R Inance O.T Baths

WATER PURIFICATION PLANT

Pulsometer

WATER PURIFICATION PLANT

from 1875 *onwards*

Pioneers of Mechanical Filtration

On

ADMIRALTY, WAR OFFICE AND AIR MINISTRY LISTS

Contractors to :—

INDIA OFFICE, CROWN AGENTS TO THE COLONIES, Etc.

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Pulsometer Engineering Co. Ltd.

NINE ELMS IRONWORKS · READING

and 39 VICTORIA ST · LONDON · S.W.1

BRANCH OFFICES ADDRESSES - SEE PAGE 51

FOREWORD

The discoveries and inventions of the eighteenth century which gave a predominant importance to coal in industry, transformed textile manufactures and produced steam-driven machines, vastly enlarged the scope of mechanical engineering and created an industrial revolution led by Britain.

Towards the close of the nineteenth century, however, a growing difficulty in obtaining suitable water for numerous domestic, municipal and manufacturing purposes had become a serious hindrance to progress.

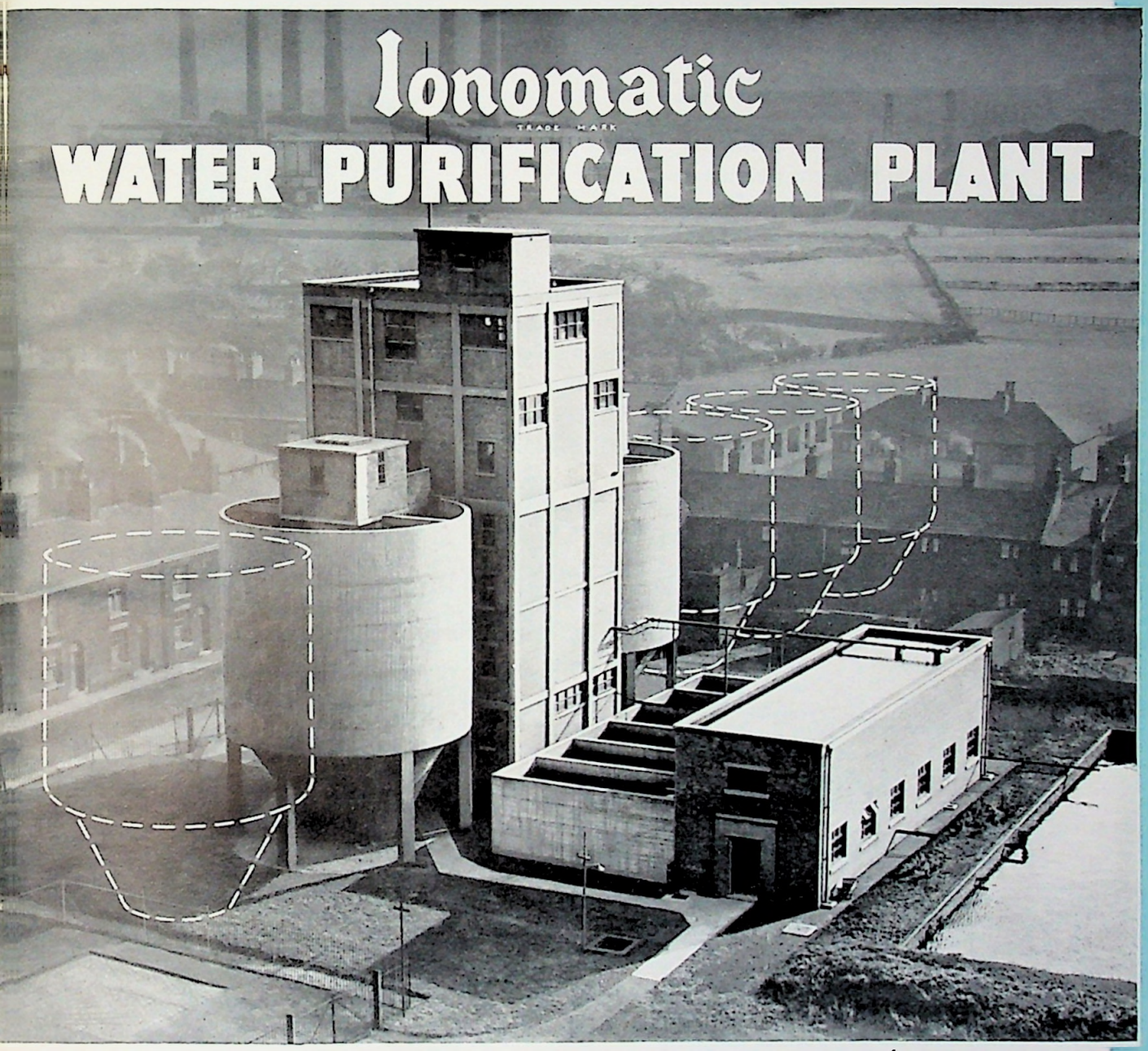
This brochure records the Pulsometer Engineering Company's timely and vital contribution to industry everywhere, in putting the first effective industrial mechanical filter on the market ; and the results of its researches into the problems of water purification in successive types of filters, each marking a definite stage in filter evolution and each giving—in its day—a filtrate satisfying maximum requirements of water purity.

Efficient filtration requires an adequate filtering medium and a perfect system of filter bed cleansing. The Pulsometer Engineering Company's method of cleaning by blowing compressed air into the filter has been so successful that it has been copied by filter makers in this country and abroad.

" Pulsometer " Filters are to be found in many parts of the world for a variety of duties. Tested by the highest modern standards, " Pulsometer " treated water is absolutely satisfactory in all respects.

The hydraulic experience gained by the Pulsometer Engineering Co., Ltd., through many years of making pumping plants has contributed largely to the successful design of their filtration plants in which hydraulic losses are exceptionally low—a welcome factor to the plant engineer who is concerned with the running costs of an installation.

Pulsometer



The illustration shows a Pulsometer plant with two treatment tanks using the **Ionomatic** process of water purification. The conventional method of treatment would require the four additional chain-dotted treatment tanks for the same output. Every Pulsometer plant is designed individually to give the most effective treatment of the water to be handled.

Thames Filters

ACUTE INDUSTRIAL PROBLEM

Sources of Water

In early days, a factory needing clean water built its works near some unpolluted natural supply.

Early Filtration Methods

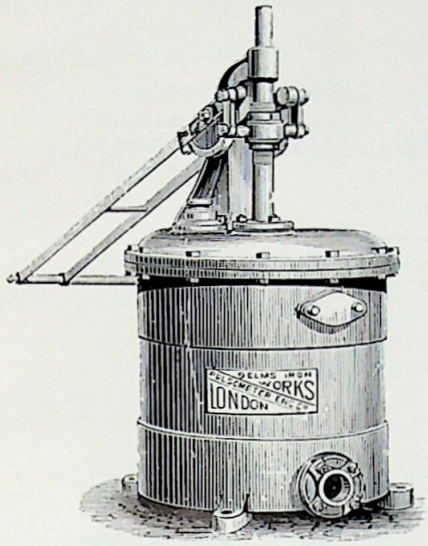
One result of the rapid industrialisation of the nineteenth century was an increasing demand in British mills and workshops for more clean water. Manufacturers, finding it impracticable to transfer their activities to areas where suitable water was plentiful, studied the economic possibilities of water purification, thereby interesting water companies and engineers in finding a solution of their difficulties.

First attempts to clarify water on a large scale were made by the water companies using the " slow-sand " or gravity filtration method introduced in 1829, by which water, percolating through large areas of prepared sand and gravel beds, deposited its suspended matter as it trickled through. A certain amount of the deposits assisted filtration but further accumulations slowed it down and polluted the beds so that cleansing became necessary. This was effected by " paring-off " the sand, wheeling it away, washing it, then returning it to the bed—a tedious and expensive process.

Acute Water Problems

Towards the end of the nineteenth century the unparalleled growth of British population and trade had brought to an acute stage the difficulty of obtaining sufficient water suitable for boilers, laundries, paper mills, power stations, breweries and other manufacturing purposes; while the only existing means of getting further supplies—by erecting works further afield, sinking wells, building reservoirs, or buying water from the water companies—had become correspondingly inconvenient and expensive.

EARLY FILTERS
SPONGE TYPES



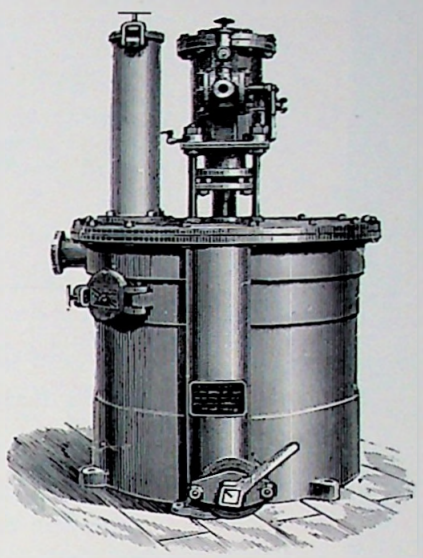
Hand-Driven "Thames" Filter.

Easily operated by one man.

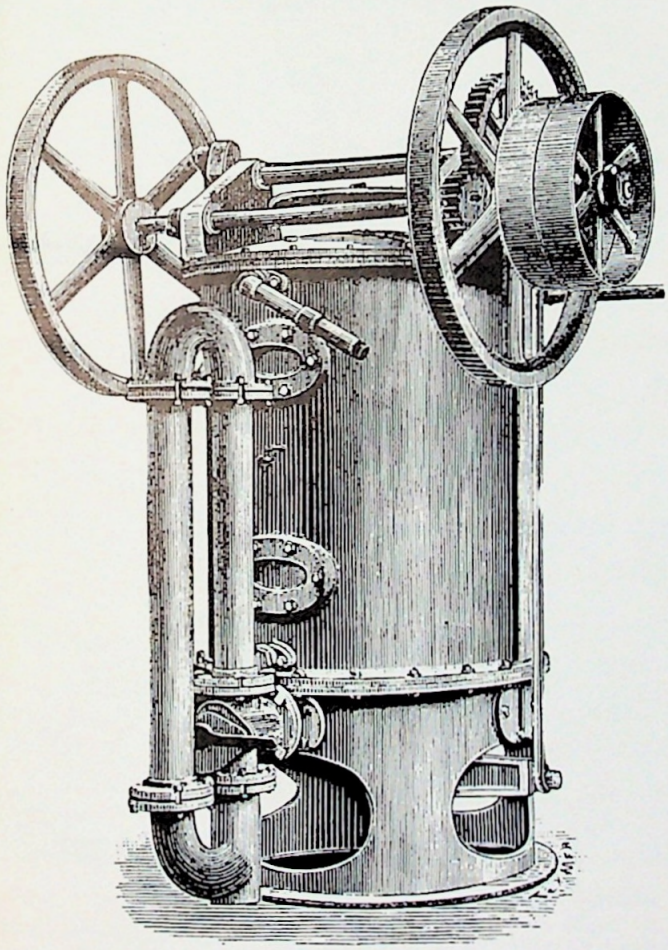
Steam-Driven "B" Type "Thames" Filter

Capacity: 550-850 gallons per hour

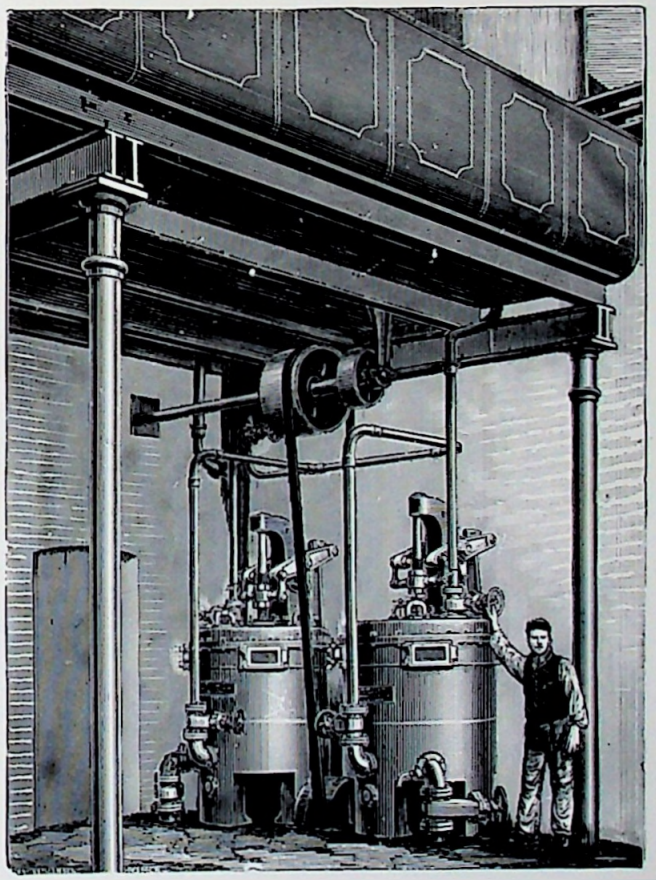
Cleaned by independent Steam Cylinder fixed on cover.



Belt-Driven "Thames" Filter.



An early installation "Thames" Filter.



Two "Thames" Filters installed in Battersea in 1883, to convert muddy river water into a "bright and clear" effluent to feed eight boilers, each 30-ft. by 7-ft.

SOLUTION OF THE PROBLEM

The Pulsometer Engineering Co., Ltd.—At this juncture the Pulsometer Engineering Company decided to enter the lists of those seeking means whereby dirty water could be made clean at a reasonable cost and without much difficulty.

The "Thames"—Between 1875 and 1880 an answer to the problem was found in their "Thames" Filters, which, making a pronounced departure in filter construction, were the first mechanical filters able to deal effectively and continuously with large quantities of dirty water to produce a high quality filtrate and, at the same time provide for regular, easy and certain cleaning of the filtering medium without its removal.

Medium Used—The medium employed for filtration was sponge.

Description of the Filter—This consisted of a copper-lined iron cylinder in which a perforated piston covered with a wire gauze was free to reciprocate.

During filtration, the piston, held at the top of its stroke, kept the sponge tightly compressed against a perforated plate in the cover, through which the clean water passed to the discharge pipe.

Cleaning the Filter—To clean the filter, the piston was released and moved up and down (by hand or power) alternatively compressing and releasing the sponge while the reverse current passed through to wash away the dirt thus set free. By alternately raising and lowering the piston, the sponge could be thoroughly cleaned, even after treating the most turbid river or canal water.

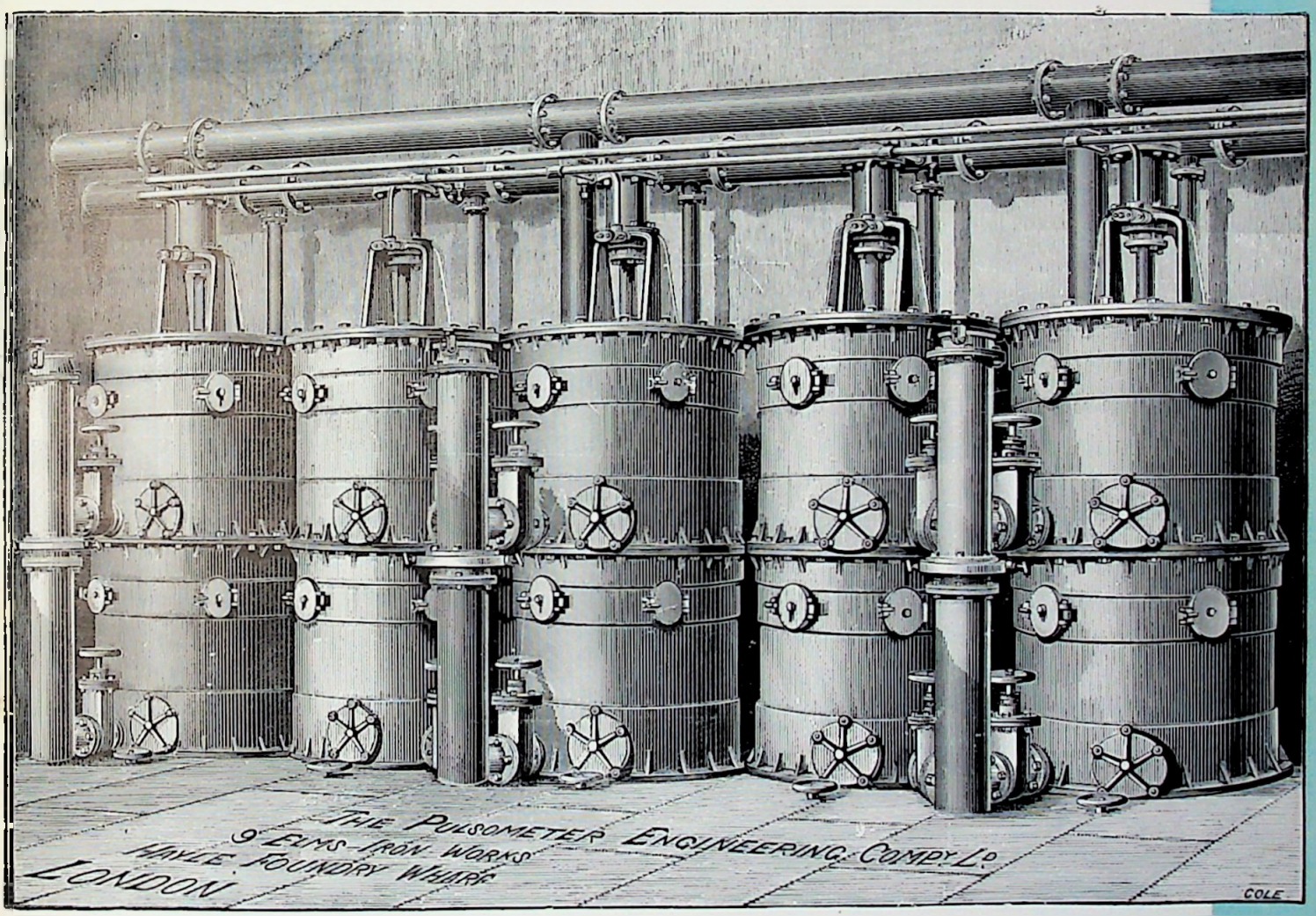
"THAMES" FILTERS

Supplied to The London Hydraulic Power Co. (under Guarantee)

Beginning with small installations the manufacturers were soon encouraged to enlarge their plants. The London Hydraulic Power Company, rather than pay the water companies' high charges, invited claims from firms professing to filter large quantities of water.

The "Thames" Filter was selected as the only one likely to prove successful. Two pairs of filters were ordered in 1882 under a strict guarantee of efficiency and the stipulation that 10,000 gallons of Thames water should be filtered daily to a definite standard of purity. Within 12 months the filters were duplicated. Two more were added the following year—five double sets, capable of filtering 25,000 gallons of Thames water every hour, occupied a floor space of 33-ft. by 8-ft.

The success of these filters brought an immediate market. Orders poured in from paper-mills, boiler users and swimming baths at home and abroad. For swimming baths the water was warmed and aerated by a "Pulsometer" Steam Pump.



Five original Double Sponge type "Thames" Filters supplied to The London Hydraulic Power Company between 1880 and 1884, to treat 25,000 gallons of Thames river water per hour. The report of the Power Company was "entirely satisfactory."

Torrent Filters

A New Development

The Pulsometer Engineering Co., Ltd., having perfected the "Thames" Filter, using sponge as a filtering medium, began to experiment with other types of filtering material.

Tests made with water containing animal, vegetable and mineral matter, showed that certain impurities were more easily removed by sponge, while others were better treated by granular material.

The "Torrent" Filter—patented in 1880—was the result of these experiments. It introduced an entirely new method of cleaning granular filtering material rapidly and thoroughly without removal. The new filter reduced space and costs to a point hitherto unattained.

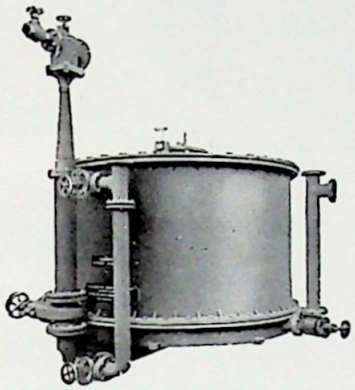
The New Method

Cleaning of the "Torrent" Filter was effected by a reverse current of water assisted by high pressure air introduced by means of a steam pump, and later, by a steam driven air-blower.

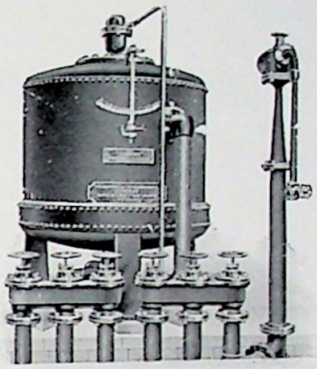
The high-pressure air violently agitated every part of the filtering medium and loosened the adherent impurities which were drained away in the washing water through an outlet pipe.

Easily cleaned and efficient, the new filter revolutionized the treatment of water, and made it possible for industry and public authorities to obtain the standard of water each required.

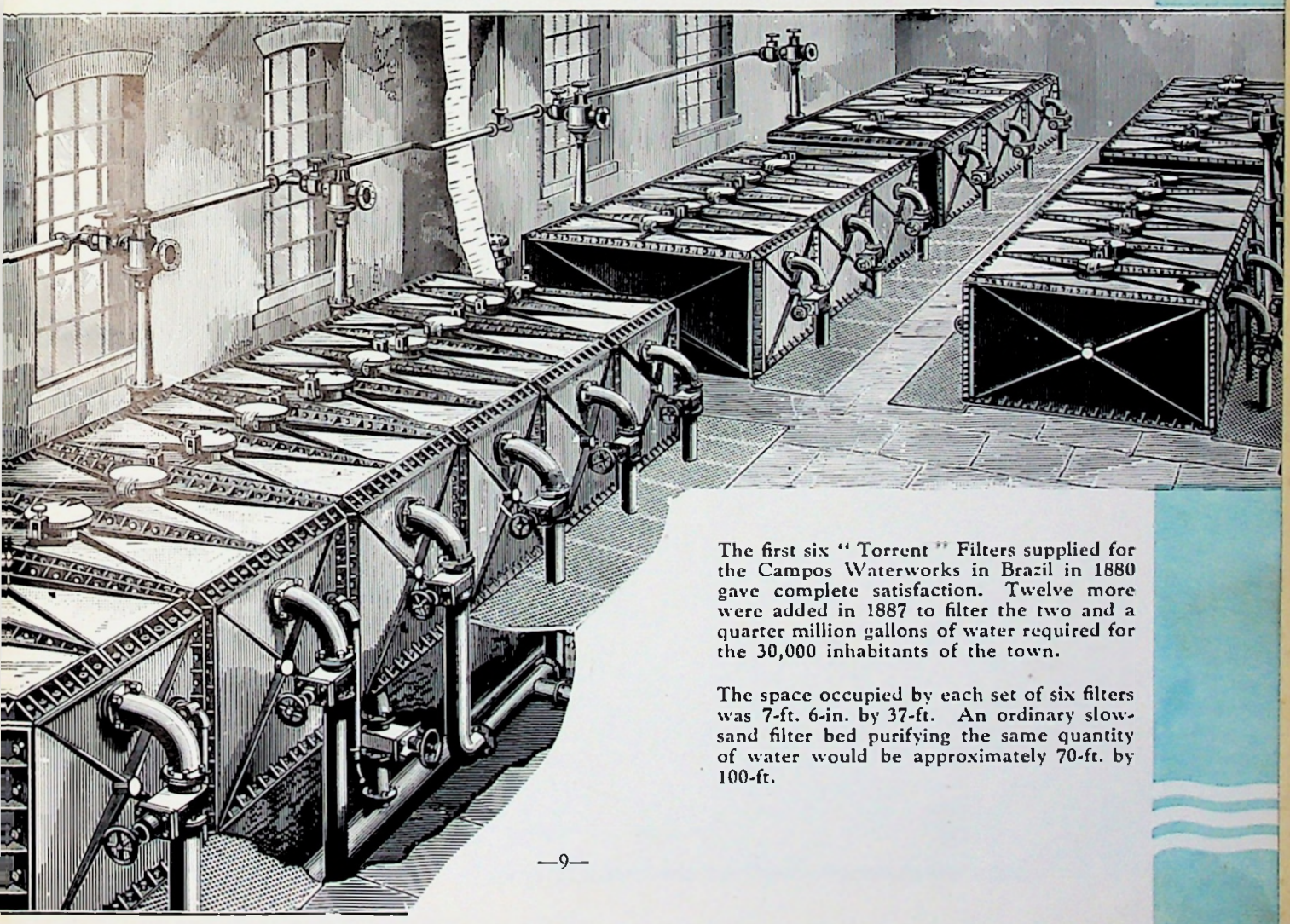
"TORRENT" FILTERS
EARLY 20th CENTURY



Low Pressure Industrial Type.
Two Gold Medals Awarded.
Supplied for chemical and paper works, hydraulic plant, power stations, gasworks, mills, etc.

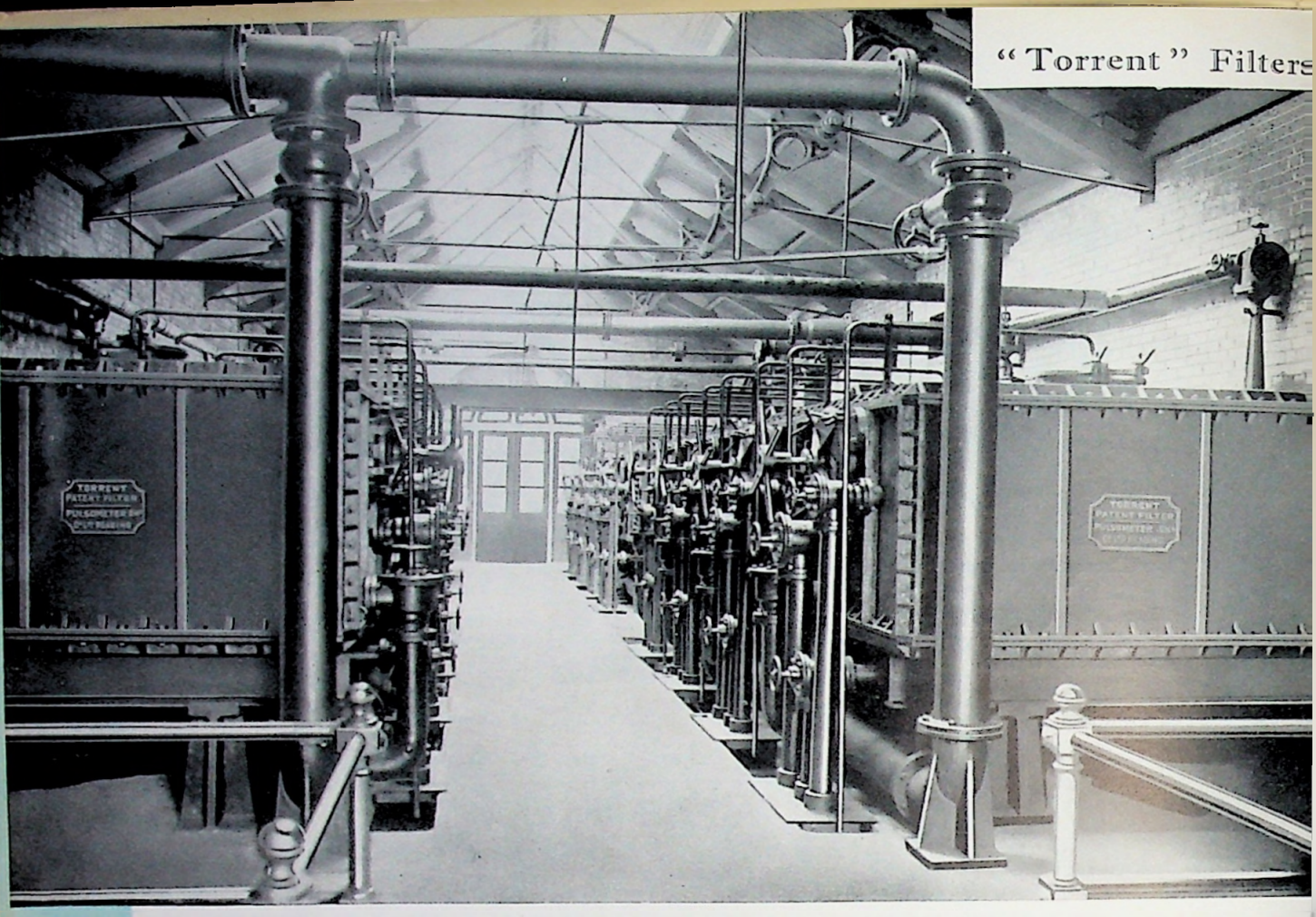


High Pressure Type.
For swimming baths the dirty water was treated and returned to the bath warmed and clean.



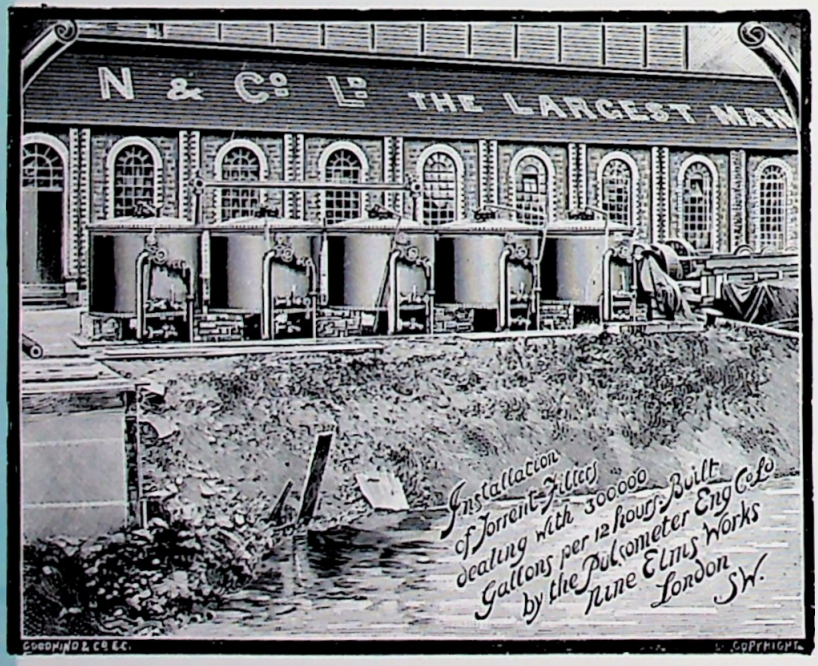
The first six "Torrent" Filters supplied for the Campos Waterworks in Brazil in 1880 gave complete satisfaction. Twelve more were added in 1887 to filter the two and a quarter million gallons of water required for the 30,000 inhabitants of the town.

The space occupied by each set of six filters was 7-ft. 6-in. by 37-ft. An ordinary slow-sand filter bed purifying the same quantity of water would be approximately 70-ft. by 100-ft.



Installation of "Torrent" Patent Pressure Filters, filtering 60,000 gallons of river water per hour, for hydraulic purposes.

The Square Type of Filter shown above was made for a lower pressure than the Cylindrical Filters illustrated below.

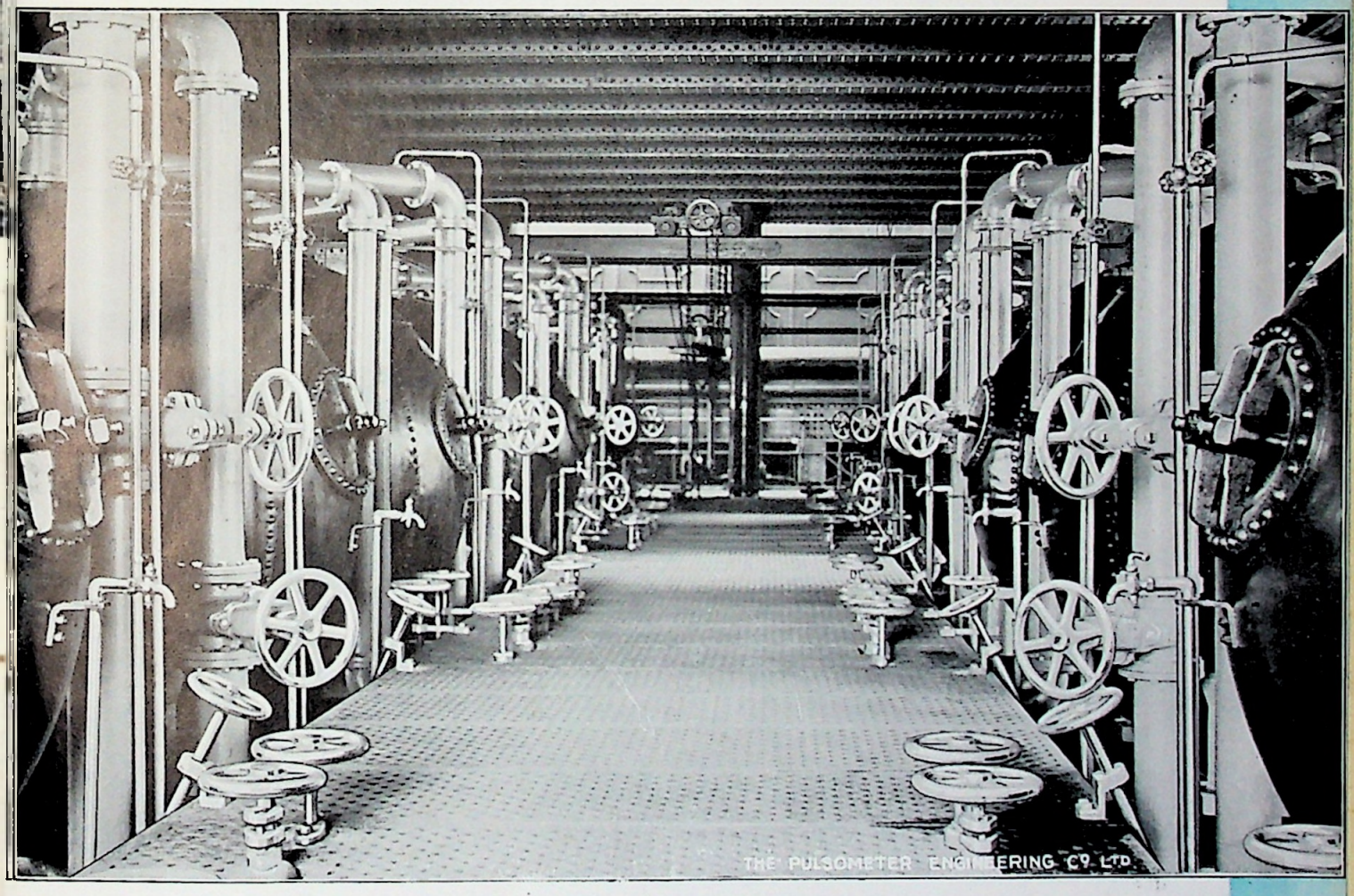


Five "Torrent" Filters treating river water continuously, night and day, at the rate of 24,000 gallons per hour, for the manufacture of fine white paper at the Ely Paper Mills. These were replaced some forty years later (1936) by the most modern type of "Pulsometer" Filters.

FAR-REACHING RESULTS OF "PULSOMETER" CLEANING METHOD

The method of blowing compressed air through the filter was adopted by nearly all filter makers, particularly in the United States of America, where, for many years, large filtration plants using the new cleaning method have been installed.

The new system of filter cleaning brought widespread benefits. It enabled boiler users to filter out mud and dirt from river water at a fraction of the cost of water bought from the water companies. The removal of suspended impurities from water pumped by hydraulic plant gave it a longer life. Paper mills were able to use continuously filtered water instead of depending upon stream water, which was often unsuitable at flood seasons. Factory owners could comply with sanitary regulations prohibiting the return of dirty water to rivers and brooks.



"Torrent" Filters dealing with 50,000 gallons of water per hour.

Gravity Filters

In addition to the standard Pressure Filters which work in a closed circuit, the Pulsometer Engineering Co., Ltd., make Gravity Filters, which are constructed on the same lines as the Pressure Types, except that they are open at the top so that there is no pressure within the filter and filtration is effected by the static head of water over the filtering medium.

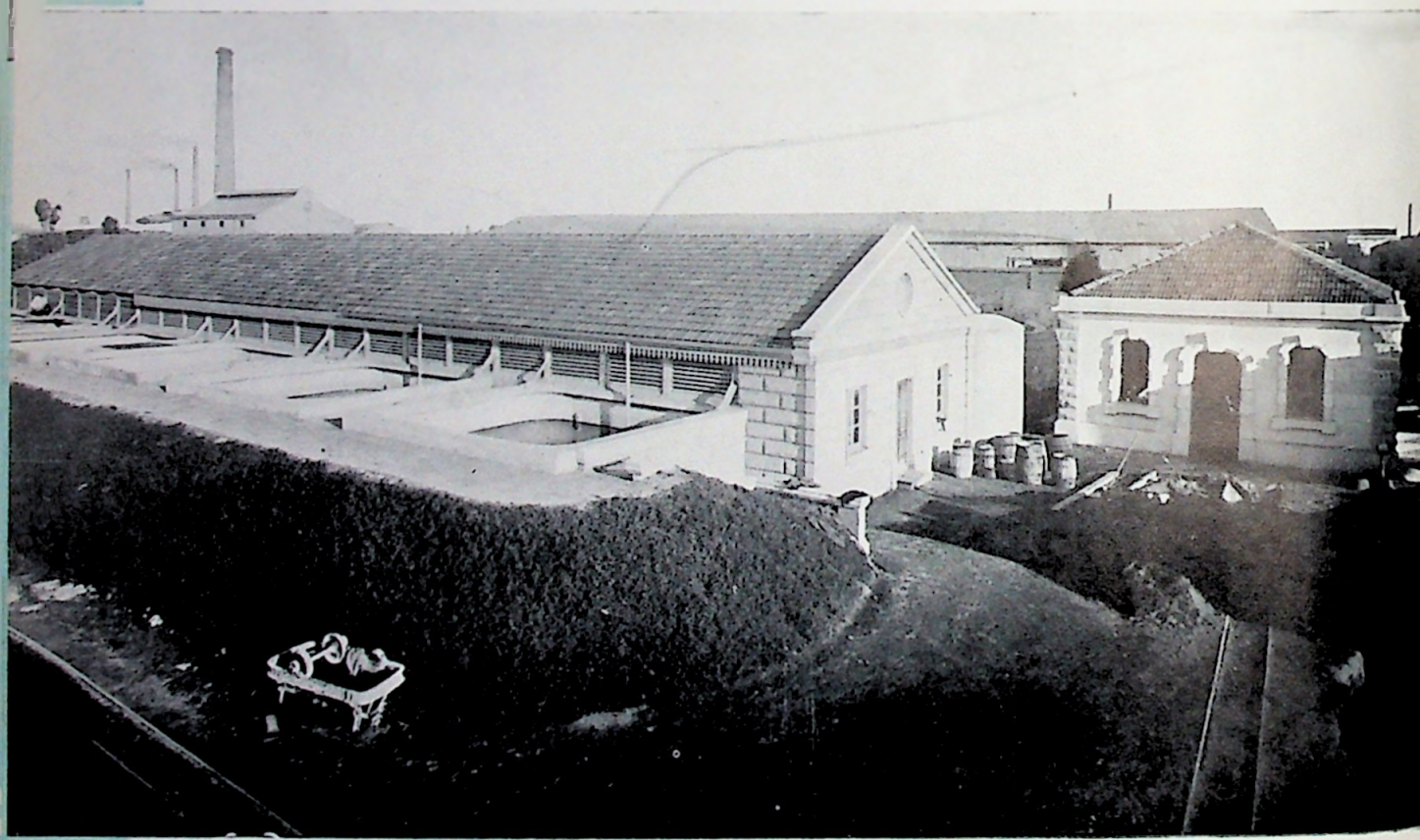
Gravity Filters are made in concrete, plain or re-inforced masonry or steel.

The water level in the filters is kept constant by means of float-operated automatic valves, generally fitted with effluent-controllers which regulate or control the rate of delivery and therefore the rate of filtration.

As land is increasing in value in most localities, great economy is realised in space occupied, operating costs and manual labour, by using this type of filter as compared with slow-sand filters.

The Gravity Filters shown below are each 18 feet square, and deal with 1,000,000 Imperial gallons of water per 24 hours. The total capacity of all the filters is 34,000,000 gallons a day.

The adoption of these filters by the Rosario Waterworks in the Argentine, set free a very much larger area formerly occupied by slow-sand filters, dealing with only six million gallons per day.



Pressure Filters

"PULSOMETER" TYPE

INTRODUCTION

The success of the "Thames" and "Torrent" Filters proved the easily-cleaned mechanical plant with its continuous and rapid action to be a great advance on the large-area, slow gravity type. Its continued usefulness, however, would depend upon its ability to meet changing conditions.

Meanwhile, progress demanded constant improvement in machines, and the quality of the filtrate. Existing problems had, with the passage of time, been further complicated by Britain's steadily expanding trade, the increasing size of her towns and cities and the new teachings of bacteriologists on the subject of water hygiene.

Adapting the principles on which the "Torrent" Filters had been built to advancing requirements, the Pulsometer Engineering Co., Ltd., evolved the "Pulsometer" type.

PRINCIPLES OF MODERN FILTRATION

Need of Treatment

Water of the standard now desired for large-scale domestic and industrial purposes can seldom be obtained in sufficient quantity in a pure state, and must be subjected to treatment in several ways.

Pre-filtration Measures

Water heavily charged with suspended matter undergoes a pre-filtration process of sedimentation. Chemical re-agents are added at certain stages to correct over-hardness, softness, acidity or alkalinity, and to form the jelly-like substance on the surface of the filter-bed necessary to trap suspended particles, colouring matter and bacteria, minute enough to pass through the filtering medium. Chlorine is added as required either before or after filtration for sterilization purposes.

MODERN FILTRATION METHODS—continued

Filtration is effected by passing raw water through a thickness of correctly graded and selected filtering material. The area of the filter-bed must be carefully predetermined, for, if too small, output is reduced and a high pressure is soon built up through the filter-bed, with a consequent drop in efficiency.

In a way it may be said that treated water provides its own filtering medium, inasmuch as it is the coating which is formed on the surface of the filtering material that makes the filter effective. As this coating thickens there is a greater resistance to the water. The time when the filter should be cleaned is indicated by the pressure gauge on the filter. This shows the difference in pressure between the top and bottom of the filter-bed. It is advisable to wash the filter when this differential pressure reaches ten feet, otherwise the efficiency of the filter may be impaired.

TO OBTAIN THE BEST RESULTS

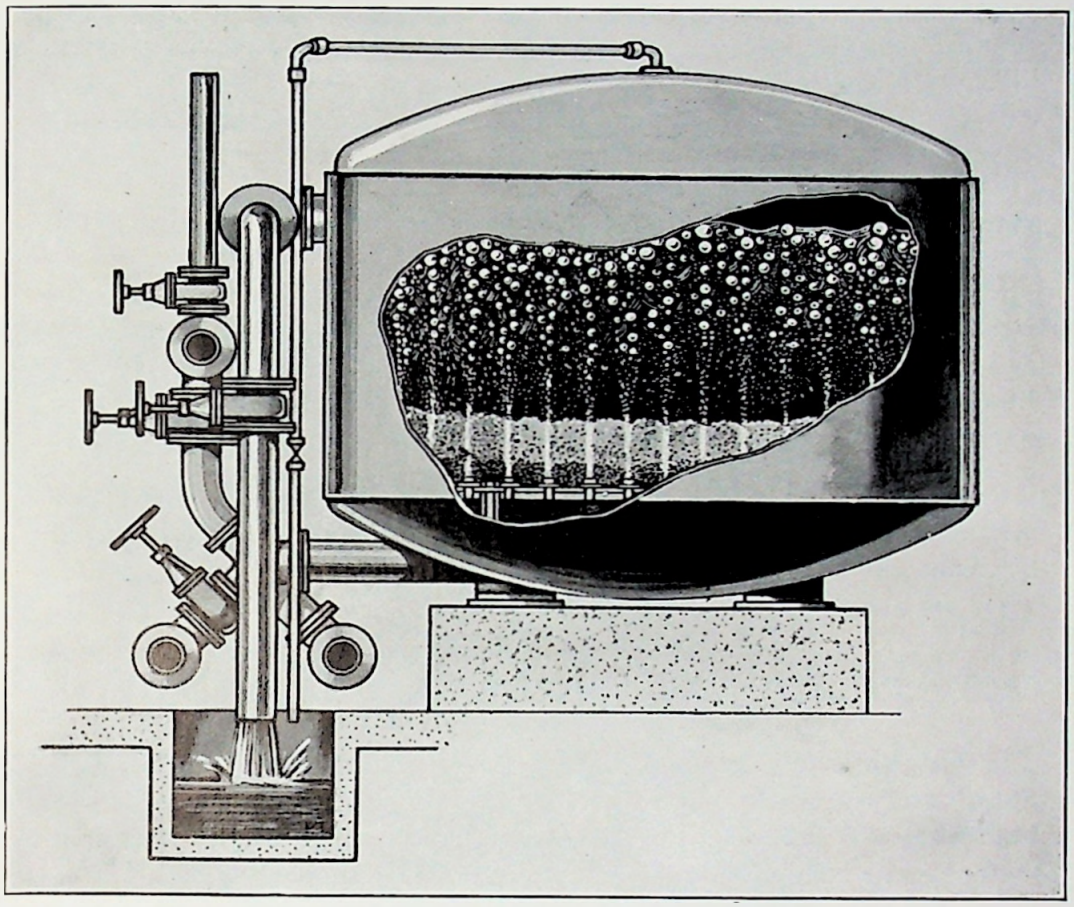
To obtain the best results, the entire bed must be cleansed throughout its whole thickness, because, if even a small portion of it is left undisturbed, the effective filtering area will be reduced with corresponding disadvantage.

Method of Filter Cleaning

Before the impurities can be discharged from the filter, they must be thoroughly freed from the filtering medium to which they cling, and this is done by violently agitating the whole filter-bed.

In the " Pulsometer " Filter, this is done by first shutting off the unfiltered water and admitting to the underside of the bed a reverse current of clean water accompanied by jets of high pressure air through a system of scientifically proportioned air nozzles.

AIR-CLEANING PROCESS



The compressed air and water introduced into the bottom of the bed, are distributed to every point in the filter and rise through the bed in a cloud of small bubbles which throw the whole bed into a state of violent and agitated suspension.

During this process, the sand particles bombard each other and rub off the adhering dirt to be carried away to waste by a flow of clean water.

The design and distribution of the nozzles is such that the entire filtering medium is thoroughly and rapidly cleaned and there are no places inside the filter where dirt can accumulate.

ADVANTAGES

Freedom from Mechanical Breakdown

In the construction of a " Pulsometer " Filter there are no loose parts inside to rust or fracture. As the filters are cleaned by compressed air and water, there are no mechanical blowers or internal agitating gear. There is, therefore, a complete elimination of risk of mechanical breakdown or of oil pollution of the water.

Automatic Control of Air Injection

The " Pulsometer " Filter is correctly air-scoured and hydraulically cleaned. No musty smell is developed because the air disturbs the sand and oxydizes the organic matter by means of the " Pulsometer " Hydrair Motorless Air Compressor, which also ensures that the filter cannot be overwashed or the medium ejected into the trench if operated correctly.

" Pulsometer " plants are scientifically designed to ensure a continuous and satisfactory filtrate. Their efficiency has been abundantly proved by their low hydraulic losses and long " trouble-free " working life. They are simple and economical in operation.

THE " PULSOMETER " HYDRAIR COMPRESSOR

The Pulsometer Engineering Co., Ltd., has kept its lead in the mechanical filtration of water not only by notable inventions but by a succession of improvements either in the means of removing impurities found in water or in simplifying the cleaning process of a filter.

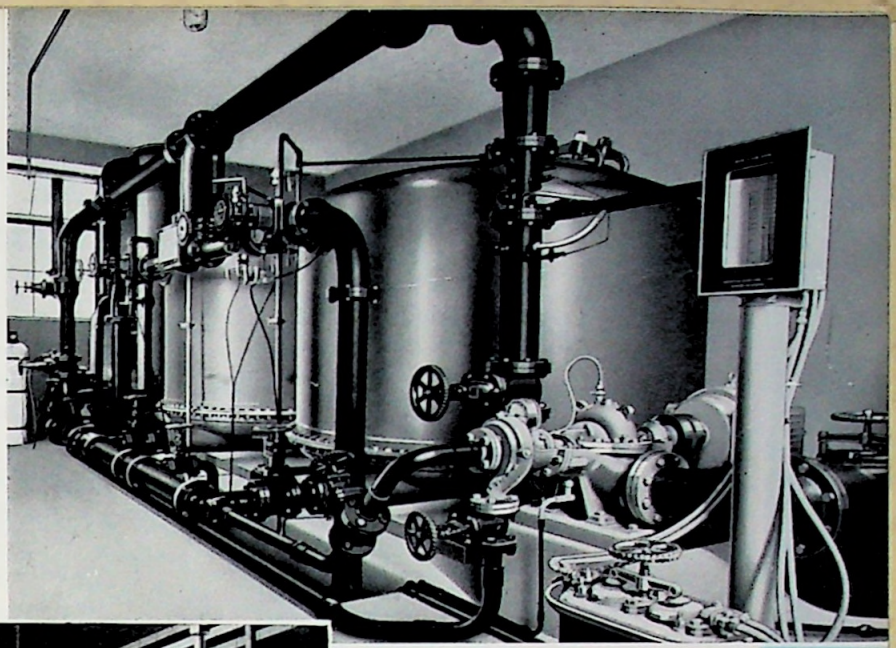
Amongst these is one of no little importance—their Motorless Hydrair Compressor—which is both a most convenient apparatus for introducing compressed air into the filter, and a method of controlling the rate of wash water, thereby effecting considerable economy.

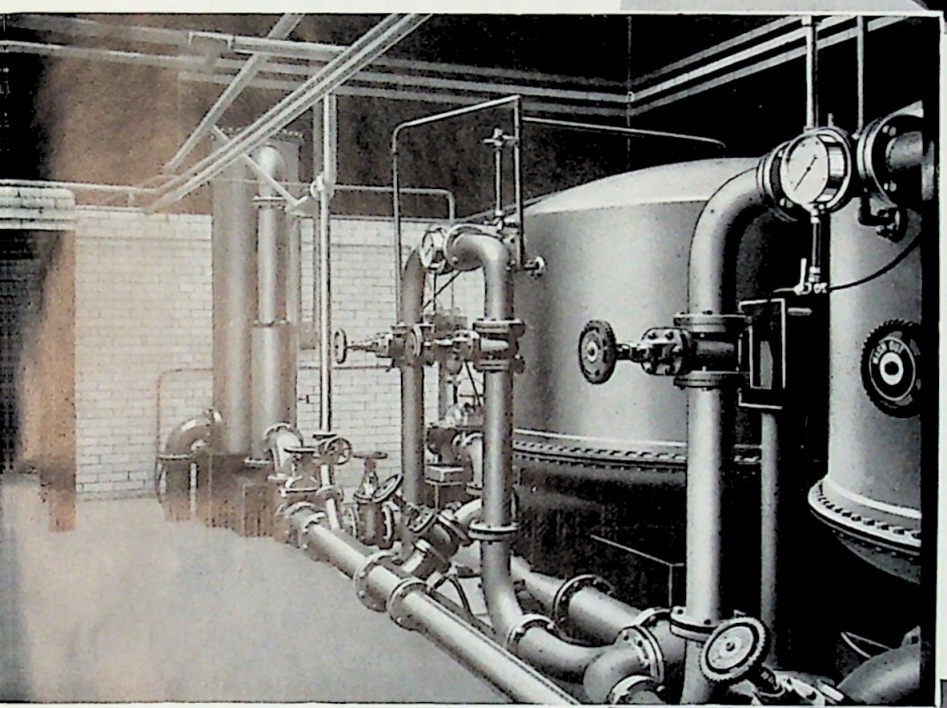
Economy in Time and Water

From a Baths Engineer

" *The effective cleaning and washing of the filter by means of ' Hydrair ' is a saving in time and water, and this operation alone is well worth something over and above another tender.*"

The illustration shows the pump and air compressing device, two vertical filters and, on the right, the strainer box, chemical gear and metering equipment. Special attention has been paid to the grouping of the valves and gauges to facilitate control and secure economy of operation.

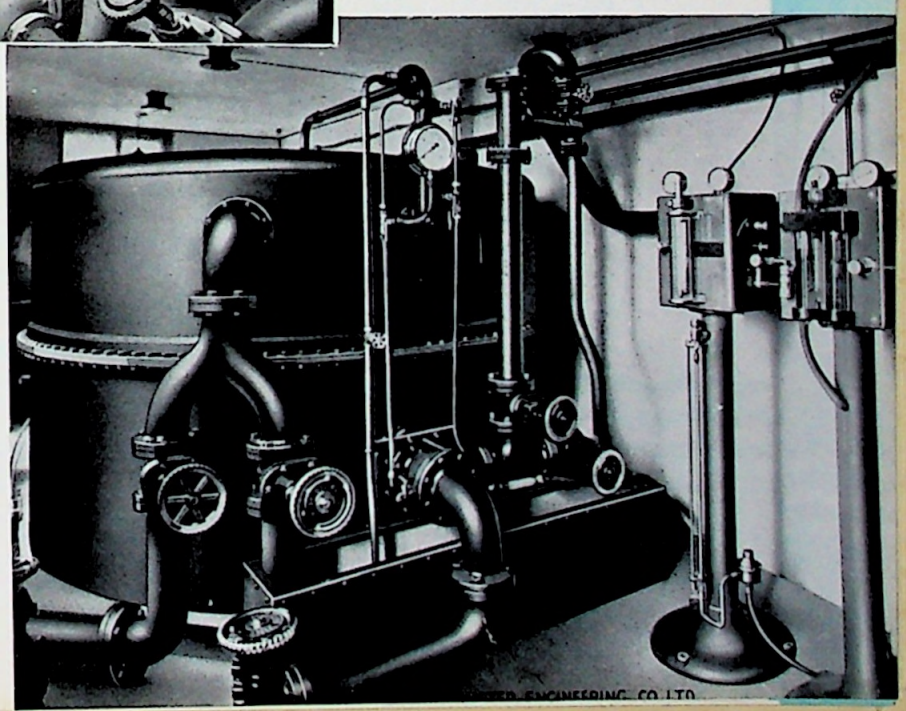




A typical installation of "Pulsometer" Vertical Filters.

The 8-ft. horizontally-split Steel Filter shown, treats 60,000 gallons of water every six hours. The Filter was made in halves to enable it to be taken through narrow doorways to be assembled.

Note the Chloramine apparatus on the right.



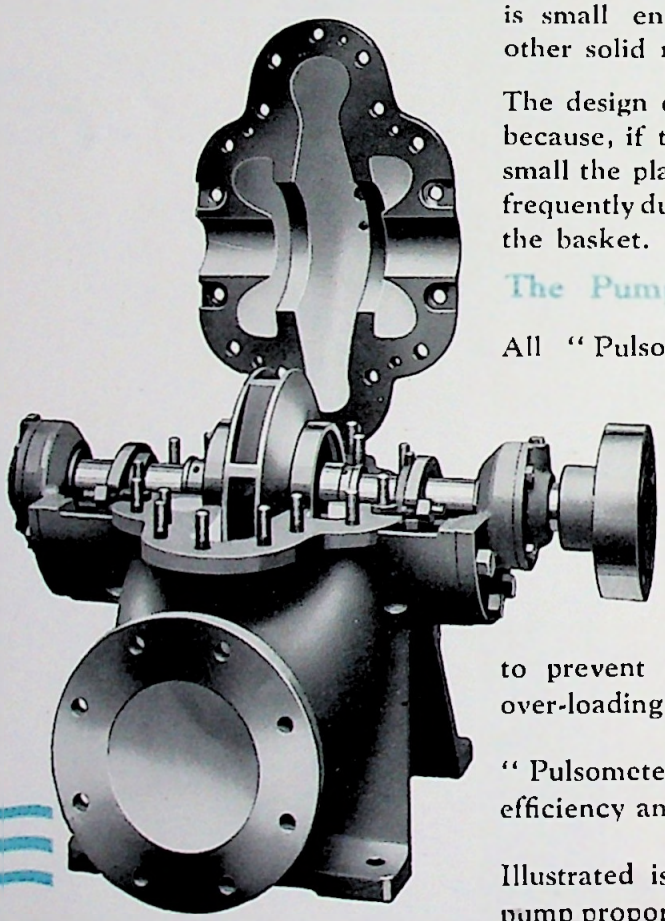
"PULSOMETER" PROCESS
FUNCTION OF COMPONENTS

Purification of water often requires chemical treatment combined with mechanical filtration. A short description follows of the components of a plant and the function of each.

The Strainer

The "Pulsometer" Strainer—a box-like chamber with a lid secured by a hand wheel—is designed to prevent air locks. It is fitted with a perforated basket.

Great care has been taken in designing this unit to ensure that the total area of the strainer holes is sufficient to offer the minimum resistance to the flow of the water, and that each hole is small enough to trap leaves and other solid matter.



The design of the strainer is important because, if the area of the holes is too small the plant may have to be stopped frequently during the day's run to change the basket.

The Pump

All "Pulsometer" Pumps used in filtration plants are characterised by a steady flow to the filters at the varying conditions of head encountered during the entire filter cycle to ensure complete harmony in operation and to prevent damage to filter-beds and over-loading of motors.

"Pulsometer" Pumps give high efficiency and low maintenance costs.

Illustrated is a split-casing centrifugal pump proportioned to suit the particular

FUNCTION OF COMPONENTS—continued

duty required for the installation. This type of pump enables the filters to work smoothly without pulsations such as are set up by reciprocating pumps and avoids contamination of the water by oil.

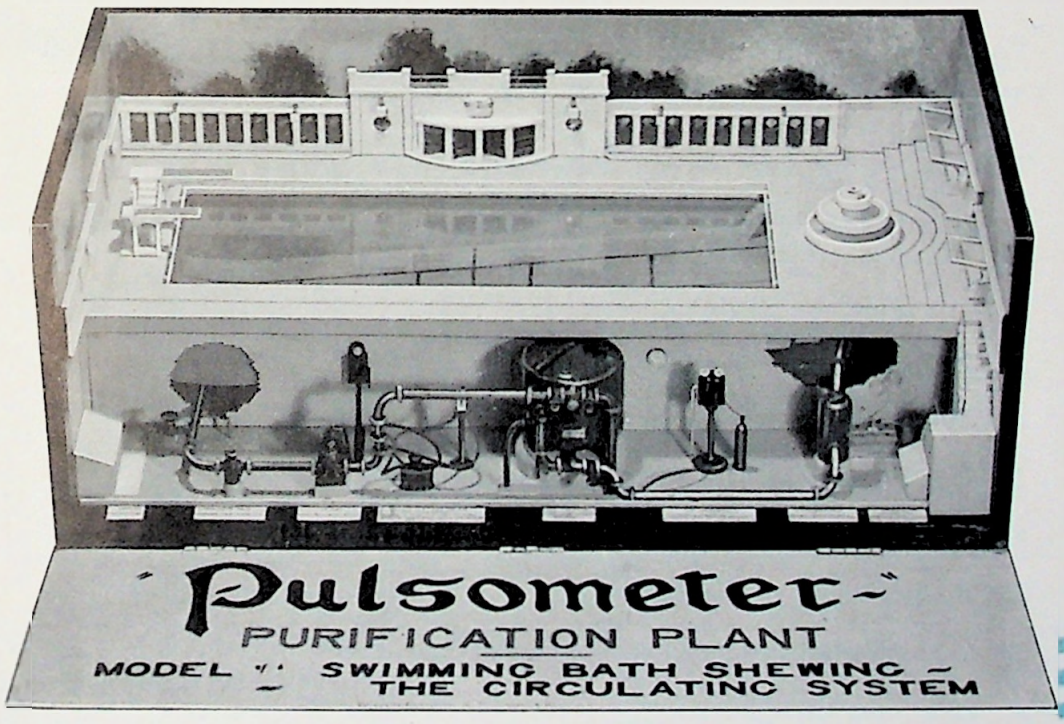
Coagulating Gear—constructed to withstand corrosion—injects sulphate of alumina and soda into the water to form a flocculent precipitate on the surface of the filtering medium to trap approximately 99% of the bacteria and other suspended matter. Chemical pumps are installed when necessary to ensure accurate administration of chemical doses in large plants.

A "Pulsometer" Automatic Injection—Parallel Feed device adjusts the rate of injection to the rate of the circulation of the water, and automatically ceases to deliver the chemicals when the circulation of the water stops.

The Filter consists of the shell or casing containing the medium, and is made in a variety of designs—for vertical or horizontal use—to suit the exigencies of the site. Proportions and shape are modified by requirements.

The Chlorinator—for sterilization purposes. Sterilization—the last phase in the cycle of purification—is necessary if the water is to be rendered bacteriologically safe. The most satisfactory sterilizer for water is chlorine, which can be introduced in the form of chlorine solution.

Chlorine can be introduced either before or after filtering. If before, no live bacteria or vegetable growth will be present in the filters—a great advantage. Naturally, the dose of chlorine used will be rather greater than when the chlorination takes place after filtration, but the filters will keep sweet and require less frequent washing out.



(See illustration on page 17 for Filters with strainer box, chemical gear, metering equipment and chloramine apparatus.)

SELECTION OF FILTRATION PLANT

Notes for Guidance

First cost v. running cost. The purchaser should first decide whether he intends to buy the smallest filter, just capable of doing the duty when working "all out," or whether he is prepared to allow a reasonable margin.

Size. Apart from any question of margin, the size of the filter depends largely upon the area of the filter bed for a given quantity of water. This ratio varies with the purpose of the filter—whether for municipal, factory or swimming baths.

Margin. The allowance of a reasonable margin reduces the working costs, and the filter requires the minimum of attention in operation, and a smaller consumption of washing water.

It also affords a reserve for sudden fluctuations of demand or in case the incoming water becomes more difficult to treat.

Simplicity of construction. A very important point, both as regards attention and maintenance. (The absence of internal mechanism is definitely advantageous.)

Power for operation. This, of course, affects the running costs as well as the first cost. (See Nomograph page 21.)

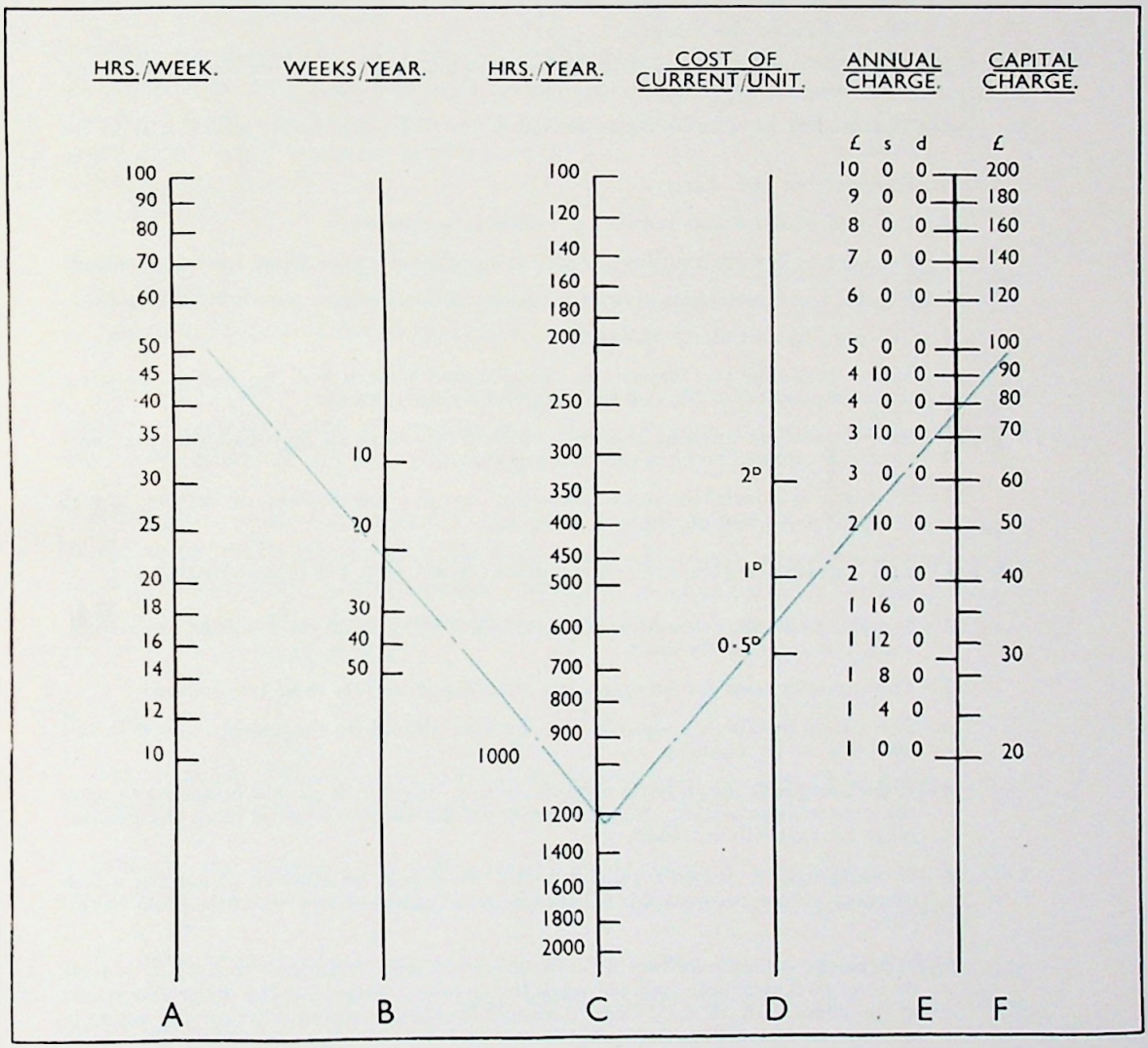
The Leading Features of the "Pulsometer" Filter are:—

1. Can be thoroughly and quickly cleaned without removal of the filtering medium.
2. Is simple and easily understood.
3. No internal mechanical movements.
4. Will work with a few feet head.
5. Can be arranged to work under pressure.
6. Easy sterilization of the filter and filtering material.
7. Revivification of the filtering material by the introduction of air.
8. Occupies but little space.
9. Low cost of upkeep.

THE NOMOGRAPH

A CHART FOR CALCULATING PUMPING COSTS

Cost of operation is a serious consideration when choosing a purification plant, as shown by the nomograph chart below. This chart gives the current cost per annum and at 5 per cent. interest the corresponding capital charge. From the point on Scale "A" draw a straight line through the point on Scale "B" to Scale "C." From that point draw a straight line through the point on Scale "D."



Remember every unnecessary horse-power represents an unnecessary annual charge and corresponding capital outlay.

General

IMPORTANT

When inquiring or ordering, it is of the greatest assistance in selecting the most suitable size and type of filters, to furnish the fullest details of the unfiltered water and of the quality of filtered water required. The points given below may therefore be of assistance:—

1—The maximum quantity of filtered water required per hour and average per day, or the number of hours per day the filters have to work.

2—The source of the water.

3—The objectionable features in the water which have to be removed and if they are constant or variable.

4—The quality of filtered water required and the purpose for which it is to be used.

5—Hardness of the water.

6—Copy of analysis and sample, if possible (see below).

7—Pressure or head of unfiltered water at floor level where filters have to be fixed.

8—Highest top water level in tank where the filtered water has to be delivered.

9—The number of units preferred.

10—Space available for filters. A dimensioned sketch will be useful, showing size and position of filtered and unfiltered water mains.

11—Size of smallest opening through which filters have to pass and whether temporary openings can be made if necessary.

12—If steam is available, state pressure, or give particulars of motive power available near site of filters.

Please read carefully the following directions for taking samples:

1—Samples of water to be filtered should be sent in clean glass bottles or earthenware jars—not in tin cans.

2—The quantity sent for examination should not be less than two gallons.

3—The vessel in which a sample is to be sent should be thoroughly rinsed in the water it is to contain.

4—If the sample is taken from a pond, brook, or river, it should be taken as near the centre as possible. Scum floating on the surface or mud from the bottom must be carefully avoided.

5—If the sample is drawn from a tap, the tap should be allowed to run for a few minutes before the vessel is filled, to get rid of the water which has lain in the pipe.

6—Where the quantity of matter in suspension varies from time to time, it is well to send two samples—one showing the average water and the other the water at its worst. In all such cases it should be clearly stated whether the water is sometimes worse than the sample sent, and if so at what periods.

7—Attach a label to each bottle sent, and let the label bear your name and also a distinctive mark (where more than one sample is sent), so that the contents of each sample may be distinguished.

8—All samples should be sent carriage paid to our Works, Reading.

"PULSOMETER" FILTRATION PLANT

SOME CLASSIFIED OPINIONS

Efficiency:

"As a qualified engineer who has studied filter plants very carefully, I am of the opinion that the 'Pulsometer' is unequalled. Results have exceeded the most sanguine expectations."

"I have visited most of the plants in Scotland, England, and a few in Germany, and can confidently say that I have yet to find finer filtered water. It is clean, clear, devoid of taste or smell. The plant works splendidly and is simple to operate."

"When we opened up the filter plant the quartz was full quantity, the shells practically free from scale and washing had not brought up the larger particles from the lower level. The five filters were examined, washed and passed in one day as being in first-class order for further service."

Economy:

"Although the horse-power required to run your plant is considerably lower than that offered by other makers, I have found it more than adequate for the work—in fact, the motor is never loaded above two-thirds of its rating."

"The electric motor which you have supplied with your filtration plant has never shown the slightest sign of overloading, although your running costs were lower than other offers. I am very pleased with the plant."

"When your tender was compared with others, your pumping head and horse-power of the motors were smaller, but we have found the pump ample for operating the plant to specification. In my opinion, the lower head taken is due to the efficiency of your nozzles and arrangement of the filter beds. I am agreeably and appreciatively pleased with results."

Service:

"The condition of the water is so excellent that it has to be seen to be believed, and the technical service given by the firm exceeds my expectations."

"Although the maintenance period expired last season, your representative has often visited us and given valuable assistance by his experience and knowledge."

"We have recently placed an order for another plant. I am of the opinion that the Pulsometer Engineering Co., Ltd., make a first-class plant and give excellent service afterwards."

"Your plant has given every satisfaction. After 3½ years you are still very helpful with your service—a great asset to any municipality."

Municipal Filters

"PULSOMETER" PLANT IN MUNICIPAL UNDERTAKINGS

The preceding pages have shown the Pulsometer Engineering Co., Ltd., to have been filtration pioneers and specialists progressively and successfully improving their filters for over half-a-century.

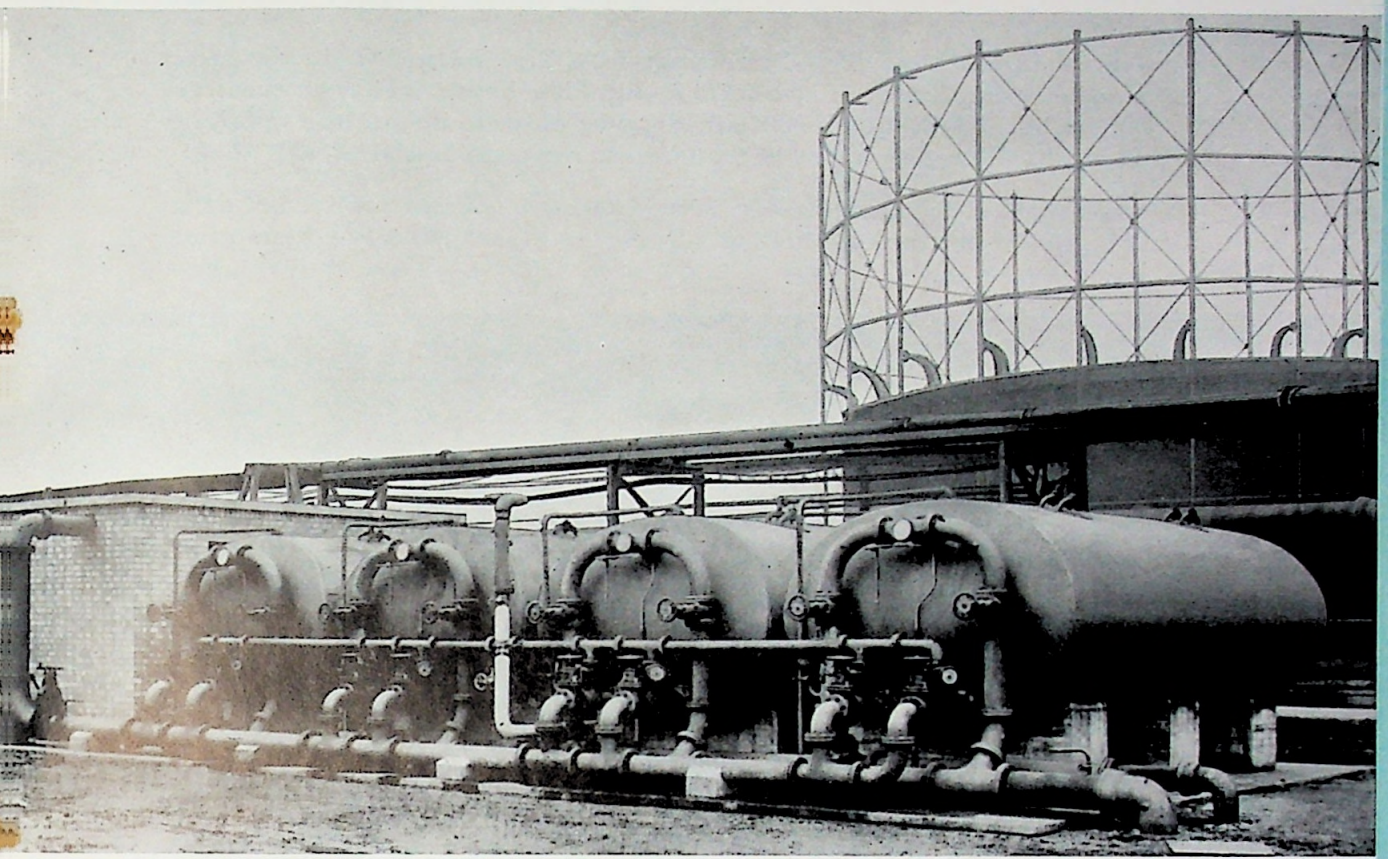
The Company has supplied many municipal and industrial plants, including the largest waterworks pressure plant in Scotland, numerous plants for swimming and pithead baths and private pools, all of which are operating efficiently and smoothly and some of which are described in the following pages. Every kind of water has been treated with complete success.

Reports from Municipal Plants

" Your filters have stood up excellently to the very severe test of getting rid of algæ spores. Although we have been satisfied with the all-round performance of this plant, a doubt always lurked in my mind whether we would get rid of algæ bi-annually. This last week there has been the heaviest dose of algæ spores we can remember. The test on the filters was most severe, and they came through with flying colours. All filter beds are back to normal and thoroughly clean. I am specially pleased that there is no evidence that any material loss of sand has occurred. In fact, the sand beds look exactly as they were when the plant was put to work three years ago."

" The water is in a most excellent condition. The filters ran for six years continuously—except for one inspection—without the least hitch."

" The filtration plant erected by your company has been under my charge for the past seven years, and despite heavy attendances has proved very satisfactory. Although it is two years since the pond was filled, the water is of excellent quality, and compares very favourably with drinking water. We cannot speak too highly of the condition of the water."



Wandsworth Gasworks Filtration Plant.

The "Pulsometer" Filters illustrated, installed in the Wandsworth Gasworks, near the benzole plant, supply 60,000 gallons per hour of filtered water for process purposes. They have given complete satisfaction and have been free from mechanical trouble.

The water, containing a quantity of matter in suspension, is drawn from the Thames, and passed under pressure through the filters to a tank from which it is pumped by two "Pulsometer" Pumps, to a tower from which it is distributed throughout the works.

The battery of four filters—each 17-ft. long by 9-ft. wide—is fitted with two independent sparge pipe systems so controlled that one half only of each filter can be washed, thus retaining the advantages of the large battery of small units at the same cost as the small battery of large units.

The filters are cleaned by a reverse flow of filtered water accompanied by the injection of compressed air, supplied by a steam blower.

Municipal Filters

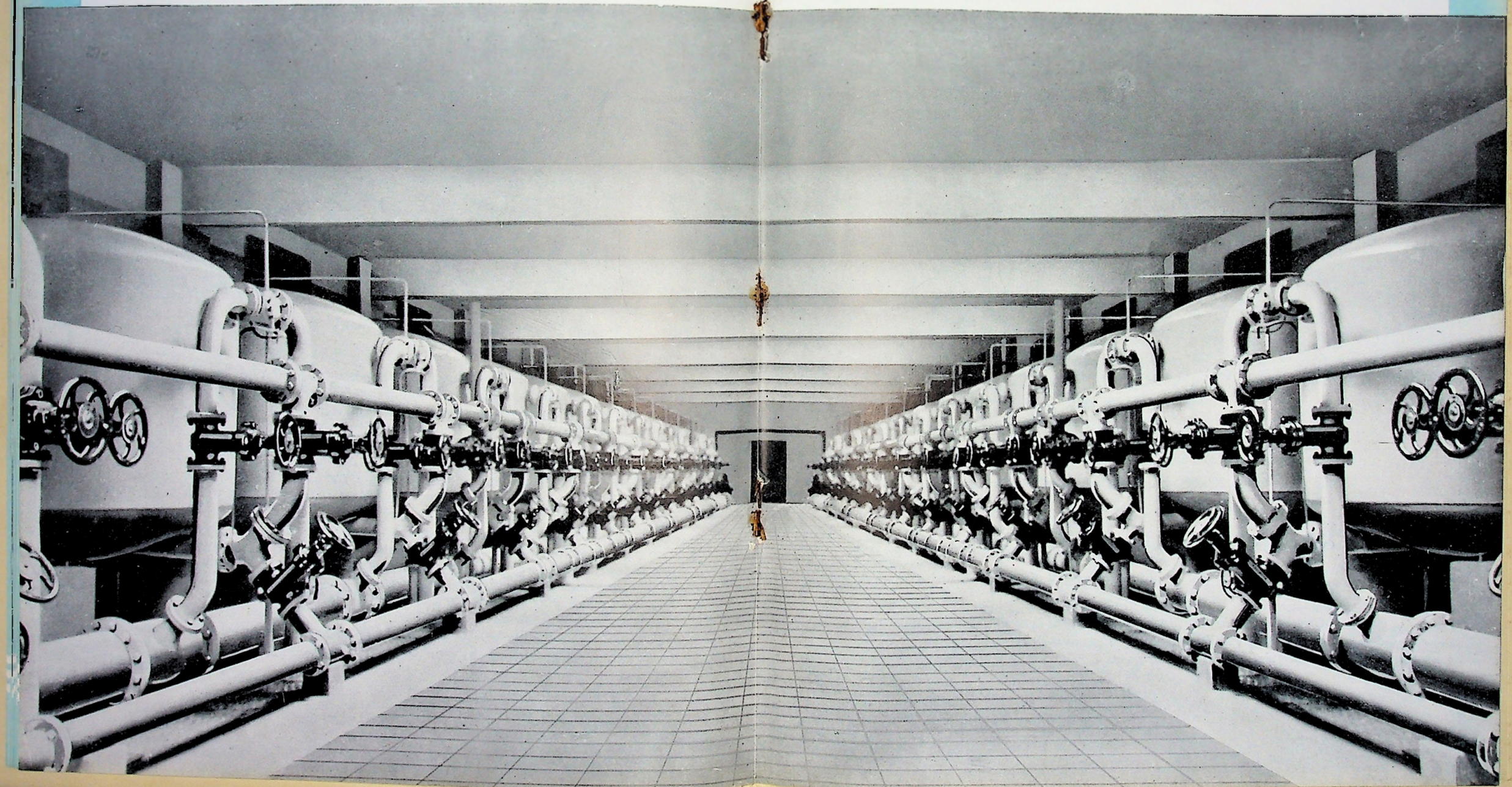
"PULSOMETER" FILTRATION PLANT IN SCOTLAND

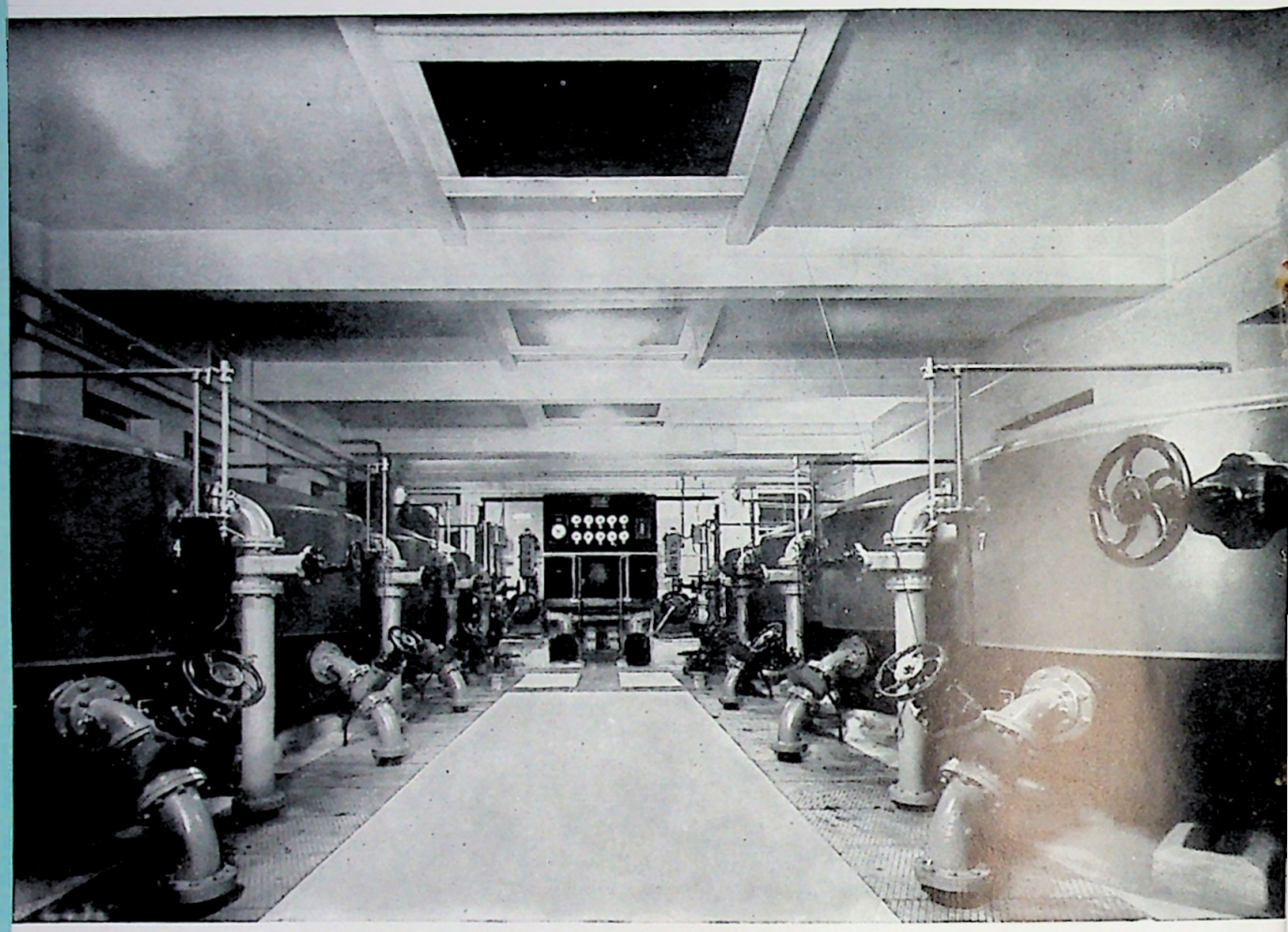
The plant contains 56 "Pulsometer" A. S. Filters, 8-ft. in diameter, and lining both sides of two bays in the filter house. Fifty of these are for continuous filtration. Six are stand-by filters to be put into operation during the cleansing of any of the filters in the main batteries.

Capacity: The plant treats over 6,000,000 gallons of water daily, to produce a filtrate fulfilling all the requirements of a high grade water supply.

Colour: The raw water is dark in colour and slightly acid. By the "Pulsometer" process this is reduced to 5 (or less) on the Platinum Cobalt Scale, and the filtrate is of the alkalinity required, hygienically pure, and crystal clear.

The pH is controlled by continuous running centrifugal pumps, delivering lime against automatically governed valves, which are regulated by the pH recorder and controller. This is simple and reliable in operation.





"PULSOMETER" PLANT
SUPPLIED TO THE ABERDEEN CORPORATION

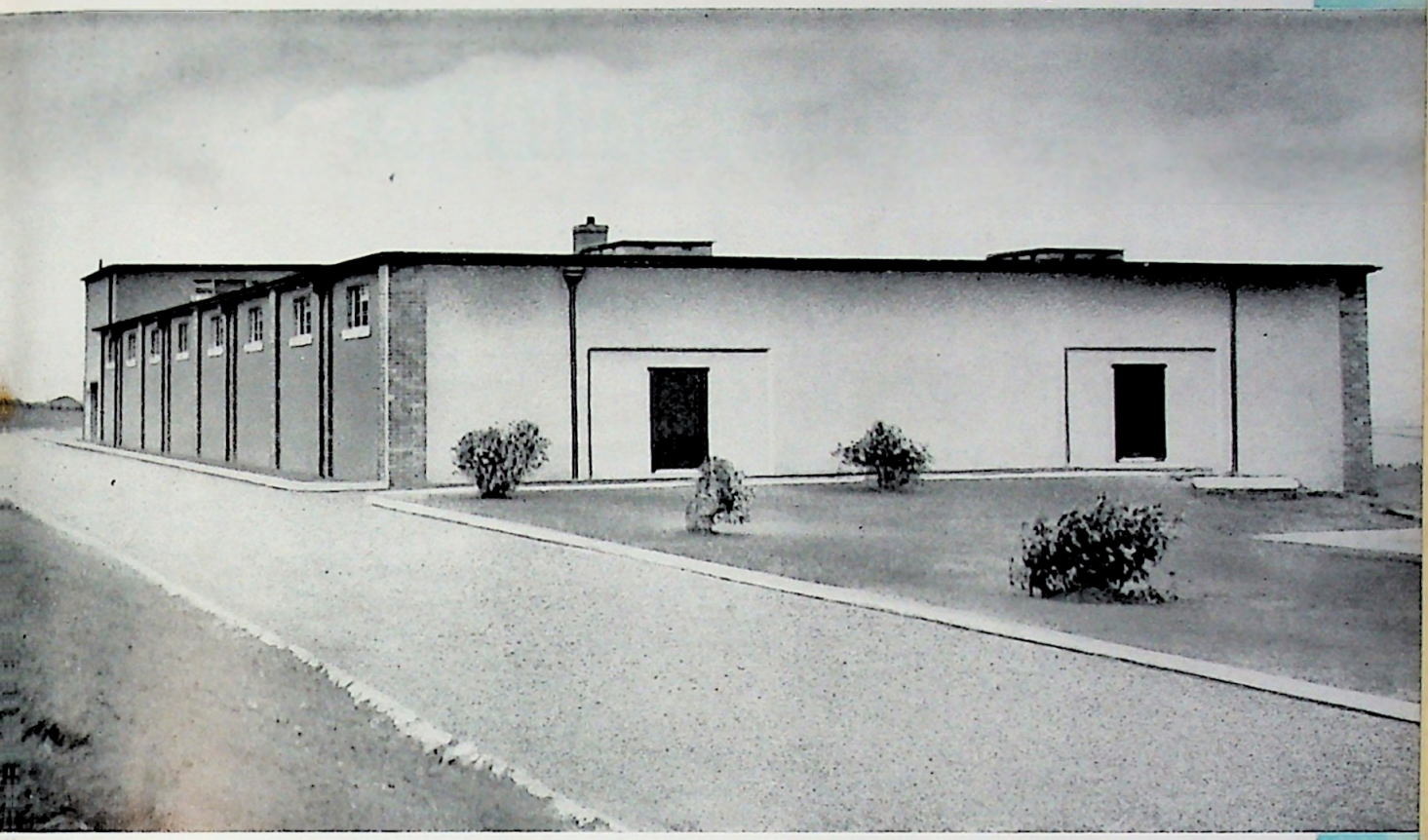
Note the instrument panel, chlorinator and pumps.

The plant treats 260,000 gallons of water in 3½ hours.

Of an older Aberdeen Plant

" We can safely say that no appreciable amount of sand has been lost by washing out."

" On opening out the older of two pumps we found that practically no wear had taken place. Impeller, shaft and wearing rings were in excellent condition. Chemical containers and meter in first class order."



A simple type of house used for covering the " Pulsometer " Filtration Plant shown on page 26.

In some instances it is possible to leave the filters exposed to the weather, but it is usually better to protect the metering equipment.

Note :—

The following summary concluded a detailed report from the City Analytical Laboratory on the filtrate shown overleaf.

" *The filtered samples were of excellent colour and free from matter in suspension. From the results of our analysis and bacteriological tests we are of opinion that they are soft waters of excellent quality, and suitable in every respect for public supply.*"

Reports on " Pulsometer " Filtrates from :

A University Bacteriological Department :

" *The water is of a high degree of purity, and is positively antiseptic. Bacteria from intestinal sources appear to be dealt with very efficiently by the purification methods employed.*"

A County Analyst :

" *Both samples are entirely satisfactory and attain the quality of a drinking water of high order of purity.*"

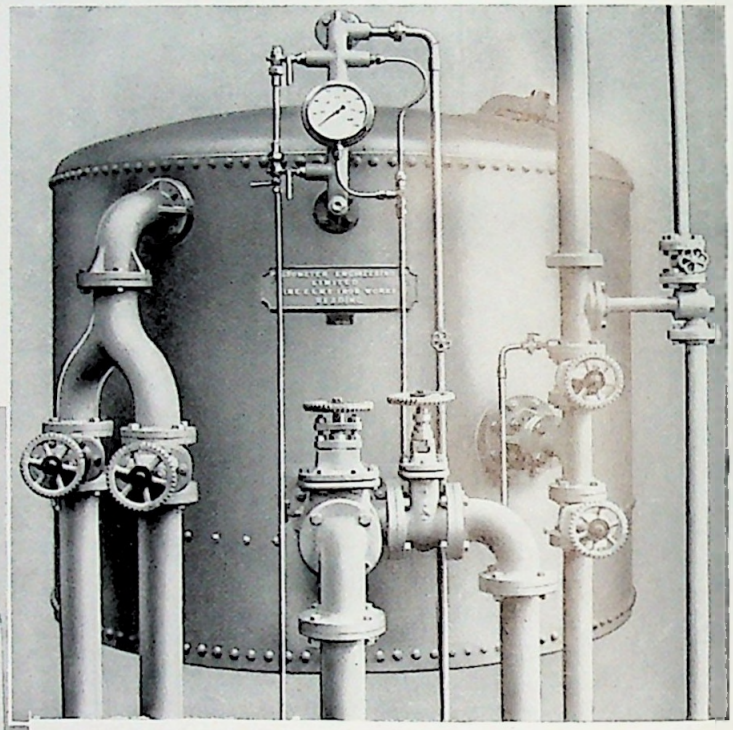
" *Chemical and bacteriological tests show water of a higher standard of purity than many towns mains supply.*"

Industrial Filters

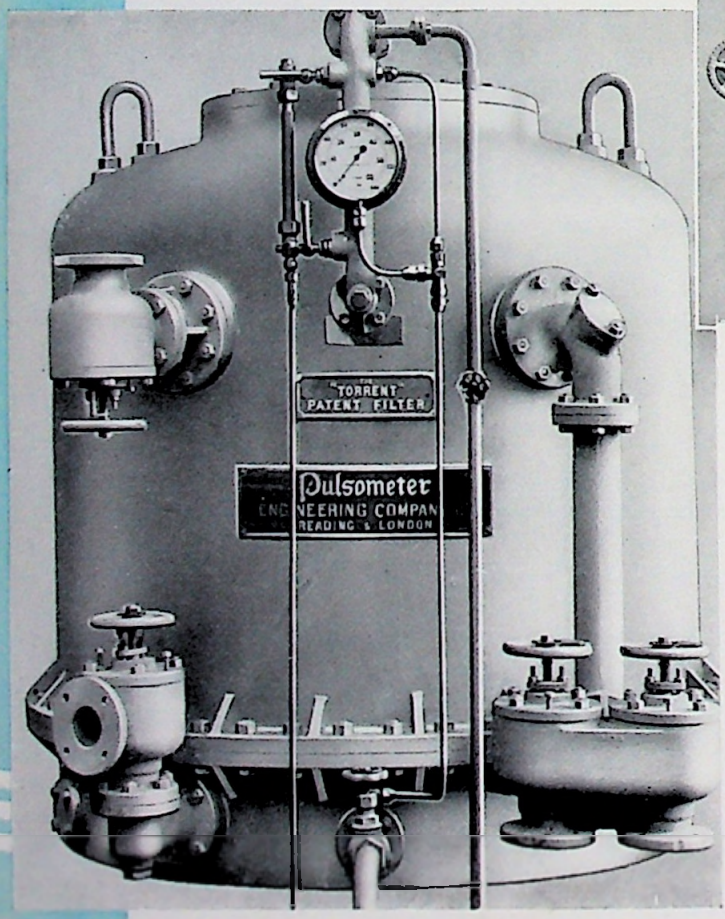
The " Pulsometer " type of filter, which is the successor of the " Thames " and the "Torrent " is the result of a varied experience covering a period of 65 years.

It satisfies all the filtration requirements of modern industry. Each plant is specially designed for the purpose in view.

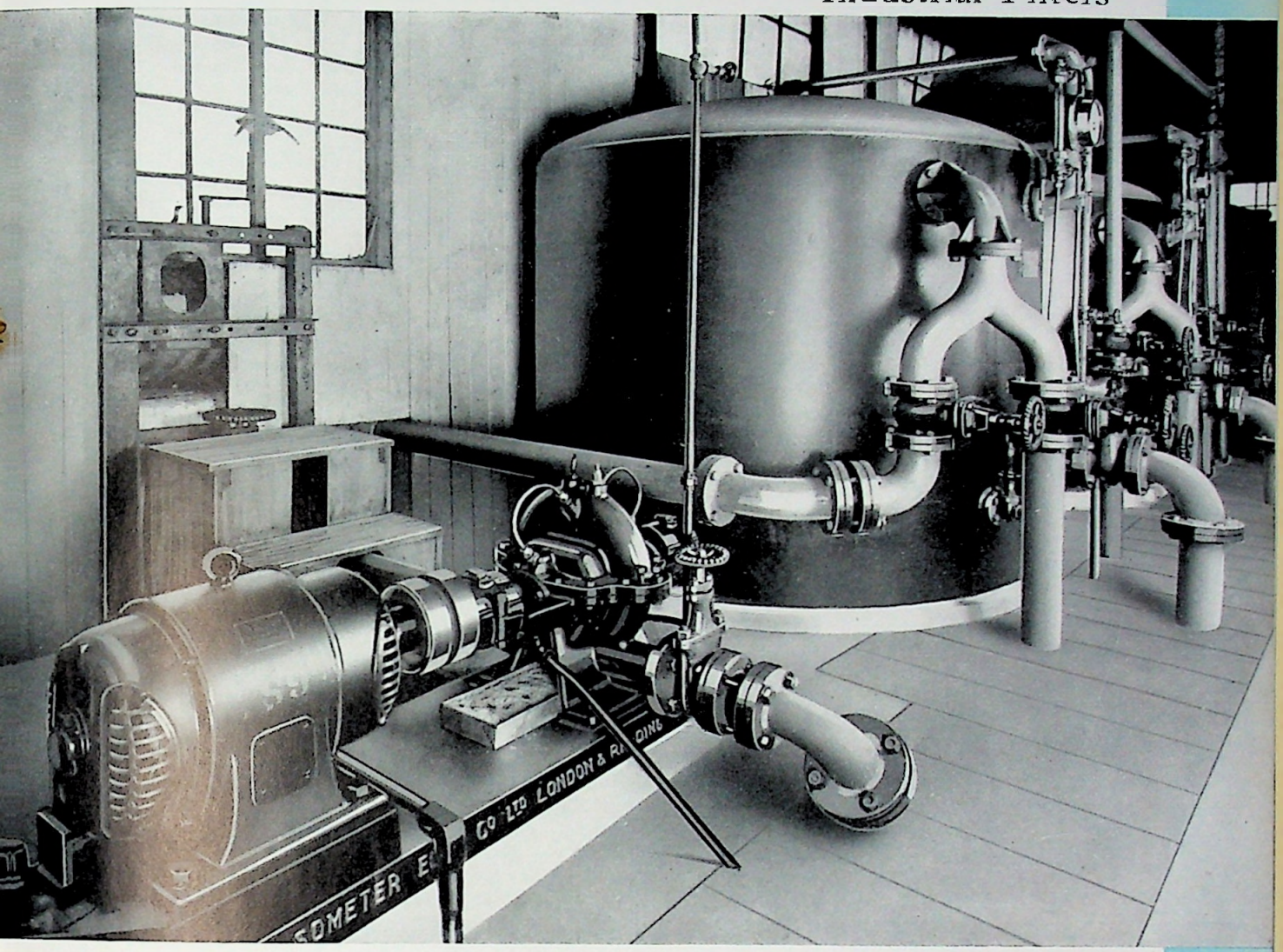
The construction is simple and robust—free from internal mechanism—easy to operate, economical in running and cheap to maintain.



One of three filters supplied to the Smithfield and Argentine Meat Co.



Filter supplied for a laboratory to Messrs. Pathescope, Ltd.



"Pulsometer" Plant in a soap works.

Two 6-ft. 6-in. diameter filters and one "Pulsometer" Split-casing Centrifugal Motor-driven Pump (120 g.p.m.). The Filters treat 6,720 gallons per hour.

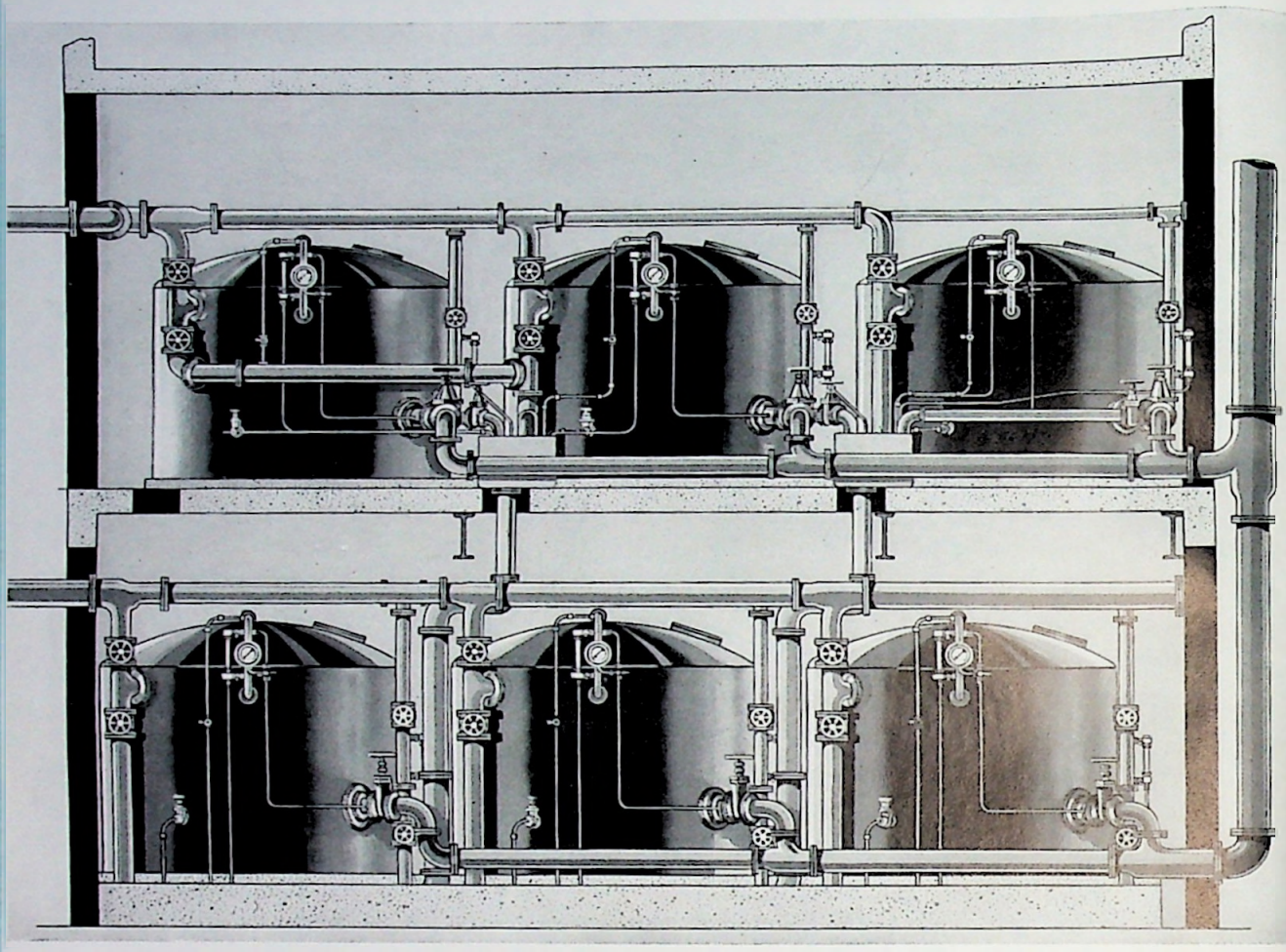
This firm writes : "The plant installed by you has given very satisfactory results, the output being considerably more than was guaranteed by you, and the quality of the effluent is in every way up to specification."

"As a qualified engineer I compliment you on the very fine workmanship and finish of your plant."

A Reference

From a baths superintendent and engineer who has had experience of various makes of modern filtration plants:

"For compactness of design and simplicity of operation, the 'Pulsometer' Filter holds unrivalled position. Its air induction is a special and economical feature as against steam for the bed agitation."



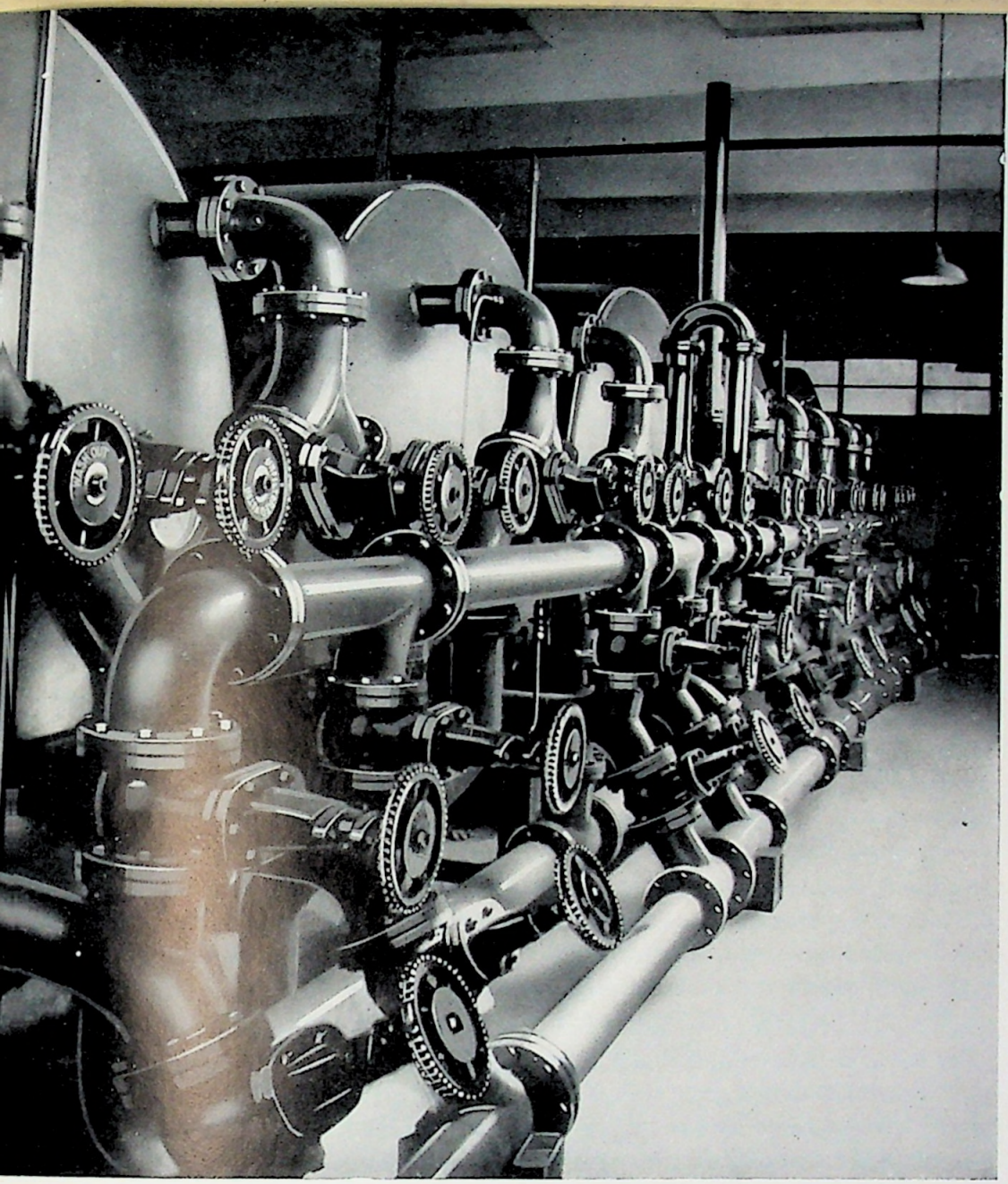
Two batteries of Filters at a large steel works.

"Pulsometer" Plant in a large Steel Works

The plant consists of two batteries of filters each able to treat 24,000 gallons of water per hour. The water, pumped from the river Don, contains a large amount of suspended matter, often very cloudy. The lower battery, first installed, was supplemented by a second battery built on a raised platform above, owing to the expansion of the works and shortage of ground space.

The high pressure air—used to cleanse the filter beds—is reduced to 5-lb. per sq. inch to prevent ejection and waste of the filter medium by careless manipulation of the filter valves. The water is filtered at a fairly high pressure, the shells being tested to 100-lb. per sq. inch to cover amply any contingency which may arise on site.

Note the compactness of the whole plant, which cannot be photographed because of the walls built round the filters.



Industrial Plant for war purposes.

Five 8-ft. (diameter) by 15-ft. Duplex Cylindrical "Pulsometer" Filters clarify 80,000 gallons of muddy water per hour. Pumping and chemical treatment plant were also supplied.

An Overseas Reference

"I have much pleasure in informing you that your filters are giving daily every satisfaction—supplying clean drinking water. The cleaning by air and water is efficient. As there are no moving internal parts to wear out in the filters, they are foolproof. The control is so simple that any coolie can manage the plant."

THE PULSOMETER Ionomatic WATER TREATMENT PROCESS FOR POLLUTED WATER

Treatment of highly polluted and turbid waters for industrial purposes presents a serious problem in purification. Installation of a new plant—the first of its kind to be operated in this country—has enabled an English paper-making firm to overcome this difficulty. Recognition of its many potential uses in overseas countries has already been clearly shown by inquiries from a papermaking firm in Australia and other concerns in New Zealand, Mexico, Iran, Syria and Kuwait, etc.

This new plant, known as the Pulsometer Ionomatic water purification plant process, installed in Lancashire on the River Irwell, treats the polluted water by using specially activated silica in conjunction with sulphate of alumina. Compared with the usual water purification process, this method economises in space and size of plant.

Clean water is a necessary component in papermaking: before being processed, paper pulp contains 95 per cent water, and an ample supply of clean water is required at all stages in making high quality papers such as white parchment and paper for cigarettes and for wrapping silver and electro-plate. Paper for wrapping silver, in particular, must have no trace of any chemical or acid ingredient for this would quickly cause tarnishing, especially in damp or humid weather.

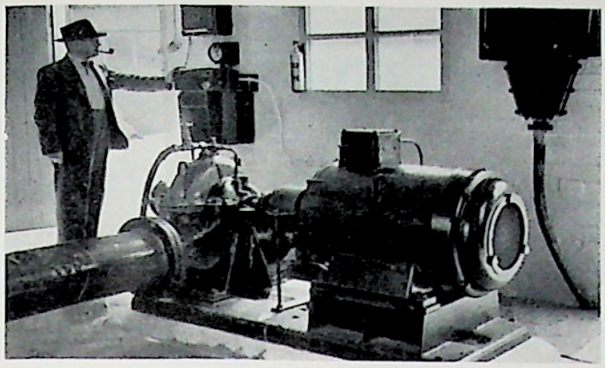
In early days, this Paper Mill employed water filtered by normal processes. Owing, however, to increased industrial activity the Irwell water deteriorated to such an extent that eventually it became too polluted to enable high-grade papers to be made, using customary filtration methods.

The new Pulsometer plant, which has completely overcome the difficulty, daily treats three million gallons of water. Before filtration, this volume passes through two settling towers: the ordinary method of clarification would have required six towers at a much higher capital cost. The reduction in the amount of chemicals used is in the ratio of two to six, and there is a corresponding saving in maintenance and supervision charges.

The raw water from the River Irwell supplied to the plant is often dark brown in colour, in consequence of the industrial effluent discharged into it, and contains patches of foam holding undesirable matter in suspension and chemicals in solution.

Colloidal matter in the raw water, which causes colour, froth and slime, carries a negative electrical charge, and advantage is taken of this fact when clarifying water by the alum method. A solution of alumina ferric

Right: an untouched photograph of the effluent in the raw Irwell water.



The Ionomatic purification plant illustrated embodies three Pulsometer H.S.L.V. 8 raw water pumps. One of them is shown in this picture. Each pump has an output of 1,000 g.p.m. against a head of 80 ft.

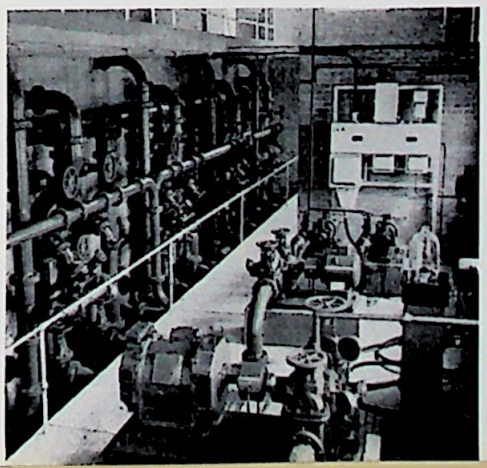
is added, causing the formation of colloidal particles and aluminium hydroxide which are positively charged. These attract the negatively charged impurities in the water, and electrically neutral particles result which coalesce to form alum floc mass.

In treating three million gallons of water a day continuously as the Pulsometer plant does, there is a large amount of alum floc to deal with and being very light, it would in the ordinary way settle too slowly. To get over this difficulty, the water, after being dosed with alumina ferric, is treated with a sodium silicate solution before it enters the settling tank, to produce activated silica with a negative charge, which unites with the organic impurities and the positively charged alum, thus adding to the weight of the floc and speeding up the rate of settlement.

Pre-filtration measures, therefore include the pumping of raw water into a dosing channel then into the concentric reaction chambers in one or the other of the Conical towers there to be gently agitated. The resulting floc described above, falls to the bottom of the cones and is periodically drawn off as sludge. The water thus clarified, overflows into a sill on the outer annular portion of the towers and is fed by gravity to the filters. Whenever necessary, the water is drawn through the filters with the aid of the filtered water booster pumps. The whole design is new.

The two towers of the plant are able to deal with more water than the present gravity filters. The advantage of this is that more gravity filters can be added at reasonable cost, should the paper mills demands increase, without the expense of adding new towers.

Design and construction of the plant has been carried out by the Pulsometer Engineering Co. Ltd., whose own pumps have also been employed.



A general view of the filter house, showing the control valves. One of the filtered water booster pumps is seen in the foreground.

THE PULSOMETER Ionomatic WATER TREATMENT PROCESS

For the treatment and clarification of highly polluted and turbid waters the Pulsometer **Ionomatic** treatment process is the only reasonable approach to a complete solution of a difficult problem.

The illustration on page 3 gives a dramatic demonstration of the saving in space and in size of plant to be achieved by employing this process for the treatment of highly polluted river waters.

For purposes of comparison, the chain-dotted figures in the diagram show approximately the additional plant required for orthodox methods of treatment of the same water. This is one illustration of the many advantages of the **Ionomatic** Treatment Process.

An equally important feature is that control and application of the process are reduced to their simplest essentials, with corresponding saving in maintenance and supervision charges.

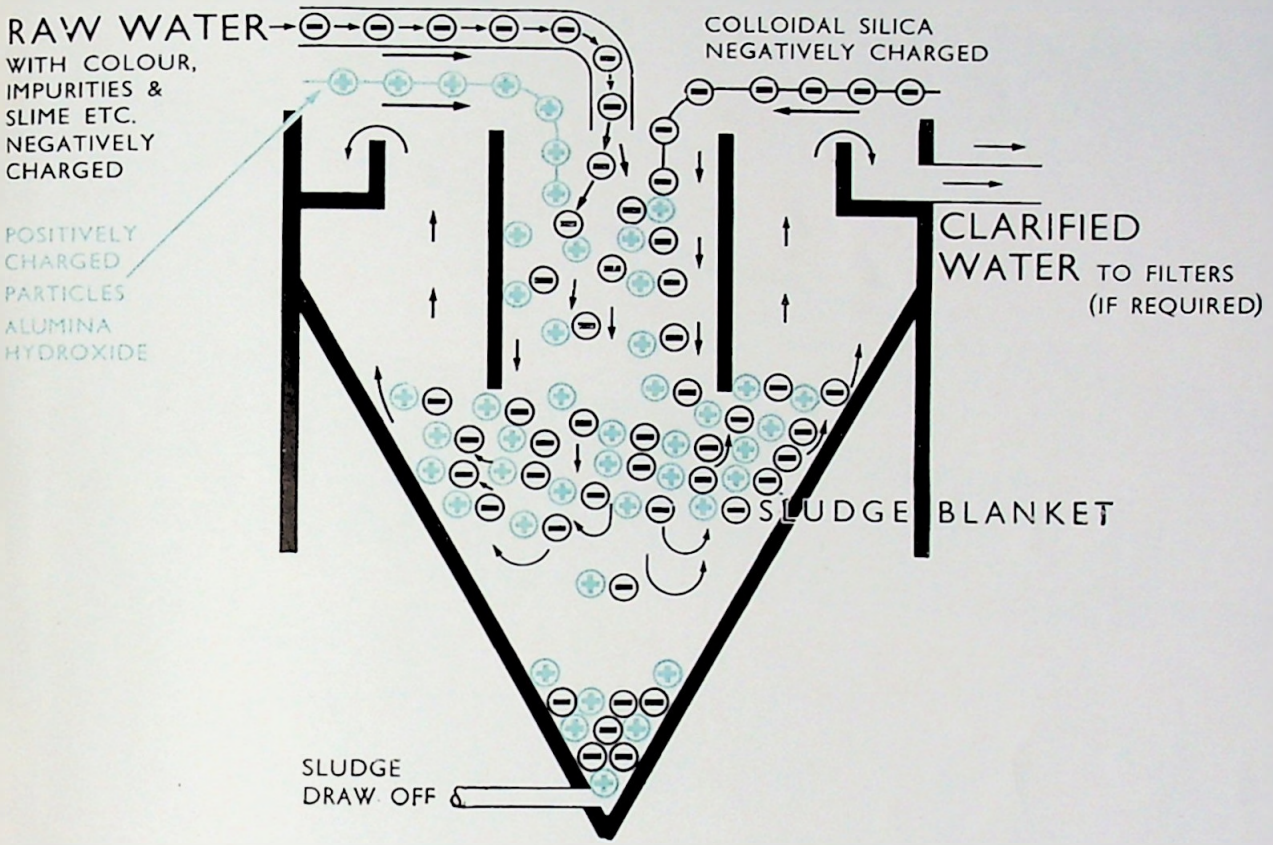
The Pulsometer **Ionomatic** Process employs the most recently developed scientific principles of ionisation for accelerating the rate of precipitation of solid, colloidal, and other matter in suspension in the water treated. The bare essential principles on which this advanced process is based are illustrated on page 37 in diagrammatic form. The rate of precipitation of the ionised particles is so high that the major proportion of the foreign matter is removed rapidly from the water before filtration.

This feature permits a considerable saving in the amount of plant, in the precipitation area, and in the number of filters required, with corresponding reduction in space occupied, capital costs, and maintenance charges. This is only one of the many Pulsometer Water Treatment Processes that are available for industrial and domestic water treatment.

Have you a water treatment and filtration problem ?

If so, let us advise you regarding the best type of plant to install so that we can offer the most economical unit for your purpose.

THE PULSOMETER Ionomatic WATER TREATMENT PROCESS

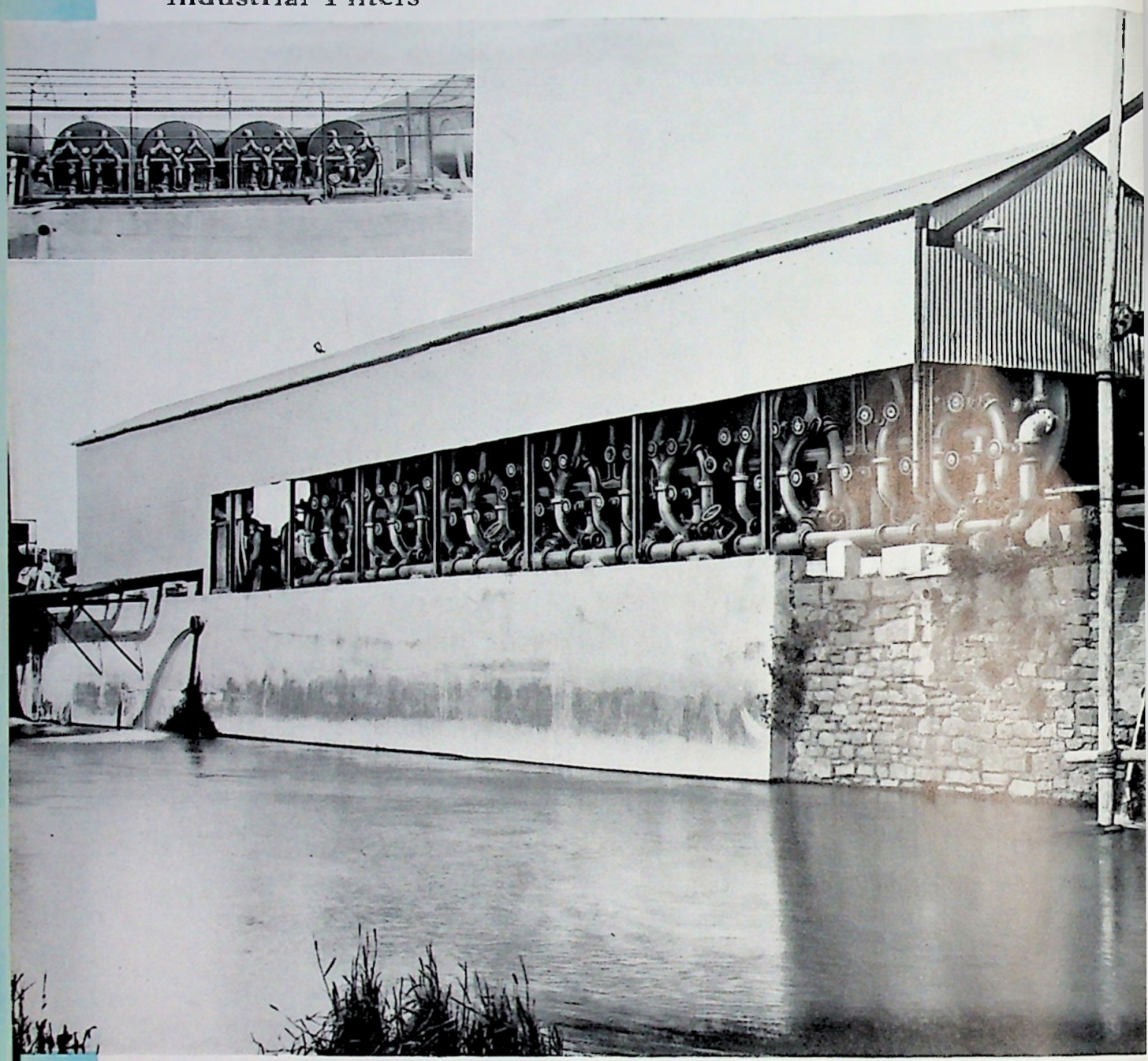


Typical flow diagram for Pulsometer **Ionomatic** sodium silicate treatment for removal of solid matter from heavily polluted water

As an example of what can be done, the photograph on page 3 shows a Pulsometer **Ionomatic** Water Treatment Plant of most advanced design.

This most recent process is not of universal application but, where the water contains a considerable amount of suspended matter, such as industrial pollution, this plant may well prove to be the answer to your problem.

You can rely on us to advise you as to the type of plant most suitable for your requirements and to consider your interests first in making our recommendation. Our study of your problems will include not only capital costs, but total operating costs, and any other factors which are applicable.



A Paper Mill's Plant

Capacity: Seven horizontal filters, each 8-ft. diameter and 26-ft. 6-in. long, treat 150,000 gallons of river water per hour, at a pressure of 100-ft.

Two "Pulsometer" Horizontally-split Motor-driven Pumps assist in adding the necessary coagulating agents to the incoming water. A "Hydrair" Motorless Air Compressor connected to the filtered water supply is used for the cleaning operation.

Swimming Baths

FILTRATION FOR SWIMMING BATHS

Introduction

The swimming bath or pool has become almost as necessary to the modern community as the bath to the modern home and swimming now forms part of the curriculum of most educational institutions. Gymnasia, universities and schools of standing, together with many public resorts, hotels, parks, etc., advertise the possession of swimming facilities as a special advantage.

With this modern tendency is a demand for a high sanitary standard to prevent bacterial growth from polluting water used by a large number of persons.

Stringent tests and numerous testimonials prove that if the plant is operated in accordance with instructions, water treated by the "Pulsometer" system attains the purity of drinking water, and is always, in the words of a baths master, "beautifully clean, clear, sparkling, devoid of taste or smell," and "the apparatus manufactured by the Pulsometer Engineering Company is without equal."

The extreme clarity of "Pulsometer" treated water has had unexpected results. Desjardins, the American diver, was unable to carry out his programme at one bath until a swimmer had travelled across the surface to disturb the water, and so enabled the diver to see where the water began.

Confirmation from Port Seton

"*I am more than satisfied with the water treated by your plant. It is the cleanest, clearest and most sparkling I have ever seen in any pond.*"

And from Durham

"*Your plant has turned a dull and unclean pool of* 90,000 *gallons capacity into a lake of crystal clearness, and by test, of greater purity than that of our domestic supply. It has proved our greatest advertising medium and greatly increased the number of our patrons at a negligible cost.*"

Swimming Pool at Robert Gordon's College.

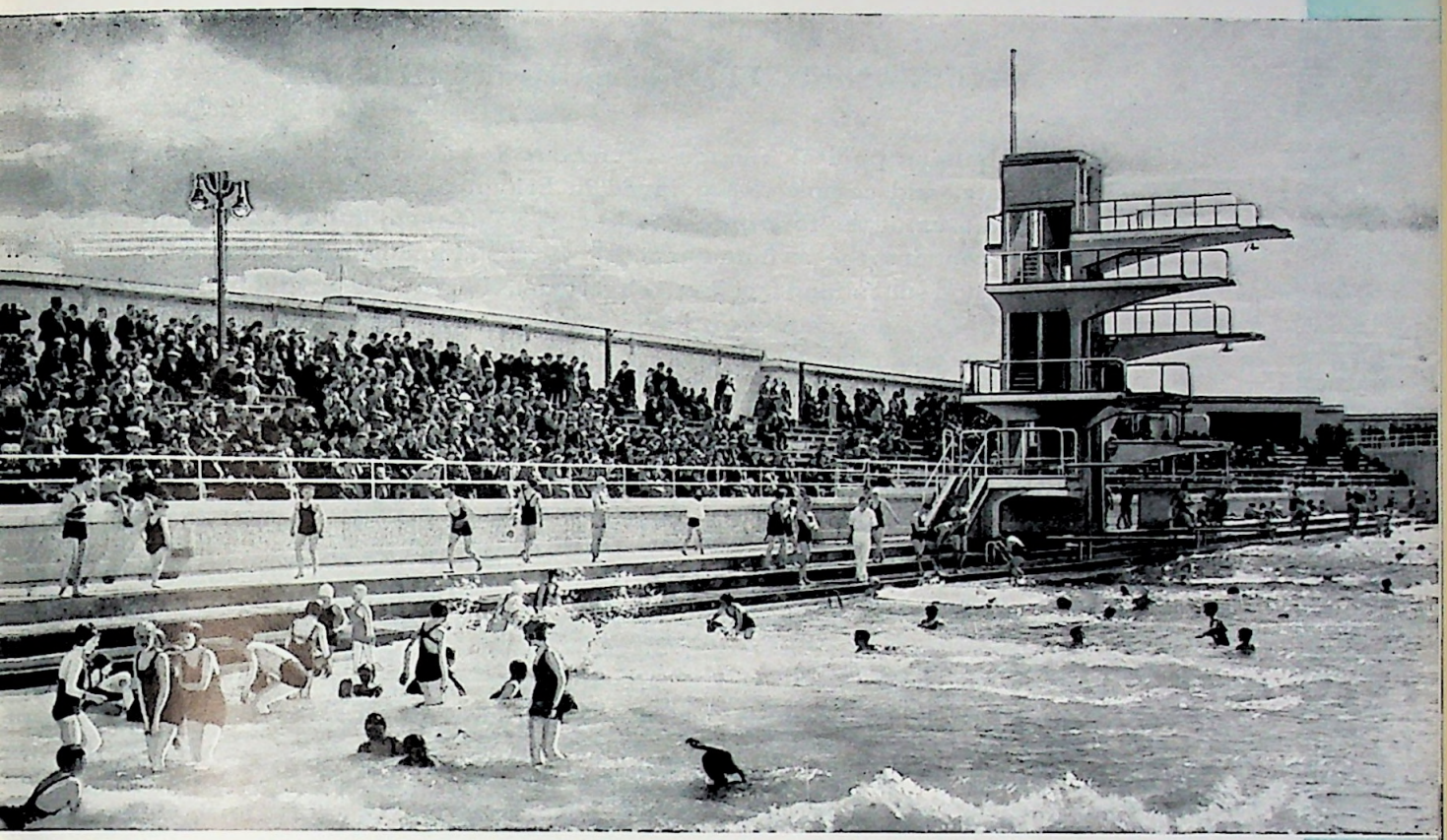
An untouched photograph showing the clarity of the water.

Capacity

74,000 gallons of water are treated every four hours at the rate of 210 gallons per sq. foot per hour, by two 7-ft. 6-in. (diameter) A.S. type "Pulsometer" Filters.

From a boys' school:

"*Although the boys have been bathing two and three times a day almost the whole term, the water is beautifully clean and clear and has been much admired by everybody.*"



PORTOBELLO BATHING POOL, EDINBURGH
(The largest in Scotland)

Capacity: One and a quarter million gallons of sea water, taken from the Firth of Forth, treated by two "Pulsometer" Filters and chemical gear.

Testimonies from

A Pithead Bath:

"*Highly pleased with the ease of working of your plant and the condition of the effluent . . . Have had absolutely no trouble since the beginning.*"

A Miners' Welfare Swimming Bath:

"*As engineer and clerk of works during the installation of your filtration plant, I write to say the job is satisfactory and working very efficiently. The filter has had a very stiff test on untreated river water, and it has done splendidly. Your erector has given attention to details and left a job very pleasing to the eye.*"

WESTON-SUPER-MARE SWIMMING BATH

The swimming pool at Weston-super-Mare is one of the largest, most up-to-date, and completely equipped in Britain. A centrally situated, enclosed area of the foreshore—325-ft. by 370-ft.—adjoining the promenade, contains the swimming pool with its administrative buildings, dressing and sunbathing facilities. Every detail in the design and building material have been chosen to provide beauty, scrupulous hygienic cleanliness with maximum convenience.

The pool is 220-ft. long and 140-ft. wide with a normal capacity of 760,000 gallons of sea water, which a "Pulsometer" purification plant keeps constantly clean, clear, sparkling and according to reports, is bacteriologically comparable with a good drinking water.

Before filtration, the water, heavily charged with sand and silt is drawn from the sea into an 80,000 gallon capacity tank to precipitate the suspended matter. Later it is pumped through three elliptical "Pulsometer" Filters being chemically treated and sterilized before entering the pool through eleven inlets, one of which makes a constant cascade.

During the season the water is continuously drawn from the deep end of the pool, then strained, filtered, sterilized and aerated before it is returned to the shallow end in a sparkling condition.

The illustration on the opposite page shows the bath with its diving stage, considered to be one of the most beautiful in Europe.

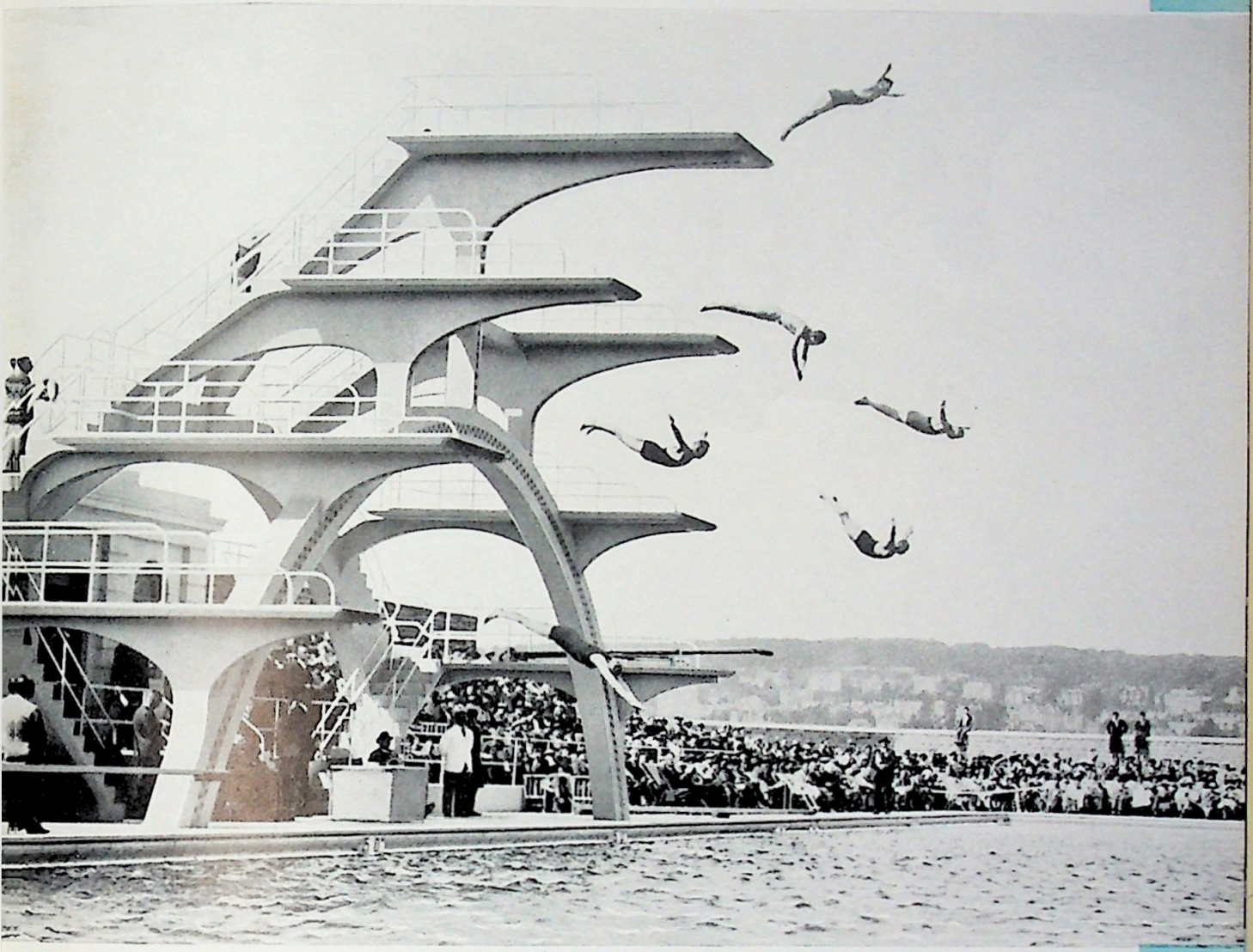
References from:

An English Municipality

"*The condition of the water has always been sparkling and attractive and a recent examination has shewn that bacillus coli and streptococci were both absent in* 100 *c.c., and bacillus enteriditis sporogenes absent in* 250 *c.c. Such a report speaks for itself and I have no hesitation whatever in recommending your purification plant.*"

A Sea-Beach Bathing Pool in Wales

"*Our difficulty was sand, and we have managed to get rid of same by suction sweeper. Bathers have remarked on the clearness of the water. Several firms have sent their engineers including two who were then building pools. They were much impressed and took full details.*"



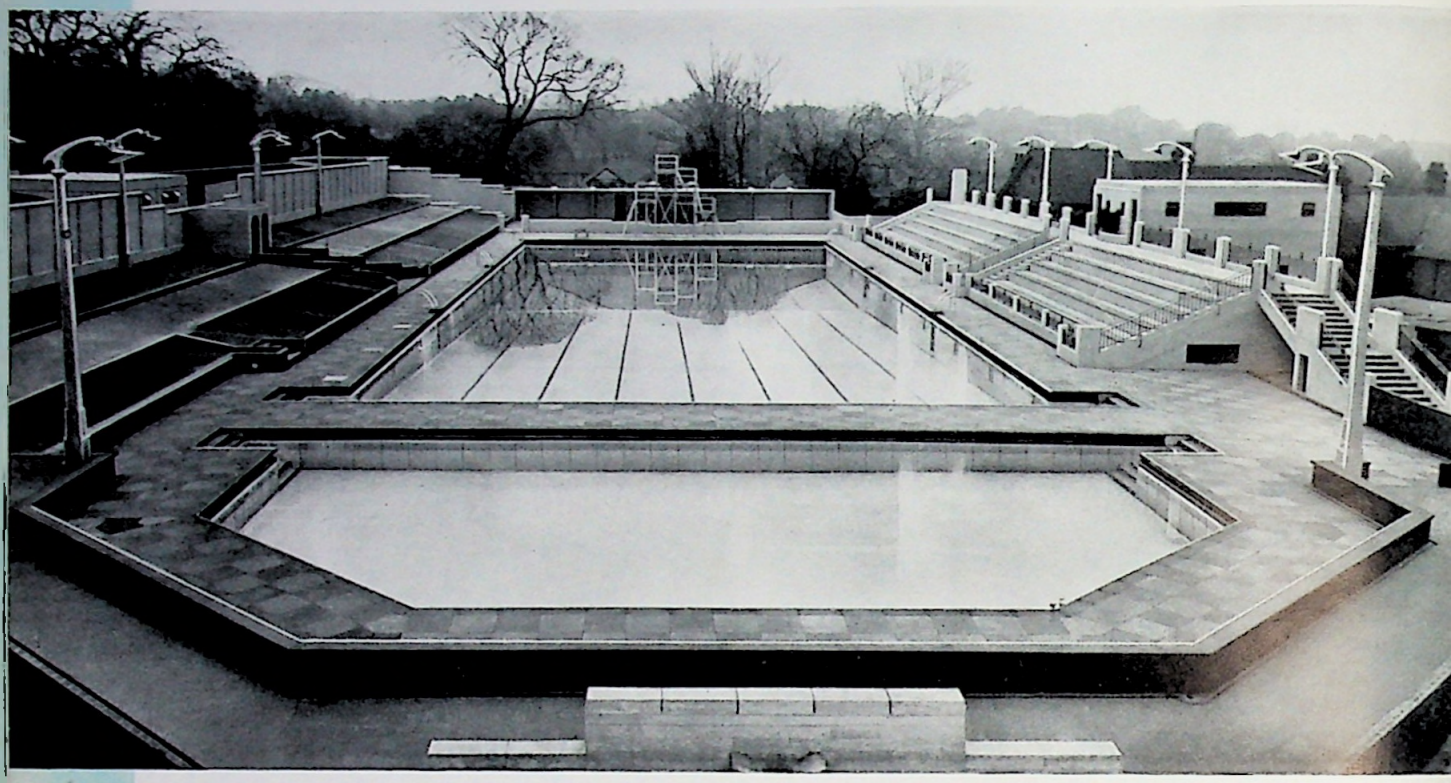
Weston-Super-Mare Swimming Bath and Diving Stage.

An Opinion from Falkirk:

" Your plant has been taxed fairly heavily owing to the abnormal number of bathing loads, as this is an industrial area. I opened up my filters this month, and the surface of the sand beds were as level as six years ago.

" The clarity of the bath water is such that deputations from other areas, on seeing it, remark on this.

" Bacteriological and chemical analysis proves it to be sterile and to conform to the standard laid down by the Ministry of Health, for the purification of water in swimming baths."



Broom Hill Bathing Pool, Ipswich, and Children's Swimming Pool.

The Broom Hill Bathing Pool, one of the finest in England, is 165-ft. long, by 60-ft. wide. A "Pulsometer" Plant with a total capacity of 155,000 gallons of water per hour gives a three-hour turnover—probably the shortest of any open-air bath in Great Britain.

The water, drawn through a suction main with an auxiliary draw-off from the scum channel across the deep end is passed through a strainer box, and picked up by two "Pulsometer" Split-casing Centrifugal Circulating Pumps which carry it to the filter plant. The pumps are designed to harmonise with the purification cycle and control the quantity of water.

The battery consists of four air-scoured filters, each 8-ft. 6-in. in diameter, by 19-ft. 3-in. in length. A hydraulic air pump provides the compressed air without extra power, and controls the rate of washing, thus removing the risk of ejecting the sand or overloading the motor.

The children's swimming pool nearby is 60-ft. wide, by 37-ft. 6-in. long, and the total capacity of both pools is 464,000 gallons. The water is chemically treated and heated.

WEST BROMWICH SWIMMING BATHS

The purification plant for three swimming baths in West Bromwich—the new first-class bath, a second-class bath and a learner's bath—was supplied by the Pulsometer Engineering Co., Ltd.

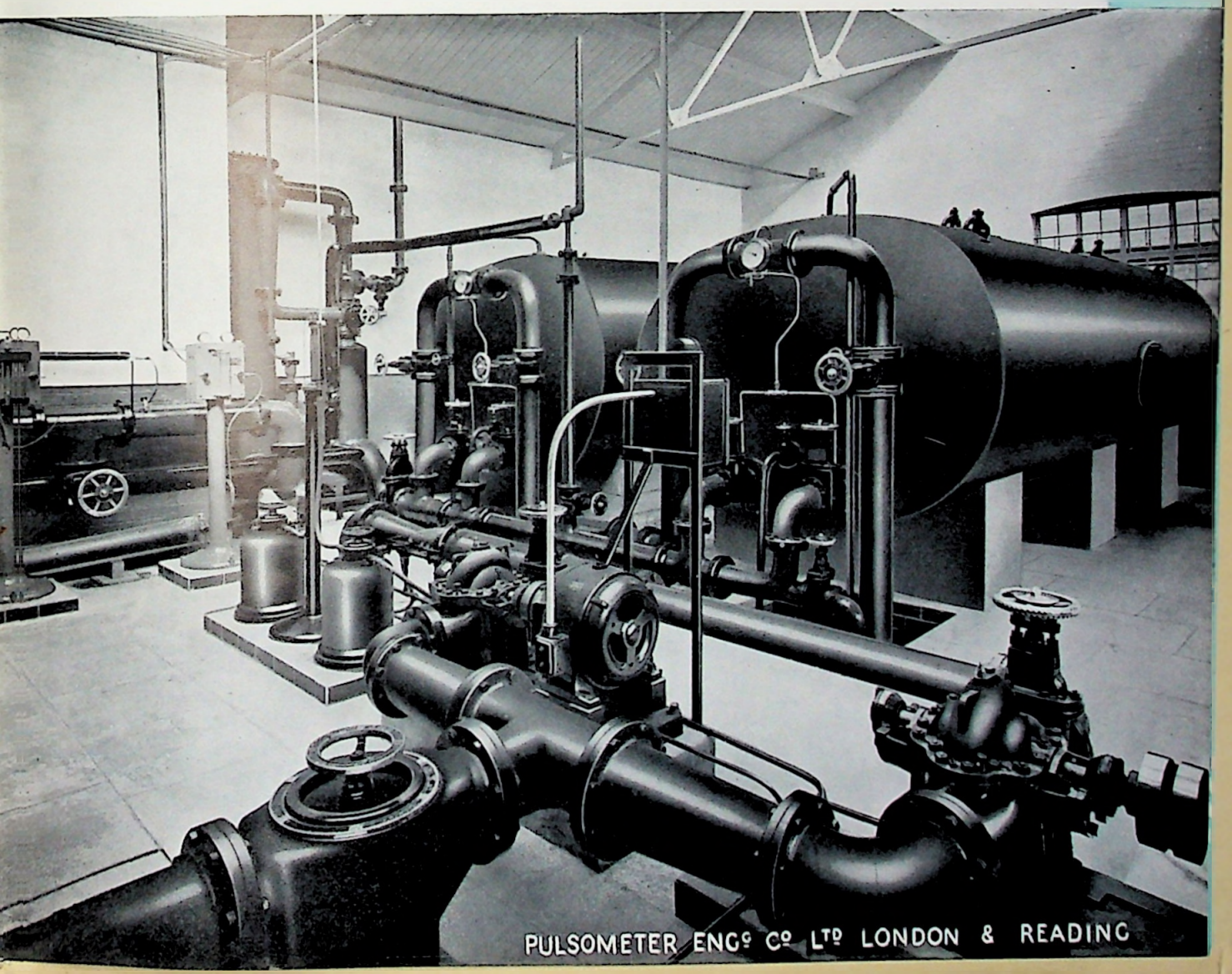
The plant—shown below—and rated to treat 258,000 gallons of water in four hours, consists of two horizontal duplex elliptical filters, each 19-ft. in length, designed so that one filter can be washed at a time. Two horizontally-split casing pumps supplying the water for the filters and the "Hydrair" Hydraulic Air Pump fitted into the filtered water main leading to the aerator, are also made by the Pulsometer Engineering Co., Ltd.

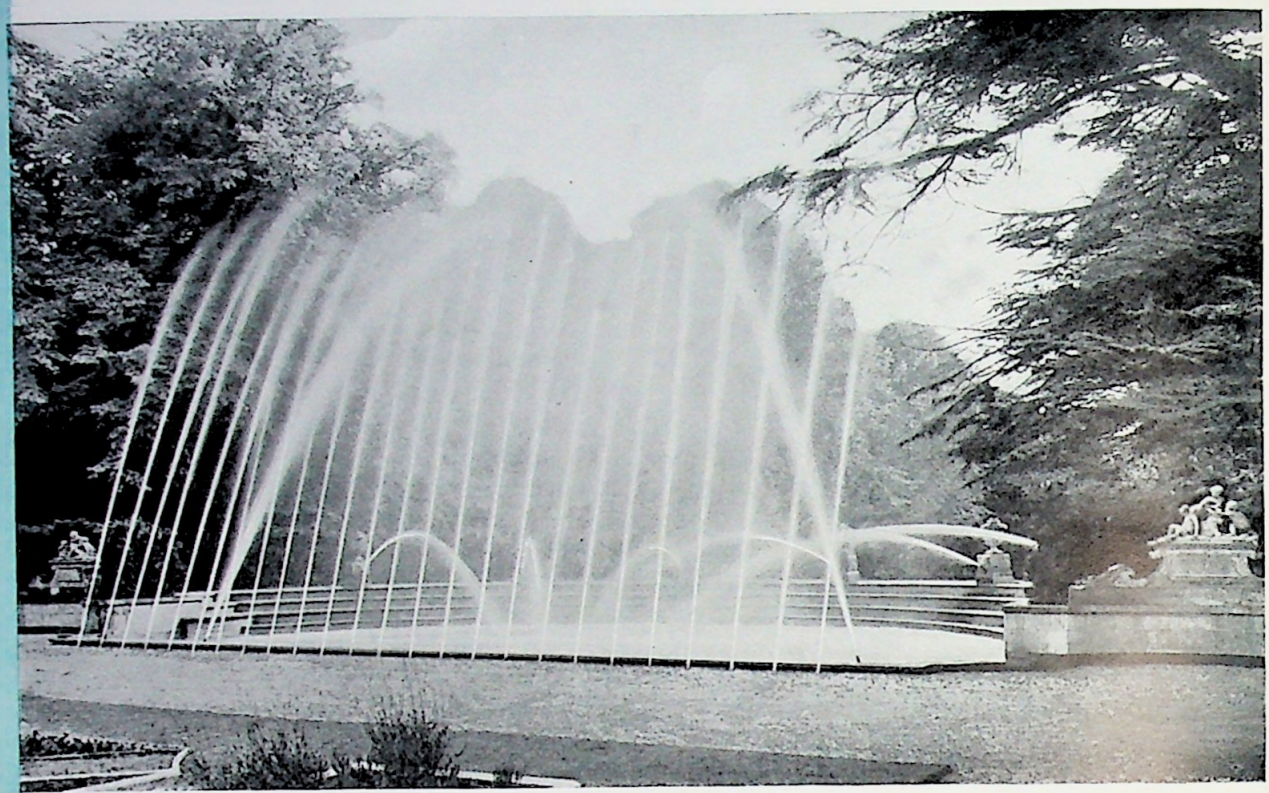
Two coagulent re-agents are injected by "Pulsometer" parallel feed chemical gear, the flow meter giving the rate of injection.

The Engineer writes:

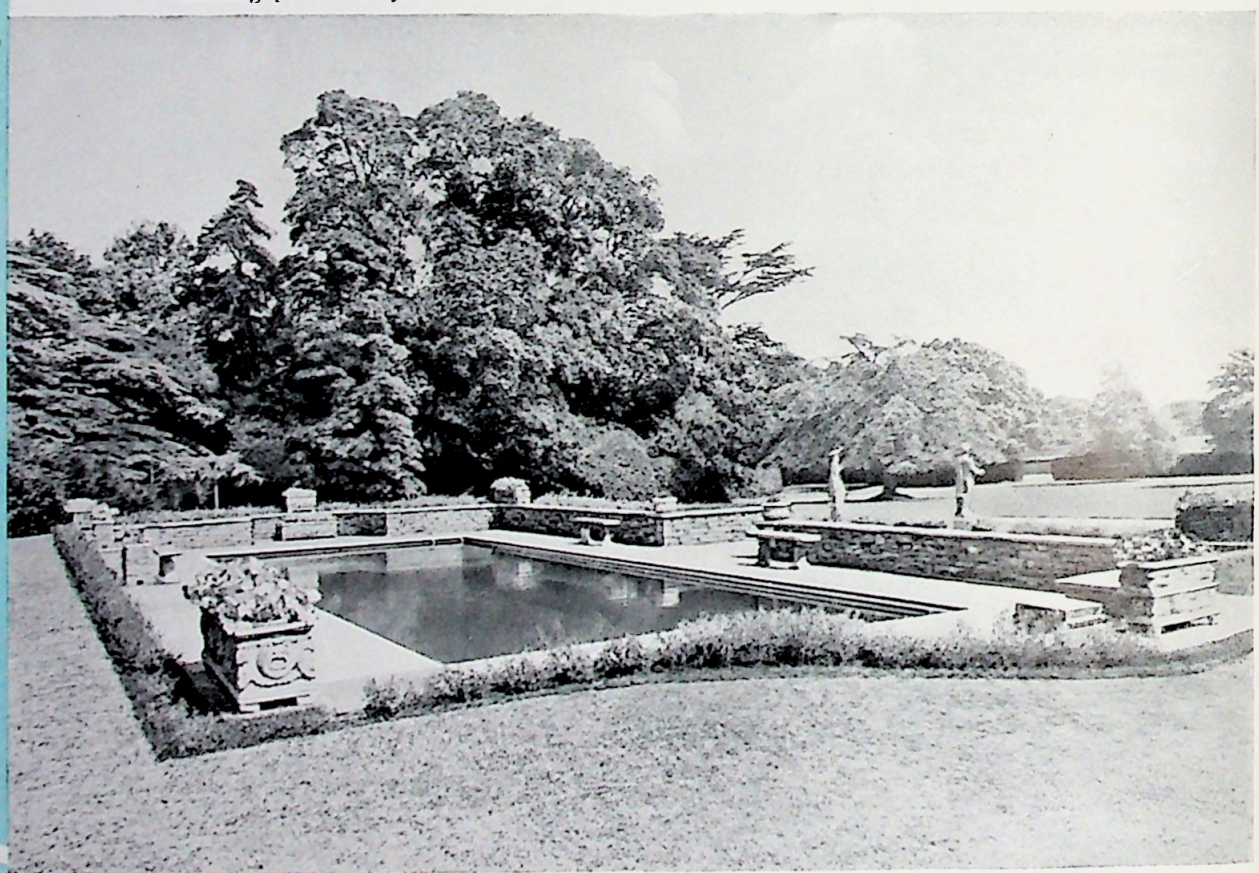
"*A really good job. One of its greatest advantages—not observable—is the design, strength and wearing possibilities of the air and water nozzle system. The West Bromwich job can be used as freely and as frequently as you may need, as a reference.*"

"*After seeing this plant I can honestly place 'Pulsometer' Plants prior to any.*"



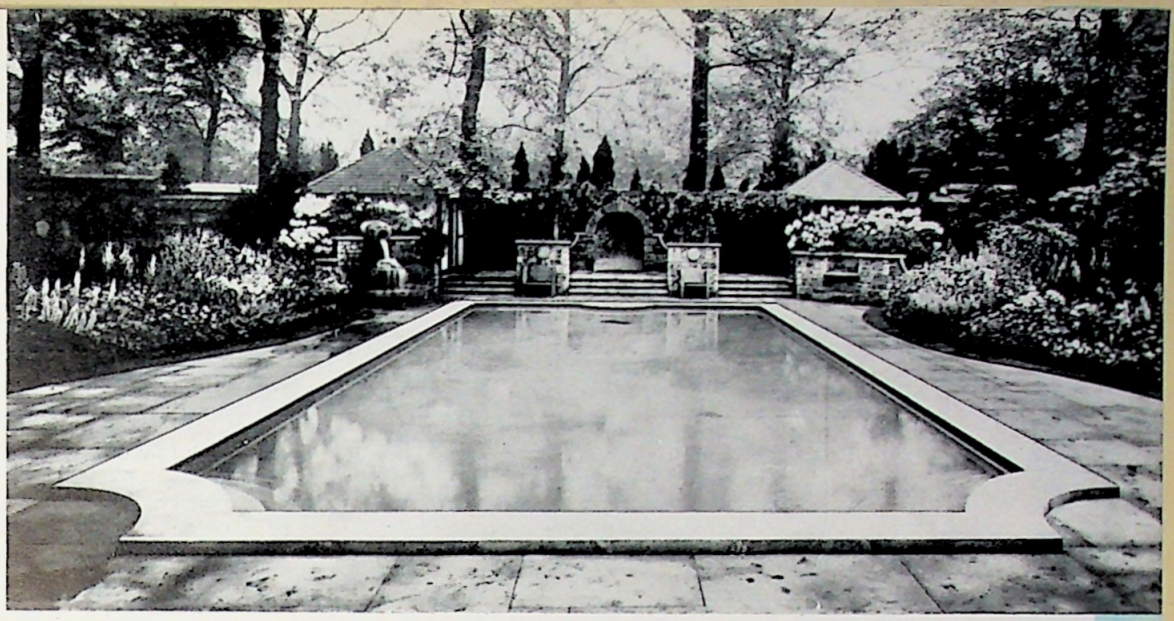


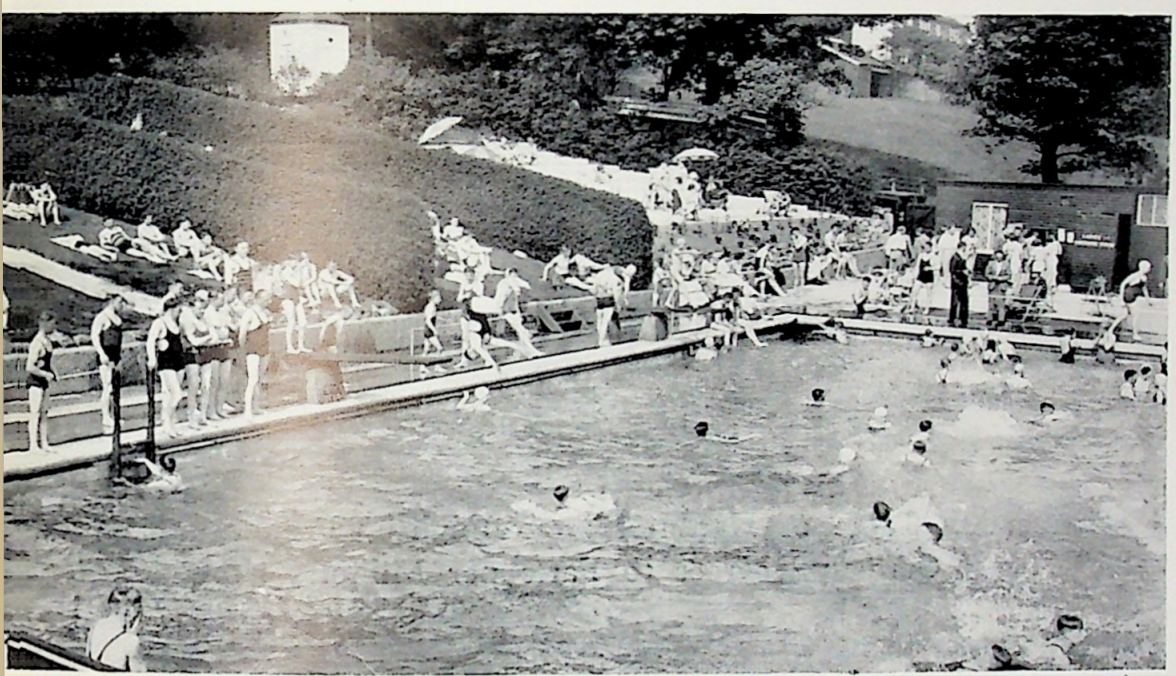
Swimming pool with jets to form a water curtain when the pool is used for bathing.



Both pools were constructed by Wm. Wood & Sons, and the water purified by " Pulsometer " Plants.

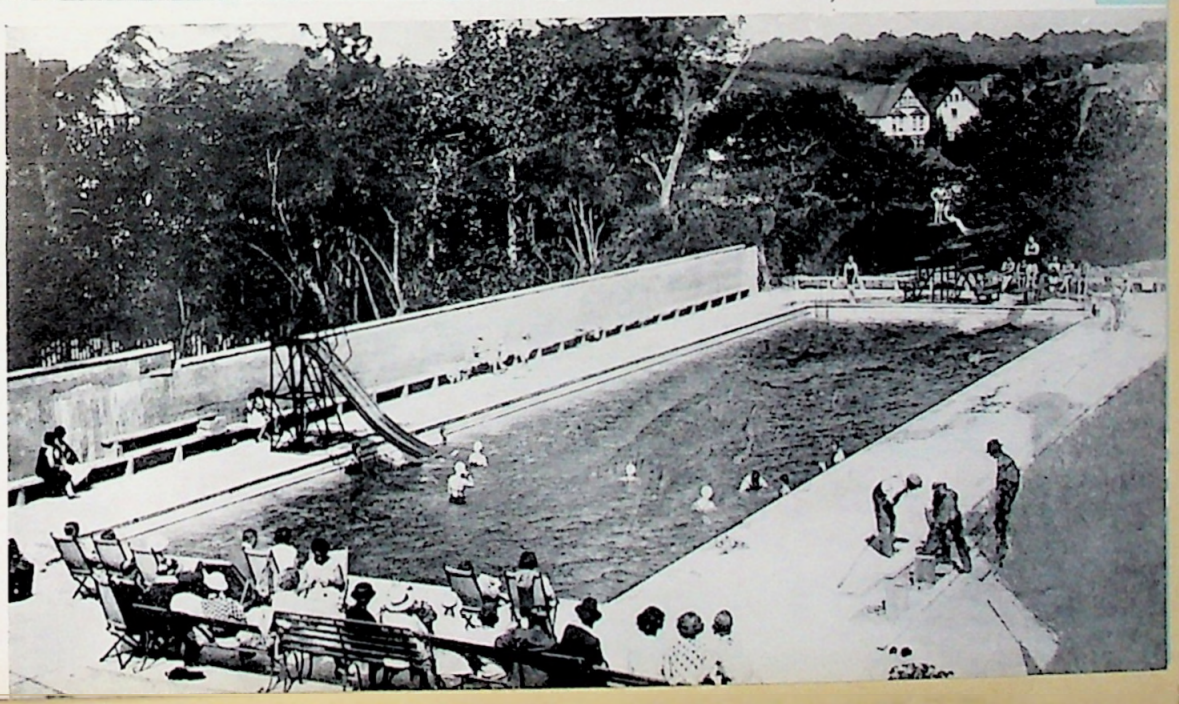
Private
Swimming Pool
with a
"Pulsometer"
Plant.





Ashgrove
Swimming Pool
in
Holmfirth.

Hotel
Metropole
Swimming Pool
in
Llandrindod Wells.



USEFUL DATA

Equivalents of Chemical Proportions

	Grains per Imp. Gal.	Grains per U.S. Gal.	Parts per 100,000	Parts per 1,000,000
1 Grain per Imperial Gallon	1.00	0.83	1.43	14.3
1 Grain per U.S. Gallon ...	1.200	1.000	1.72	17.2
1 Part per 100,000	0.70	0.58	1.00	10.0
1 Part per 1,000,000	0.07	0.580	0.10	1.00

Equivalent Measures

	Imp. Gals.	U.S. Gals.	Litres	Cub. Feet	Cub. Metres	Cub. Inches	Pounds
1 Imperial Gallon	1.00	1.20	4.54	0.16	0.0045	277.27	10.00
1 U.S. Gallon ..	0.83	1.00	3.79	0.13	0.0038	231.00	8.34
1 Litre...	0.22	0.26	1.00	0.04	0.001	61.03	2.20
1 Cubic Foot ..	6.24	7.48	28.32	1.00	0.028	1728.0	62.37
1 Cubic Metre ..	220.0	264.0	1000.0	35.32	1.00	61027.0	2204.0

Conversion Table of Hardness from English, French and German Degrees to Parts per Million

	Parts per Million	Clark Degrees	French Degrees	German Degrees
Parts per million	1.0	0.07	0.10	0.56
Clark or English degrees ...	14.3	1.00	1.43	0.80
French degrees	10.0	0.70	1.00	0.56
German degrees	17.8	1.24	1.78	1.00

Note.—English degrees of hardness, Clark scale, are equivalent to grains of calcium carbonate per imperial gallon, and are multiplied by 14.3 to give parts per million. French degrees of hardness represent parts per hundred thousand of calcium carbonate, and are multiplied by 10 to give parts per million. German degrees of hardness represent parts per hundred thousand of calcium oxide, and are multiplied by 17.8 to give parts per million of calcium carbonate.

TABLE OF CONTENTS

Pulsometer Engineering Co. Ltd.

READING
Nine Elms Iron Works

Telegrams "Pulsometer, Reading"
Telephone READING 67182/3/4/5

39, Victori 1

Telegrams "

LONDON
Offices:
Pulsometer House,
20/26, Lamb's Conduit Street,
London, W.C.1

Telegrams: "Pulsometer, Westcent, London.
Telephone: Holborn 1402.

BRANCH OFFICES

	Telegrams	*Telephones*
Birmingham—Central House, 75, New St.	"Pulsometer, Birmingham"	Midland 0474
Cardiff—25, Charles Street	"Pulsometer, Cardiff"	Cardiff 30033
Glasgow—180, West Regent Street	"Pulsometer, Glasgow"	Douglas 7836
Leeds—16-17, Cavendish Chambers, 91, The Headrow	"Pulsometer, Leeds"	Leeds 26143
Manchester—208 Corn Exchange Buildings	"Pulsometer, Manchester"	Blackfriars 4045
Newcastle-on-Tyne—57-60, Sandhill	"Pulsometer, Newcastle-on-Tyne"	Central 23421-2

SOME PURPOSES for which "Pulsometer" Filters have been supplied:—

Municipal Water Supply
Industrial Water Supply
Domestic Water Supply
Chemical Works
Gas Works
Boiler Feeding
Dairies
Soap Manufacture
Hydraulic Power Supply
Cinematography
Swimming Bath Purification
Brickworks

Cotton Spinning
Steel Works
Jam Manufacture
Lead Manufacture
Glass Manufacture
Linen Weaving
Laundries
Dyeing and Finishing
Rubber Manufacture
Collieries
Paper Manufacture
Hospitals, etc.

Abridged Conditions of Sale

Whilst we use our best endeavours as regards the design, quality of material, and construction of machines which we supply, no condition or warranty, express or implied, is made or given in respect thereof. We undertake to replace or repair any part of any such machine which is proved to have been originally defective in material or construction, if returned to our works, carriage paid, within six calendar months from the date of delivery. Save as aforesaid, we undertake no liability in respect of goods which we supply, whether in respect of design, material, construction, or otherwise, or in respect of any matter arising directly or indirectly from any defect therein, or in respect of any failure to complete or deliver the same by any specific date, whether they shall be required for any particular purpose or not.

Although every care has been taken in preparing this catalogue, all data and illustrations must be considered as approximate, and subject to revision without notice.

Tillotsons (Bolton) Ltd.
Bolton and London