# PAPER No. 105.
# THE METERING OF WATER SUPPLIES.

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In Architecture there is a well known saying which states that " The Arch never rests " implying that its thrust is always actively opposed to the inertia of the walls.

In a Water Works Distribution System a somewhat analogous state prevails, the water under pressure being continually on the look out for any way of escape from its imprisonment and one of the principal duties of the Water Works Engineer is to carry on an incessant and vigilant watch in order to see that the water escapes only in the proper manner by valves and taps.

In this struggle the water is aided greatly by nature, and invokes the aid of forces such as frost, heat, rain, chemical action, gravity, all of which bear their part in helping to break down the prison walls.

In addition to fighting nature, the Engineer has also to see that there is no abuse of his orthodox method of allowing the water to escape, and that valves and taps are not left open for longer than is necessary for the Public to get sufficient for their legitimate needs.

A properly equipped Water Works, therefore, must be adequately supplied with meters of various sorts, and certain accessories, in order that the Engineer may satisfy himself that his distribution system is in order and that the loss due to waste and leaks is kept at the irreducible minimum. Without meters a Water Works may be compared to the business of a tradesman who keeps neither books nor weights and measures.

The result in either case is bankruptcy, and many Water Works in India have already reached this stage in that those responsible although levying taxes for an adaquate and constant supply, yet are unable to give this, and the tax-payer has to be content if he can get water for a few hours morning and evening.

The cause of this is fairly well known, and is largely attributable to the custom of allowing house connections without meters, this results in reckless waste which in its turn causes an intermittent supply, and this again is the cause of taps being left open, and so a vicious circle is created.

The remedy lies in metering, and this should be applied not only to House Connections, but to the whole system of mains, and the proof of its value may readily be appreciated from the experiences of Simla, which is the seat of the Imperial and Local Governments in the Summer

and is fully metered. The town has a water borne sewage disposal system, the roads are watered, and nearly every house except in the Bazars has a garden ; there are many large Hotels and Government Offices with Sanitary Installations. Yet the consumption per head in the month of May 1918 with an unrestricted and continuous supply was only 14 gallons per head per day, and for the whole year the average was 11 gallons per day. During May 1925 in similar condition the consumption was 14·5 gallons per head. This may be compared with the consumption in Calcutta which in the year 1918-19 was 33 gallons per head of filtered water and 31 gallons of unfiltered, or a total of 64 gallons, and steps are being taken to raise the supply to 100 gallons per head per day.

Even making every allowance for the greater temperature and the fact that Calcutta is a Commercial town yet the comparison is striking.

I will now deal with the question of house metering.

Broadly speaking there are 2 classes of meters :

(*a*) " Positive " in which the measuring is done by the filling and emptying of a chamber of known capacity. This may be done by Pistons or by the revolution of a disc or shuttle in a chamber, in each case the strokes or revolution are communicated to a train of wheels actuating the pointers in a dial or a counter.

(*b*) " Inferential " in which the measuring is inferred by the revolution of a fan or set of vanes, which movement is communicated to the dial as in the case of the Positive meter.

A comparison of the two classes shows that each has its points, the Positive is considerably the more expensive, but is more accurate, and will measure a dribble which would not move the Inferential meter, which is lighter and smaller. The Positive requires a greater head of water, and though when in perfect order some types of the Positive meter will work with a surprisingly small head (even as little as three feet) yet when new and stiff or when old and dirty considerably greater pressure is required.

Assuming that a Municipal Committee is anxious to adopt a system of House Meters, they should first make up their minds to do so thoroughly and systematically, and realize that to buy a few meters and fix them half heartedly with an untrained staff is simply waste of money.

On the other hand, just as " Rome was not built in a day," so a Meter Department must be built up gradually, experience must be gained, and men must be trained, and seldom are there sufficient funds available for metering a town straight away.

The first thing is to provide a proper workshop, this should have water laid on, and provision for testing meters with a pressure if possible above the ordinary working head.'

The Workshop should have a well paved floor of tiles or concrete, sloped to a central drain, and the walls should be amply provided with substantial shelves in tiers for storing meters.

The rental charged is an overall rate of Rs. 12 per year irrespective of size or type.

Besides periodical cleaning, meters must be read regularly, and probably a monthly period is the most suitable, and for this purpose the town should be divided into districts and a day allotted in each month for the reading of all meters in each district.

The number of readers must depend on the size of the town and the facilities for locomotion. In Simla where the work must be done on foot and the town is scattered there are 3 readers for 850 meters.

The readers work directly under the water Works Inspector, who is also responsible for the staff of mistries.

In the latter there are 4 mistries of various grades and 2 blacksmiths.

But this staff is employed on work connected with the entire distribution system as well as metering it not being possible to keep men only for meter work as the bulk of this is carried on during the winter.

## WASTE WATER DETECTION METERS.

In addition to the meters on the connections of all private consumers, no water supply can be kept under proper control without Waste Water Meters, originally known as Deacon's meters from the inventor, but now made in various forms.

To the Engineer, who wishes to prevent waste, and keep a check on his distribution system, these are indispensable.

The house meters will tell him of waste and undue consumption with the consumers, but there still remains his net work of mains, all liable, however well laid, at any moment to accident which will cause waste of water.

Such accidents arise from innumerable causes, expansion and contraction may loosen the lead joints, concussion due to an intermittent supply, or sudden closing of valves may cause pipes to crack, or joints to start leaking, or harm to fittings. In the Hills frost may cause considerable damage to the smaller pipes.

If the packing of glands of sluice valves, leather washers of fire hydrants, balls of air valves, etc., are not renewed such materials rot and cause leakage.

Another very fruitful cause of leakage particuarly in the hills is due to subsidence. I have seen a 3" Cast Iron main broken as though cut with a knife by a piece of road subsiding a few inches, or the whole main may go bodily leaving behind the broken ferrules of house connection.

Moreover it must be remembered that there are few mains that have no weak places. That part of the joint at the bottom is often not so well caulked as the more accessible portion, the joints may be kinked, or not quite central, thus causing the lead to be thinner on one side, the laying may have been (and frequently is) entrusted to ignorant Contractors.

All these factors tend to leakage, and the Waste Water meter is the only reliable method of detection.

Leakage sometimes is visible, and this depends on the soil and the extent of the leak, but in the Simla hills consisting of fissured slates and shales, it is very rare to find any superficial indications, in fact I have had a 3" pipe burst 1 foot below the surface of the road which remained dry and dusty, and have frequently experienced leaks up to 30,000 to 40,000 gallons per day with no external evidence.

The Waste Water meter as designed by Deacon is extremely simple and consists of a disc which, by the velocity of the water is made to travel up and down a cone.

The disc is attached by certain wires to a counter balance and a pencil, and the latter marks on a 24 hour revolving chart the actual flow per hour.

It is usual to divide the distribution system into districts, each of which is controlled by a Waste meter.

The size of this district can only be decided by the man on the spot but roughly speaking it should not be larger than will give the Inspector time to make his test in the night working hours when the flow is at its minimum, and this is generally from about midnight to 5 or 6 a.m. depending on the seasons and local conditions.

That is to say the Inspector must be able to close all his valves and do his necessary inspection and test in say 6 hours.

If he cannot do so, then the district is too big. Moreover the record of the meter on the diagram tends to get confused when the district is too large.

A very necessary accessory of the Waste meters is a requisite number of valves, so that the mains may be divided into convenient sections.

For instance suppose it required to test a section of main 3,000 feet in length with no side branches or connections and with a Waste Water meter at the head. The meter will first be put in action, and the Inspector will then go to the end of the section and shut the valve, noting the time ; the effect of this will be shown on the diagram if water is flowing, and the recording pencil will rise correspondingly.

Supposing the flow before closing the valve was 900 gallons per hour and after closing it was 400 gallons per hour, then it shows that 500 gallons per hour are escaping in leaks in the section of 3,000 feet.

If such leakage is not visible nor can be located with a stethoscope, then the only means of locating it is to dig up every joint, which is obviously expensive and inconvenient.

Hence mains must be divided into shorter sections, and the length of these must be determined by local conditions, and in Simla it is found a distance of 600 to 1,000 feet between the valves is suitable.

## DISCUSSION.

MR. ASTBURY introducing Mr. Buchanan's paper " The Metering of Water Supplies " owing to the author's absence said that the Paper had come at a very opportune time. The Sanitary Board had very recently been considering that question at some length. In fact grants-in-aid had been made on two or three occasions conditional on the introduction of metering. He said that the Paper gave an account of how meters on a complete scale had actually worked.

Referring to Simla he said that there was no doubt whatever that the water-supply system would have had to have been increased at very heavy capital expenditure running to 18 or 20 lakhs but for the efficient metering under Mr. Buchanan's charge. When one considered that the Simla water-supply ranged over probably greater variations in level than in any other part of the world one could imagine the amount of water-hammer action. Then again Simla was subject to heavy frost. In spite of all those difficulties Mr. Buchanan had been able to maintain the supply with the minimum of loss through leakage, mainly by the effective use made of water-meters.

Referring to Lahore he said that in 1924 the population in receipt of water-supply was 222,000 people and that the waste through lack of metering was deplorable. The speaker here read from the " Engineering News, 1875 " a resolution passed by a Municipality, and again from the same Journal of 1925 showing how in the United States of America vested interests and political influence retarded a proposed system of metering acknowledged to be to the general interest.

R. B. AMAR NATH welcomed Mr. Buchanan's Paper both as a Member of the Congress and in his official capacity, because the question of metering had reached the crucial stage in this Province. The Sanitary Board had appointed an expert committee to report on the metering of Municipal water-supply and he was a member of that Committee. The report of the Committee came up for consideration at the last meeting of the Sanitary Board on the 18th February 1926.

(Here the speaker read from a Blue Book).

He described the difficulties of the Sanitary Department and said that the man having piped water-supply in his house put forward the maxim that " water is a free gift of God " and nobody had a right to penalize it. When the Hydro-Electric Scheme was completed it was bound to be confronted by the same argument that electricity was the result of natural forces.

He said that he was in complete agreement with Mr. Buchanan that the remedy lay in " See to the house connection as also to the whol. system of distribution." He thought that the tap inside the house should be taken care of. He also agreed with Mr. Buchanan that in the plains it would be well to use inferential meters, and experiments in Lahore showed that inferential meters were suitable and, on account of corrosion,

dry-dial meters were best. Credit was due to Col. Foster and Mr. Astbury for throwing light on the subject of metering because it was in 1924 that they volunteered to confront the Municipal Committee of Lahore on this question.

Mr. Astbury had written an able note in the form of questions and answers in which he traversed the whole ground in regard to the questions that were put to him on the subject of metering. R. B. Amar Nath Nanda read the headlines of a few of these questions to show what sort of objection was raised by an average Member of the Municipal Committee on the subject of the practicability of metering. Great stress is laid on the idea that metering is not applicable to the Indian temperament ; in fact that metering is not suitable.

One of the non-official members of the Municipal Committee had said that he was afraid that a resolution to introduce meters on piped water-supplies in smaller Municipal towns, would be a sort of engine of oppression by which they would levy blackmail on the residents by tampering with bills, etc. This was a question of the general enlightenment of the public and it could only be attained as education increased and added to the responsibility of the Municipal employees.

Mr. Buchanan had mentioned that Capital outlay for metering should be found by Municipal Committee. It had been advocated in the report mentioned that the householder should be made to pay meter-rent and that he should not be bothered by the cost of the meter, so that as soon as water-supply was installed the meter would also be a part of the installation. Mr. Astbury had also worked out Rs. 12 per annum as the cost maintenance of a single meter. Mr. Buchanan had stated the same thing ; so that every householder in Lahore would have to pay Re 1 p. m. per meter. In Simla conditions were different owing to migratory residence. He then summarised his proposals as regards universal metering :—

(1) Metering of houses for water required for non-domestic use.
(2) Metering of hotels, etc., and afterwards
(3) Metering of the ordinary houses.

MR. FOY said that in America an irrigation scheme was got up by a company and they obtained certain rights from the Senate. The rates were fixed. People who used this water bought their lands on certain lines and terms laid down in this behalf by the Senate.

MR. LINES asked if it would be a possible solution to have meters for certain Sections instead of metering several houses or blocks and regulate rates accordingly.

MR. COLYER asked whether anybody would describe the Stethoscope and gave an account of how a steel rod had been used about 20 years ago by the East London Water Works for that purpose for detecting the exact point of wastage, when a certain area of houses had been isolated by meters as the offending group.