any water is relatively very small. In comparatively few actual cases would the rate of dosing exceed one pound of chlorine to one million pounds of the water treated : and at this rate of dosing the cost of chlorine for treating one million gallons of water (with chlorine at $2\frac{1}{2}$ pence per lb.) would be approximately 25 pence.

The economic consideration of the advisability of installing a Chlorination Plant in connection with an industrial supply chiefly consists in a comparison of running charges. The small cost of the requisite chlorine is set against the saving to be effected in the reduction of labour costs, as for example in the cleaning of pipes, condenser surfaces and pumps, and in the reduction of material costs, as for example in coal consumption by the maintenance of efficient vacuum. The making of the comparison is usually an easy matter. In most cases, too, the result of the comparison will admit of no doubt as to the economy to be effected by the installation of the appropriate Plant.

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AUTOMATIC GRAVITY FEED TYPE

The above Chlorinator installed for the Cornwall Waterworks, Canada, shows an Automatic Type Chlorinator in action.

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(RG 10, Volume 6188, File 461-5, part 6)

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CHLORINATORS WITH SPECIAL CONTROLS

The incorporation of special controls in connection with Chlorinators will naturally depend upon the individual requirements of each particular case, and reference has already been made to one type of control on Page 16, in which a description is given of the Automatic Regulating Valve which regulates the amount of gas being added according to the amount of water to be treated.

In other forms of control the action of the particular valve is in the nature of stop and start, and in a regulating action the controls may deal with either the supply of gas, or the supply of water to the tower or injector, and on Page 9 there is an illustration showing a Chlorinator incorporating an Automatic Shut-off Valve to the water supply which is operated by means of a float.

Another type of control dealing with the supply of gas is shown attached to the instrument on page 5, and consists of a valve placed between the cylinder of gas and the board to which a connection is brought from the pipe supplying water to the tower or the injector. The valve is so arranged that when the water supply is turned on sufficient pressure is created to keep the valve open, but immediately the water supply fails the valve shuts, and thus automatically cuts off the supply of gas. This device is primarily a safety device, and is particularly useful where the instrument is housed in places which are difficult of access, and which would be dangerous in the event of anyone endeavouring to get close enough to the instrument to shut off the gas at the cylinder.

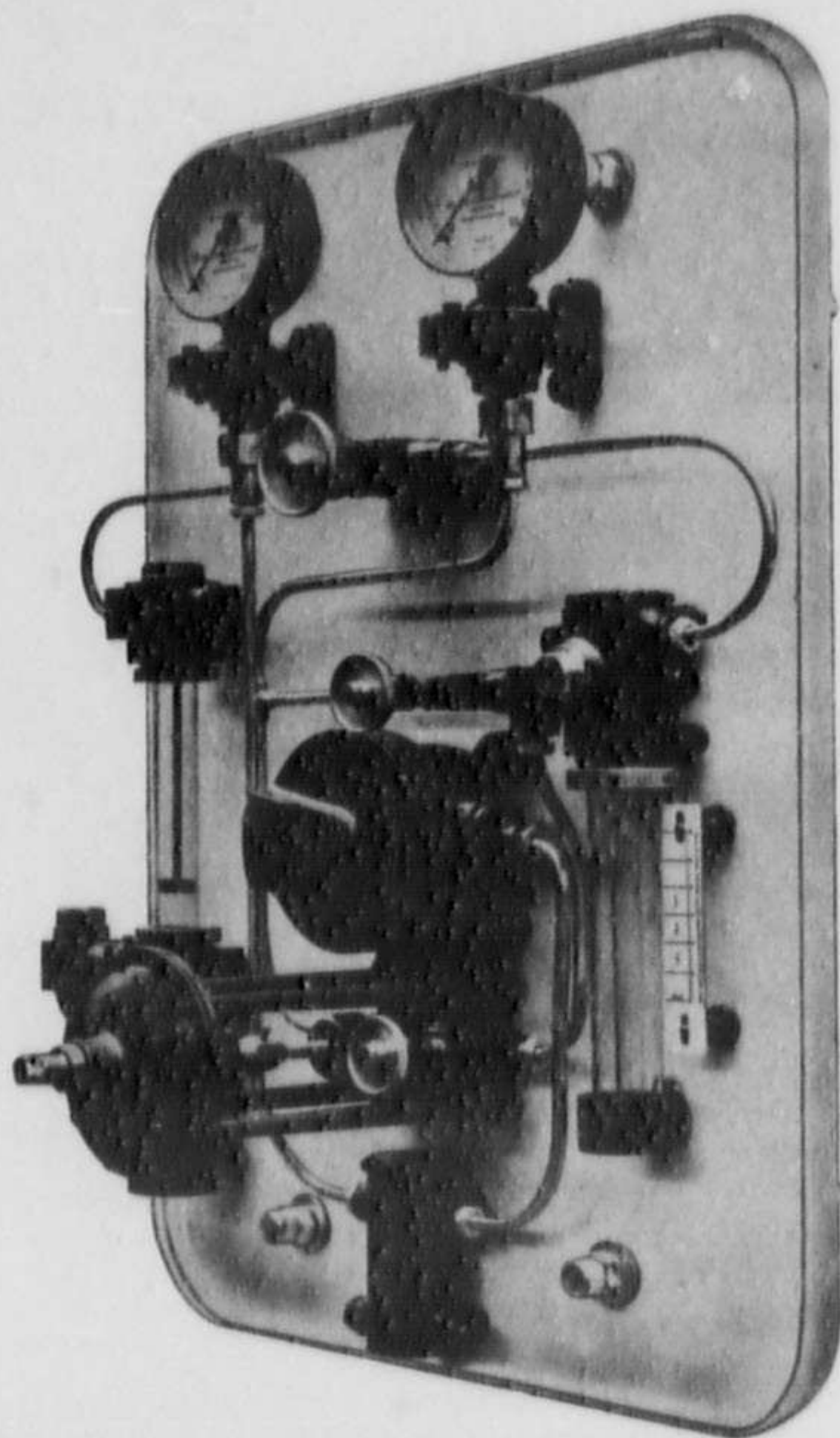
The Automatic Shut-off Valve may be adapted where the Chlorinator may suddenly be called upon to deal with large volumes of water as in the case of a fire. In this instance the Chlorinator may normally be working at a very low rate. In the event of a fire when large volumes of water are introduced into the main the rising pressure operates the valve and thus increases immediately the amount of chlorine being added, and by this means prevents the possibility of pollution by the increased quantities of water which are often drawn from sources liable to pollution.

An instrument of this type has been supplied for a mill in Canada, where the supplies of water for the mill are liable to be drawn into the town's mains in the event of a fire.

When the meter in normal use is not of a large enough capacity the instrument can be fitted with two meters, the second one only coming into operation when the automatic valve operates.

Electric control can also be supplied when necessary, e.g., to shut off the gas in the event of electrically driven pumps stopping, etc.

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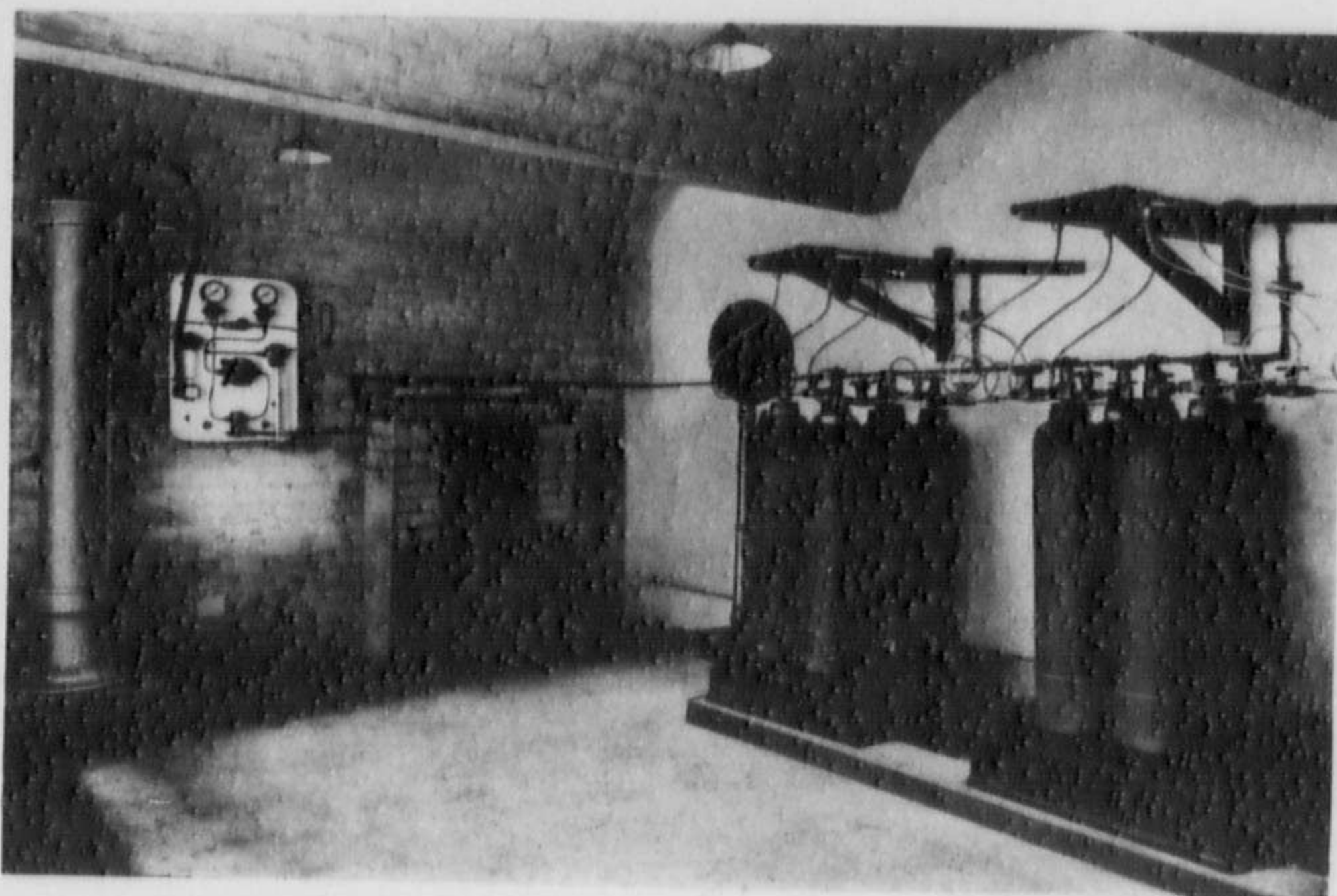
The above apparatus has been installed at Messrs. Findlays, Ltd., Canada, and incorporates a special valve which comes into action when the pressure in the main rises due to a sudden increase in the volume of water passing, the action of the valve immediately increasing the amount of Chlorine being added.

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(RG 10, Volume 6188, File 461-5, part 6)

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NEWCASTLE AND GATESHEAD WATER COMPANY



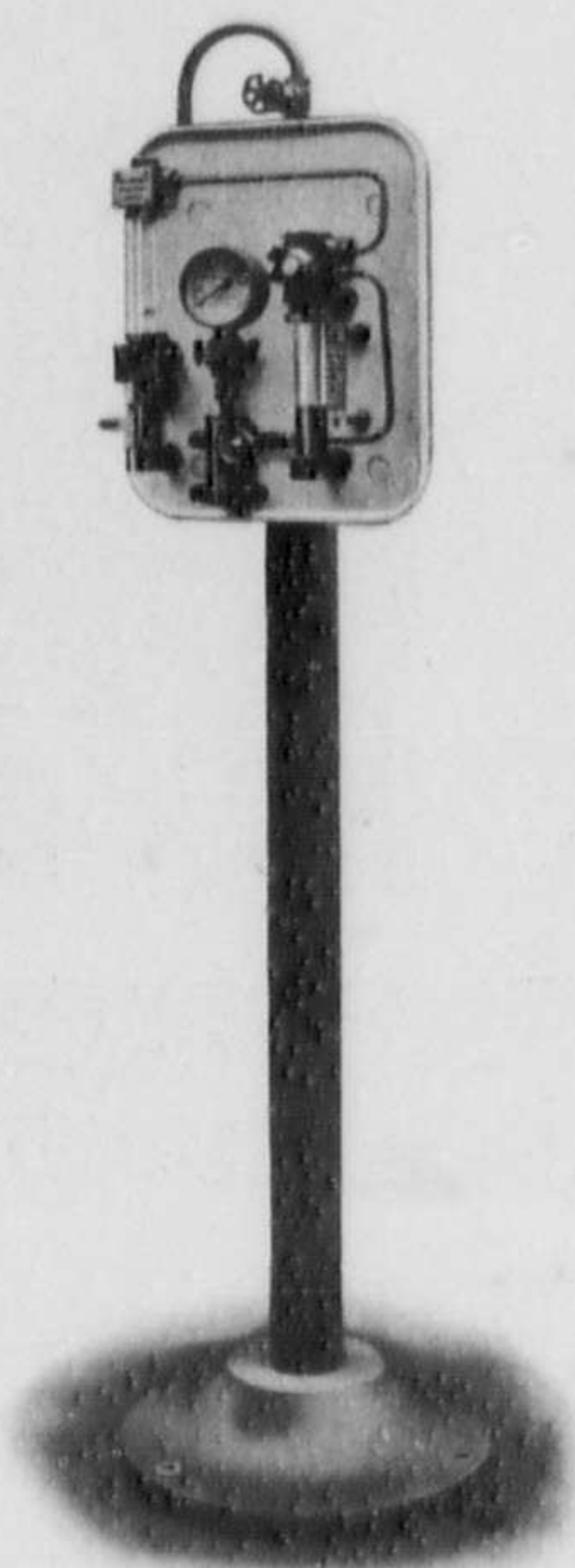
The above illustration shows the Chlorination Plant installed at Wylam Pumping Station.

The apparatus comprises Gravity Type Chlorinator, together with twelve cylinder connections and cylinder auxiliary valves, and two weighing machines on which the cylinders of chlorine stand.

This Plant is capable of adding up to two parts of chlorine per million to a supply of six million gallons of water per day.

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(RG 10, Volume 6188, File 461-5, part 6)

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“ BELL ” CHLORINATOR FOR SWIMMING BATHS

This instrument which has been adapted from the larger type of Chlorinator has been designed so as to render the working of the Plant as simple as possible without impairing the efficiency.

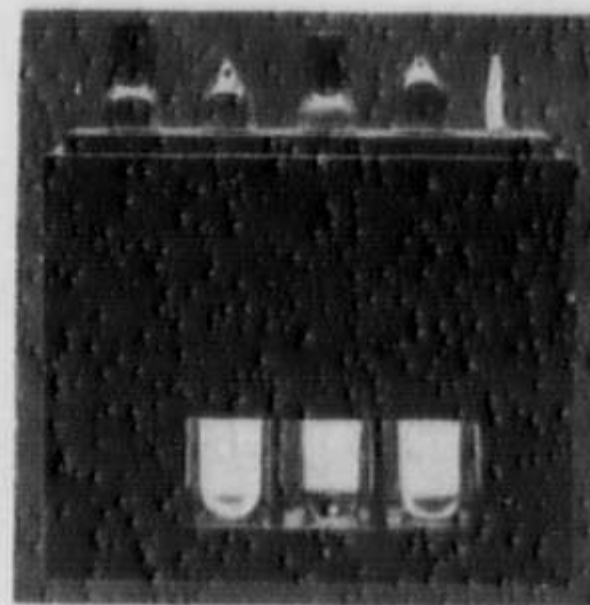
The instrument has been thoroughly tested in every possible way, and has proved extremely satisfactory.

It will usually be supplied as shown in the accompanying illustration complete with base and pedestal, but where clients desire, the panel alone can be supplied suitably drilled for wall mounting.

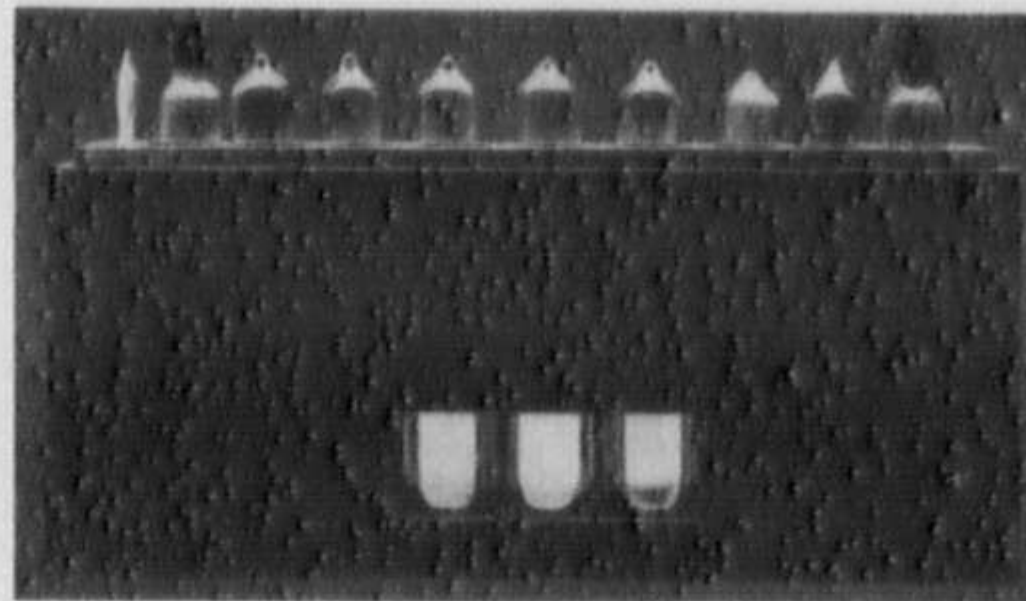
TEST SETS

In connection with the treatment of water supplies by Chlorination it is essential that some simple form of test should be provided whereby the amount of free Chlorine left in the water may be easily and simply ascertained at any time. Two forms of Test Sets are put forward for this purpose as follows :—

1. A small Test Set consisting of two standard colour tubes and one test tube, this Set being particularly useful in connection with Swimming Bath Water where the free Chlorine content should be maintained between .2 and .5 parts per million. In this Set the two tubes provided are for the two limits given, that is, .2 and .5, and when testing, a sample of the water is placed in the test tube, and a pre-determined quantity of re-agent added, and if the resultant colour falls between the two standard colours then the free Chlorine content is between .2 and .5 parts per million. Other colour standards can be supplied if required.



2. In the larger type of Test Set the number of standard colour tubes varies according to the particular requirements of each individual enquiry, and although the actual testing procedure is similar in each case yet in this instance as there is a greater range of colour it is, of course, possible to obtain more exactly the free Chlorine content of the treated water.



With the above sets once the correct dose has been decided the attendant can at any time test and see in a few moments if the correct dose has been maintained.

Chlorine—Useful Data

Atomic Weight	35.46	Molecular Weight	70.92
Specific Gravity :			
Gas (Air = 1)	2.44
Liquid (Water = 1)	1.33
At N.T.P. 1 lb. of Chlorine Gas has a volume of 143.6 litres or 5.07 cubic feet.			
SOLUBILITY IN WATER.			
Temperature.	Volumes of Gas, per Volume of Water.		
10°C.	3.09		
15°C.	2.63		
20°C.	2.26		
25°C.	1.96		
30°C.	1.77		
35°C.	1.57		
40°C.	1.41		
45°C.	1.30		
50°C.	1.20		
For 100% saturation.			

Chlorine—Conversion Table

Pounds of Chlorine.	Cubic Feet.	Litres.
1	5.07	143.6
2	10.14	287.2
3	15.21	430.8
4	20.28	574.4
5	25.35	718.0
6	30.42	861.6
7	35.49	1005.2
8	40.56	1148.8
9	45.63	1292.4
10	50.7	1436.0
11	55.77	1579.6
12	60.84	1723.2
13	65.91	1866.8
14	70.98	2010.4
15	76.05	2154.0
16	81.12	2297.6
17	86.19	2441.2
18	91.26	2584.8
19	96.33	2728.4
20	101.4	2872.0

1 lb. Chlorine per day = Approx. 6 litres per hour.

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(RG 10, Volume 6188, File 461-5, part 6)

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Table giving Pounds of Chlorine required

GALLONS OF WATER.

Parts per million.	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000
1	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	.13	.14	.15	.16	.17
2	.02	.04	.06	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30	.32	.34
3	.03	.06	.09	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45	.48	.51
4	.04	.08	.12	.16	.20	.24	.28	.32	.36	.40	.44	.48	.52	.56	.60	.64	.68
5	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85
6	.06	.12	.18	.24	.30	.36	.42	.48	.54	.60	.66	.72	.78	.84	.90	.96	1.02
7	.07	.14	.21	.28	.35	.42	.49	.56	.63	.70	.77	.84	.91	.98	1.05	1.12	1.19
8	.08	.16	.24	.32	.40	.48	.56	.64	.72	.80	.88	.96	1.04	1.12	1.20	1.28	1.36
9	.09	.18	.27	.36	.45	.54	.63	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.53
10	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70

Parts per million.	18,000	19,000	20,000	21,000	22,000	23,000	24,000	25,000	26,000	27,000	28,000	29,000	30,000	31,000	32,000	33,000	34,000
1	.18	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28	.29	.30	.31	.32	.33	.34
2	.36	.38	.40	.42	.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68
3	.54	.57	.60	.63	.66	.69	.72	.75	.78	.81	.84	.87	.90	.93	.96	.99	1.02
4	.72	.76	.80	.84	.88	.92	.96	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.28	1.32	1.36
5	.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70
6	1.08	1.14	1.20	1.26	1.32	1.38	1.44	1.50	1.56	1.62	1.68	1.74	1.80	1.86	1.92	1.98	2.04
7	1.26	1.33	1.40	1.47	1.54	1.61	1.68	1.75	1.82	1.89	1.96	2.03	2.10	2.17	2.24	2.31	2.38
8	1.44	1.52	1.60	1.68	1.76	1.84	1.92	2.00	2.08	2.16	2.24	2.32	2.40	2.48	2.56	2.64	2.72
9	1.62	1.71	1.80	1.89	1.98	2.07	2.16	2.25	2.34	2.43	2.52	2.61	2.70	2.79	2.88	2.97	3.06
10	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.00	3.10	3.20	3.30	3.40

Parts per million.	35,000	36,000	37,000	38,000	39,000	40,000	41,000	42,000	43,000	44,000	45,000	46,000	47,000	48,000	49,000	50,000	100,000
1	.35	.36	.37	.38	.39	.40	.41	.42	.43	.44	.45	.46	.47	.48	.49	.50	1.00
2	.70	.72	.74	.76	.78	.80	.82	.84	.86	.88	.90	.92	.94	.96	.98	1.00	2.00
3	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	3.00
4	1.40	1.44	1.48	1.52	1.56	1.60	1.64	1.68	1.72	1.76	1.80	1.84	1.88	1.92	1.96	2.00	4.00
5	1.75	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	5.00
6	2.10	2.16	2.22	2.28	2.34	2.40	2.46	2.52	2.58	2.64	2.70	2.76	2.82	2.88	2.94	3.00	6.00
7	2.45	2.52	2.59	2.66	2.73	2.80	2.87	2.94	3.01	3.08	3.15	3.22	3.29	3.36	3.43	3.50	7.00
8	2.80	2.88	2.96	3.04	3.12	3.20	3.28	3.36	3.44	3.52	3.60	3.68	3.76	3.84	3.92	4.00	8.00
9	3.15	3.24	3.33	3.42	3.51	3.60	3.69	3.78	3.87	3.96	4.05	4.14	4.23	4.32	4.41	4.50	9.00
10	3.50	3.60	3.70	3.80	3.90	4.00	4.10	4.20	4.30	4.40	4.50	4.60	4.70	4.80	4.90	5.00	10.00

NOTE.—The tables give the weight of Chlorine required per hour or per day according to the term in which the volume of water is stated.

Indian Affairs. School Files.
(RG 10, Volume 6188, File 461-5, part 6)

PUBLIC ARCHIVES
ARCHIVES PUBLIQUES
CANADA

BELL'S STANDARD CHLORINE GAS APPARATUS

TABLE OF CAPACITIES

Size. Code Word.	PULSATING METER TYPE
BTA	From .02 lbs. to .6 lbs. per 24 hour day.
BTB	From .07 lbs. to 2.0 lbs. per 24 hour day.
BTC	From .14 lbs. to 4.0 lbs. per 24 hour day.

Size. Code Word.	MANOMETER TYPE
MTA	From .5 lbs. to 5 lbs. per 24 hour day.
MTB	From 1 lb. to 10 lbs. per 24 hour day.
MTC	From 2 lbs. to 20 lbs. per 24 hour day.
MTD	From 3 lbs. to 30 lbs. per 24 hour day.
MTE	From 5 lbs. to 50 lbs. per 24 hour day.
MTF	From 10 lbs. to 100 lbs. per 24 hour day.

NOTE.—The above range of capacities do not cover automatically controlled Plants, this latter type being calculated to suit requirements for each case.

STANDARD TYPES OF CHLORINATORS

Type. Code Letters.	Description.
O.I.	Direct Injector Type.
S.I.	Suction Feed Type.
V.N.	Gravity Feed Type.
P.F.	Dry or Direct Gas Feed with Diffuser.

The above Code Letters are for the convenience of clients for reference purposes, particularly for orders by telegram or cable and are used as follow : The description code letters are given first, followed by the size code letters, then if a Gravity Feed Type instrument is required having a capacity of 2 lbs. to 20 lbs. per day the code word for this would be VNMTC.

Indian Affairs, School Files.
(RG 10, Volume 6188, File 461-5, part 6)

PUBLIC ARCHIVES
ARCHIVES PUBLIQUES
CANADA

LIST OF CHLORINE INSTALLATIONS

Accrington District Gas & Water Board.
Agricultural College, St. Vital, Canada.
Aliwal North Municipality, South Africa.
Ampleforth College. (Two Plants)
Anne Boleyn Hotel, Staines.
Arbroath Burgh Baths. Open-air and Indoor
Baths.
Arethusa Swimming Pool, Rochester.
Ashford High School for Girls.
Ashton-under-Lyne Baths.
Ashton-under-Lyne Sewage Works.
Associated Portland Cement Co., Northfleet.
Auchtermuchty, Burgh of
Aylsham Road Swimming Pool, Norwich.

Ballinrobe Waterworks.
Ballymacoll House, Dunboyne.
Banbury Waterworks.
Barking Town U.D.C.
Barn Swimming Pool, Barnet By-Pass.
Bastar State, India.
Bedford School.
Beverley Corporation.
Billinge & Winstanley U.D.C.
Birchanger Swimming Pool, Sanderstead, Surrey.
Birch Hotel, Haywards Heath.

BIRMINGHAM CORPORATION :

Sparkhill Baths.
Kent Street Baths.
King's Heath Baths.
Nechells Baths.
Woodcock Street Baths.

BLACKPOOL CORPORATION :

Open Air Baths, South Shore.
Cocker Street Baths.
Blisworth Lido, Blisworth, near Northampton.
Bloxham & District Water Co. Ltd.

BOLTON CORPORATION :

Bridgeman Street.
Moss Street.
High Street.
Bowater's Mersey Paper Mills, Ellesmere Port.

BRADFORD CORPORATION :

Wyke Baths.
Lapage Baths.
Bramhall Park Swimming Pool.
Bremersdorp Water Supply, South Africa.
British American Construction Co., Buenos Aires.
(Six Plants)
Bromley Baths.
Bruntsfield Schools, Edinburgh.
Buckie, Burgh of
Bulawayo Municipality.
Burgh Heath Baths.
Burnley Corporation.

Camberwell, Metropolitan Borough of
Canadian Pacific Railway.

CAPETOWN :

Long Street Baths.
Maitland Baths.
Carisbrooke Swimming Pool, Leicester.
Chase Swimming Pool, Ingatstone.
Cheltenham Corporation, Sandford Park Baths.
Chester Corporation, Green Lane Pump Station.
Closes Hall, Bolton-by-Bowland.
Community of Development Co., Canada.
Congleton Borough Council.
Cornwall Waterworks, Canada.
Crown Agents for Colonies, Swaziland.
Croydon County Borough.

Darlington Corporation.
Darwen Corporation.
De Danske Mejeriers Maskinfabrik, Denmark.
Department of Agriculture for Scotland (Third
Part Water Supply).
Derby Corporation.
Dewsbury Corporation.
Donaghadee U.D.C.
Doncaster County Borough.
Dorchester House, London.
Douglas Waterworks, Isle of Man.
Drumsheugh Baths Club Ltd.
Dudley County Borough.
Durban County Water Board.

List of Chlorine Installations—Continued

Ealing Corporation Central Baths.
East Dereham Swimming Baths.
Ebbw Vale Welfare Club Swimming Pool.
Edge Hill Training College, Ormskirk.
Edinburgh Corporation.
Elland U.D.C.
Ellesmere Port U.D.C.
Evesham Borough.
Exeter Waterworks.

Farnham U.D.C.
Finchley U.D.C.
Findlays Ltd., Canada.
Finsbury, Merlin Street Baths.
Fleetwood U.D.C.
Forest Hill Lawn Tennis Club.
Franklyn Gardens Swimming Pool.

General Supply Co. of Canada Ltd.
George Municipality, South Africa.
Gibraltar.

Gisbourne, New Zealand.
GLASGOW CORPORATION :
Govan Baths.
Gorbals Baths.

Gods Lake Gold Mining Co., Canada.
Grahamstown Municipality, South Africa.
Great Fosters Hotel.
Great Southern Cemetery & Crematorium, Ltd.
Grosvenor House, London.
Greenwood, J., & Sons, Trafford Park.

Hackney, Metropolitan Borough of
Hartwood Hall Swimming Pool, Chorley.
Havering Court Road House, Romford.
Hawarden & District Waterworks.
Heathfield Swimming Pool.
Hendon, Dawes Lane Swimming Pool.
Hillstone Preparatory School, Malvern.
H.M. Dockyard, Gibraltar.
Holmfirth Lido.
Holyhead Waterworks Co., Holyhead Mountain.
Holyhead Waterworks Co., Lake Traffwll.
Hornsey Education Committee, Harringay Central.
Huddersfield Corporation, Blackmoorfoot, North Side.
Huddersfield Corporation, Blackmoorfoot, South Side.

Hudson Bay Smelting Co., Ltd., Canada.
Hull Corporation, (Two Plants)
W. Hunt, Esq., Rotherham, Pioneer Fitting Station.

Ilkley U.D.C. Baths.
Inverness Burgh Council.
Islington, Metropolitan Borough of
Isebrook Swimming Pool, Burton Latimer.
Jerusalem Municipality.

Kidderminster, Borough of
Kincaple Estate, Fife.
King's Oak Hotel, High Beeches, Loughton.
Knocknagoshel Waterworks.
Kolhapur State, India.
Kuala Pilah, F.M.S.

W. R. Lancaster, Beechwood, Cleveleys.
Leeds, The Girl's High School.
Lincolnshire Sugar Co., Bardney.

LIVERPOOL CORPORATION :
Burroughs Garden Baths.
Westminster Road Baths.
Cornwallis Street Baths.
Lodge Lane Baths.

Llandrindod Wells U.D.C.
Longwood Court Swimming Pool, Maidenhead.
Looe U.D.C., Wringworthy, W. W.
Loughborough Grammar School Baths.
Lowestoft T.C.
Lympstone Water, Devon.

Macclesfield Corporation.
Malvern U.D.C.
Majestic Hotel Swimming Pool, St. Annes-on-Sea.

MANCHESTER CORPORATION :
Chorlton-cum-Hardy.
Harpurhey.
Leaf Street.
Levenshulme.
Moston.
Bradford.
Victoria.
Cheetham.
Moss Side.
New Islington.
Newton Heath.
Withington.

List of Chlorine Installations—Continued

Manor House Swimming Pool, Wilby.
Marbury Hall Country Club Swimming Pool.
Mentakab, F.M.S.
Mere Golf & Country Club Swimming Pool.
Middlesborough Corporation.
Midsomer Norton U.D.C.
Molteno Municipality, South Africa.
Montreal, City of
Montrose Burgh Council.
Morkfoss Solbergfoss, Anbeggert, Denmark.

Nassau Waterworks.
Ndola Water Supply, Bulawayo.
Newcastle & Gateshead Water Co.
Newport Borough.
Norbreck Hydro, Blackpool.
Northampton Corporation Waterworks.
Newark Corporation.

Oakham School.
Oatlands Park Hotel Swimming Pool, Weybridge.
Old Hall School, Wellington, Shropshire.
Oslo Municipality, Vestkantbadet.
Ottawa Electric Railway Co., Britannia Bay.

Pak Hin Hok, Canton.
Pioneer Health Centre Swimming Baths, Peckham.
Pong Tamale Veterinary Laboratory, Gold Coast.
POPLAR, METROPOLITAN BOROUGH OF :
 Roman Road Baths.
 Island Baths.
Port Elizabeth Municipality, South Africa.
Power & Mine Co., Ltd., Canada.
PRETORIA WEST BATHS :
 Central Baths.
 Boys' High School Baths.
Priory Cinema Swimming Pool, Royston, Herts.
Pullman Court, Streatham Swimming Pool.

Rathnew Water Supply.
Raven Hall Hotel, Ravenscar.
Redditch Corporation.
Reigate Hippodrome Swimming Pool.
Repton School.
Rising Sun Hotel Swimming Pool, Bamford.
R.M.I.G. School, Rickmansworth.
Rochdale Corporation.
Roeside Swimming Pool, Chapel-en-le-Frith.

Rotherham Corporation.
Royal Female Orphanage, Beddington.
Rugby School.

San Antonio Gold Mines.
Shrewsbury Baths.
Shropshire Beet Sugar Co., Wellington.
Sioux Look Out, Canada.
Sittingbourne & Milton U.D.C.
Six Bells Swimming Pool, Abertillery.
Societe Italiana Ingg U.A., Milano.
Spenborough U.D.C. Baths.
St. Albans Open Air Baths.
Stockport Corporation.
Stoke-on-Trent, City of
Stroods Hotel, Sayers Common.
St. Thomas R.D.C., Shrewsbury Waterworks.
Swinton & Pendlebury U.D.C.

Tampin, F.M.S.
Temerloh, F.M.S.
The Lido Casablanca, Morocco.
Torquay Borough.
Tottenham U.D.C.
Turton U.D.C., Egerton Baths.

Upton Open Air Baths, near Birkenhead.

Wagon Shed Swimming Pool, Horley.
Wallasey Open Air Baths.
WALSALL :
 Tower Street Baths.
 Bloxwich Baths.
Walthamstow Baths.
Wandsworth, Metropolitan Borough of
Warrington Lido
West Ham, Silvertown Baths.
West Hull Baths.
WESTMINSTER :
 Buckingham Palace Road Baths.
 Great Smith Street Baths.
Winnipeg Municipality, Canada.
Winsford U.D.C.
Wood Green U.D.C. Baths.
Woodsgate Guest House Swimming Pool, Pembury.
Wookey Hole Caves Ltd. Swimming Pool
Workington Town Council.

C O P Y

POWER & MINE SUPPLY CO. LIMITED

123 Princess Street,
Winnipeg, Canada,
May 21, 1937.

Dept. of Indian Affairs,
Dom. Government Public Bldg.,
Winnipeg, Manitoba.

Attention Mr. Hamilton:

Dear Sir:

With reference to your inquiry for a Chlorinator for the Indian School at Kenora, Ontario, we take pleasure in submitting the following:

ONE "BELL" GAS CHLORINATION PLANT: comprising one cast iron white enamelled wall mounting control board, upon which would be mounted - junction box with filter; two pressure gauges, one for registering the reduced pressure of chlorine after passing reducing valve, and the other for registering the pressure of chlorine in cylinder; micrometer valve for adjusting the amount of chlorine added, manometer for reading the flow of gas passing through the instrument, outlet valve and drying tube for preventing access of moisture.

ONE INJECTOR: for injecting the chlorine solution into the water, including one water trap for preventing water backing up to the control board, one Corporation Cock for inserting in the pipe at the point where the chlorine solution is to be administered and solution hose for conducting the solution from the injector to the corporation cock.

TESTING SET: - a set of apparatus and re-agents in polished wood case for testing the water after treatment.

PRICE: complete F.O.B. Kenora, Ontario, sales tax included.....\$690.00

Indian Affairs. School Files.
(RG 10, Volume 6188, File 461-5, part 6)

PUBLIC ARCHIVES
ARCHIVES PUBLIQUES
CANADA

- 2 -

As an alternative we can offer the following:

ONE BATH TYPE CHLORINATOR: comprising one cast iron white enamelled control board mounted on pedestal and fitted with junction box with filter; cylinder pressure gauge; micrometer valve for adjusting the amount of chlorine passing; indicator for indicating the flow of gas being delivered by the instrument; drying tube in provided and equipped at the base with release for preventing water or moisture entering the instrument.

ONE SPECIAL INJECTOR: to be operated by a flow of water for drawing the chlorine gas from the instrument and injecting same, as a solution, into the water being treated at the desired point of application, together with 12 feet of solution delivery hose and corporation cock, equipped with silver tube, for inserting in the pipe line at the desired point of application.

Silver fitted cylinder auxiliary valve would also be provided complete with silver lined pipe connection from the valve to the junction box on the control board.

Spares: 1 glass drying tube; 1 inner meter tube;
1 outer meter tube; 1 complete set of washers.

TESTING SET: A set of apparatus and re-agents in polished wood case for testing the water after treatment.

PRICE: complete F.O.B. Kenora, Ontario, sales tax included.....\$580.00

Prices include installation at the Indian school.

We are unable to make any allowance for the present equipment now in use at the school.

Thanking you for your inquiry and assuring you of our best attention if we are fortunate enough to receive your valued order.

Yours very truly,

POWER & MINE SUPPLY CO. LIMITED,

per (SGD) J.A.Meindl
Sales Manager

JAM/NR

Indian Affairs. School Files.
(RG 10, Volume 6188, File 461-5, part 6)

PUBLIC ARCHIVES
ARCHIVES PUBLIQUES
CANADA

HAMILTON
INSPECTOR OF INDIAN AGENCIES
MANITOBA



DEPARTMENT OF INDIAN AFFAIRS
CANADA

INSPECTOR'S OFFICE

536 Dom. Public Bldg.,

WINNIPEG, MAN. May 22nd, 1937.

IN YOUR REPLY REFER TO

211-11A

ALSO TO DATE OF THIS LETTER



Dear Sir:

In reply to your telegram dated May 19th, Fairbanks-Morse are unable to quote on a chlorinator for the Cecilia Jeffrey Indian Residential School, Kenora. A copy of the quotation from the Power & Mine Supply Co. Ltd., is enclosed herewith, together with a booklet describing the plant.

Personally, I am not prepared to state if the chlorinators are equal in value or service. You will note that no allowance can be made for the old equipment by the Power & Mine Supply Co. Ltd.

I am also enclosing a pamphlet from Wallace and Tiernan Limited, showing the cut of their chlorinator. The illustration describes the equipment, with the exception that this machine is manual, whereas the one quoted on was, I understand, semi-automatic.

Yours very truly,

A. G. Hamilton
Inspector of Indian Agencies
Manitoba.

The Secretary,
Indian Affairs Branch,
Dept. of Mines & Resources,
OTTAWA.

Indian Affairs. School Files.
(RG 10, Volume 6188, File 461-5, part 6)

PUBLIC ARCHIVES
ARCHIVES PUBLIQUES
CANADA