PAPER 188.

WATER DISTRIBUTION AND ASSESSMENT OF REVENUE AT VOLUMETRIC RATES.

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It has been proposed from time to time, that assessment of water rate, from occupiers of land, should be made on the basis of actual quantity of water supplied to them. But the subject has not, so far, received the consideration it deserves. Although it is admitted on all hands that the system is, in every way, preferable to the mode of assessment in force at present, yet it has always been dismissed, in the past, on the ground of its being impracticable, under the present conditions. It is the object of this paper to show that the difficulties, to put it into practice, are not insurmountable.

General principles of water distribution and assessment.

There are three main considerations governing equitable distribution of water and assessment of occupier's rates :

(*i*) That every shareholder gets water proportional to the area of his holding.

(*ii*) That charges levied are strictly proportionate to the quantity of water consumed by each shareholder.

(*iii*) That reasonable remission of water rates is granted, in cases of total or partial failure of crops on account of reasons beyond the cultivators' control.

In the following paragraphs each one of these is examined in some detail to see how far the existing rules in force fulfil these requirements.

Equitable distribution of water.

Theoretically each outlet is designed to deliver the discharge required for the area served by it. At the time of construction or remodelling, the officers in charge see that the outlet does get its authorised discharge. But afterwards, the outlet is left to take care of itself for years, till the next remodelling. The annual check of outlets is generally made during a closure, and therefore it gives no information regarding their actual working. The outlet is looked into only if the shareholders concerned complain about shortage of supply. Even then the process of looking into is not very satisfactory. The petition is successively passed from higher officers down to the overseer or the zilladar for report. This official, in due course, goes to the site and measures the discharge

of the outlet by methods which are not always reliable. If the discharge is found equal to or more than the authorised discharge, no further action is taken.

There are at present no means of knowing the discharges of outlets from day to day and month to month. Unless there is definite proof to the contrary it is assumed that the discharges of outlets are always equal to their permissible. But a glance at the annual efficiency diagrams of any channel will show how erroneous this assumption is. What is wanted is a permanent and continuous record of the actual daily discharges of all outlets on a canal system. Then and only then, equitable distribution of water can be ensured.

Amount charged for water supplied.

The charges for water are assessed on the actual acreage of matured crops. The system is defective both from theoretical and practical considerations.

Theoretically the assessment is not equitable. For, whether an irrigator gives one watering or ten to a crop, he is charged the same amount. The system thus puts a premium on bad husbandry and definitely discourages the economical use of water.

The practical objections against the system are the large powers that have of necessity to be given to the *patwari's* staff. Suppose a *zemindar* sows a vegetable or fodder crop in a certain field which comes to maturity within two or three months. After deriving full benefit, he sows one of the principal crops, say cotton or wheat, in the same field. Now, according to rules, he ought to be charged separately for both crops. But if the *patwari*, through laziness or intent omits to record the earlier crop, it cannot always be detected. In spite of all the checks, to which his work is subjected, a large percentage of his initial record remains unchecked and has to be accepted as correct for assessment of revenue. If an officer happens to check the work, when the first crop is standing, the *patwari* pleads that the omission was accidental and he is let off with a small fine. But if the inspection is made after it has been cut and the next crop sown, neither the *patwari* nor the cultivator will divulge the fact that another crop was sown there previously and the revenue would be irrevocably lost to Government.

Conversely, a *patwari* can maliciously make wrong entries in the register for crops that were never sown. As the *zemindars* are mostly illiterate, they cannot know what the *patwari* is writing, even if they are present at the time of his booking the irrigation. The demand slips are presented to them at the end of a crop, and if the poor *zemindar* then objects to the assessment, it is much too late for anyone to arrive at the truth.

Remission for crop failures.

Under the system at present in force, *zemindars* are required to submit applications for remission specifying the field numbers and the name of the crop for which remission is claimed. These applications are forwarded to the *zilladar* for inspection and report. The *zilladar* then makes a round of inspection of all the fields for which *kharaba* remission has been claimed and he makes his recommendations according to his judgment. Of course his recommendations are theoretically subject to the orders of the higher officers, but in practice his recommendations are mostly accepted. In the case of legitimate *kharaba* remission refused by the *zilladar*, the *zemindar* has a right of appeal to the higher officers and can get redress. But in cases of *kharaba* remission allowed on good crops by the *zilladar* there is very little check. For in such cases the *zemindar* has a right to cut and remove the crop immediately after the *zilladar's* inspection so that the checking officer has no chance to reverse the *zilladar's* decision.

The system thus gives unduly large powers to the *zilladars* and many complaints of the abuse of this power are received from time to time.

From the above, it will be clear that the existing system of water distribution and assessment of canal water revenue is far from perfect. When great strides have been made by science in so many other spheres of human activity, it is rather surprising to see antidiluvian methods still in existence in the Irrigation Department.

In the following paragraphs is described in detail an alternative system of water distribution and assessment which is free from the defects described above.

THE PROPOSED SYSTEM OF WATER DISTRIBUTION AND ASSESSMENT OF CANAL WATER REVENUE.

Water Distribution.

The ideal state of affairs in water distribution would of course be the condition under which each and every outlet gets neither more nor less than its exact authorised discharge on all days that the canal is in flow. But as this is not possible, the next best thing is that every body is charged for the actual quantity of water delivered to him. For this purpose some sort of gauge or measure must exist at the outlet head and its daily readings must be recorded so as to know how much water is being discharged from it on any particular day.

Experiments have shown that the open flume is the nearest approach to a meter with a non-variable coefficient, provided its width is above 0.4 feet. It is on this assumption that the portable wooden flume is

almost invariably used to measure the discharge of outlets. If such a flume is permanently built in the watercourse just below the outlet its gauge reading will give accurate daily information regarding the discharge passing through the outlet.

A type design of the proposed watercourse flume is given in Appendix A.

This design has the advantage of extreme simplicity, requiring no complicated calculations. The minimum working head required for its modular working is only about one *hissa* which is not likely to interfere with the working of outlets in the majority of cases in the province. In exceptional cases of outlets with very poor working heads, the outlet itself can be an open flume with H=0.48.

Each flume will have an enamelled gauge of the Type shown in Plate I. The gauge reads 1.0 feet at F. S. L., 0.9 at 90% of Discharge, 1.1 at 110% discharge and so on. Readings for gauges below permissible shall be in red and above permissible in blue.

Having built such a flume in the watercourse of all outlets on a distributary system all that is necessary, is to employ some agency to record daily gauges of the flumes. In this way it will be possible for higher officers to have accurate knowledge of the working of all outlets under their charge and to be in a position to remedy the defects as soon as they occur. This in itself will be an improvement of the first magnitude on the existing system, and it is likely to increase Government revenue by ensuring equitable distribution of water.

Assessment of canal water revenue.

The unit of assessment shall be a *cusec pahar, i.e.*, one cusec of water flowing for three hours. If the discharge of an outlet is, say 1·5 cusecs, it discharges three units of water in two *pahars* (six hours) and so on. The daily discharge in cusecs of an outlet will be known from its gauge readings as described in last paragraph. The product of discharge with the *wári* of a shareholder in *pahars* will give the *cusec pahars* consumed by him. The *khatauni* prepared at the end of each crop will show an accurate account of the total *cusec pahars* of water delivered to each share-holder during the crop. This multiplied by the stipulated rate per *cusec pahar* will determine the amount chargeable.

In order to make the scheme attractive and acceptable to the *zamindar* it is proposed that, if the actual discharge of an outlet is above permissible, it shall be assumed to be equal to permissible for purpose of assessment. But if the discharge is below permissible, the irrigators will be charged proportionately less revenue. It shall be the duty of the S. D. O. to see that all defective outlets are set right at the commencement of each *kharif* crop.

The daily gauges of all outlets will be recorded by the engineering staff of gauge readers and overseers. The chief duty of the revenue staff will be to record as accurately as possible the acutal *wáris* taken by each irrigator.

The following paragraphs will show how it is proposed to carry out these duties.

The Gauge Readers.

A gauge reader will be placed in charge of a circle or *halqa* consisting of a definite group of outlets varying from 15 to 20, and his principal duty will be to record the daily gauges of all outlets in his charge. For this purpose he shall be supplied with a printed and machine numbered gauge register and he shall record the gauges in the register in ink. The Gauge Register shall be inspected and signed by the overseer in charge at least once a week. It shall be the duty of the overseer to personally inspect and check all outlets reported defective by the gauge reader, and to bring the defects to the notice of the S. D. O. who will take the necessary action to remedy the defects.

The overseer shall also be responsible to exercise frequent independent checks on the work of his gauge readers and in case of mistakes detected as a result of this check, the gauge readers shall be suitably fined.

There are about 300 to 400 outlets in an average sub-division. The number of gauge readers required works out to fifteen to twenty which is about the number employed now-a-days.

The Patwari.

The *patwari* shall maintain a continuous record of water delivered to each irrigator in his circle. A *patwari's* Circle or *halqa* will consist of eight to twelve outlets which is about the same as at present.

Water is usually taken by *zemindars* on the basis of some fixed *wárabandi* which may or may not be sanctioned by Government. Breaches of *warabandi*, called *wárashikni*, do occasionally occur, but it is always an easy matter to determine how the *wari* actually ran even a month after the date of watering.

A *patwari* can easily record *wáris* of water taken by shareholders on at least two or three outlets a day. He can finish a full round of his circle in about four days. Allowing for holidays and other miscellaneous duties, a *patwari* can be required to visit every outlet *chak* in his circle at least once a week.

The method of recording entries will be briefly as follows. The *patwari* goes to the field that is being irrigated at the time of his visit. By personal inspection and local enquiry he can work backwards and

complete the record of *waris* taken by all shareholders since his last visit.

The *lambardar* or his representative shall be required to accompany the *patwari* at the time of making entries in the *khasra*. The *khasra* shall always be open to the share-holders for inspection.

At the end of each complete turn of *waris* on an outlet, the *patwa* shall supply a copy of his entries to the *lambardar* and take his acknowledgment. The *lambardar* will then collect all the share-holders and read out the entries to them. If there is any discrepancy, the injured party shall report it at once in writing to higher officers who shall forward it to the *zilladar*. The *zilladar* shall inspect the site and check the record within one week of the receipt of the complaint. An appeal against the *zilladar's* decision shall lie with the canal Deputy Collector.

For all mistakes found out as a result of check by higher officers, the *patwari* shall be fined from his bonus, at the rate of one mark for a mistake of one *cusec pahar*.

It may here be remarked that the opportunities to a *patwari* to deliberately make false entries will be very little. There are only eight *pahars* in a day and if a *patwari* does not enter the *wari* actually taken by any one irrigator, he must of necessity wrongly charge it to some one else and the latter will certainly not keep quiet over it.

Statistical record of crops.

For statistical purposes, the canal *patwari* will maintain a separate register of crops sown in his circle. As this will not form the basis of assessment, a much simpler form than the present *Shudkar Khasra* may be used.

The entries in this register will be made only once during the currency of a crop, *i.e.*, when the crop comes to maturity.

The Zilladar.

The *zilladar* will be mainly responsible for the supervision and the checking of the work of the subordinate staff of *patwaris*. In addition to the checking of records in case of complaints against a *patwari's* work as described in last paragraph, he shall regularly and systematically tour in his section and check the entries in the *patwari's khasra* at site. As far as possible, he shall read out the entries in the *khasra* to the share-holders present at the time of his inspection and hear and settle complaints at site.

The work of the *patwari* and the *zilladar* will be checked by the S. D. O., the Deputy Collector and the Divisional Canal Officer as at present.

The *zilladar* will perform other duties, such as preparation of Khataunis, investigation of unauthorised use of water, etc., etc., as at present.

Kharaba remission.

It has been laid down as a principle that *kharaba* remission should only be granted when the failure of crops is due to causes beyond the cultivator's control. But in actual practice this fact is often overlooked.

Now if the failure is due to shortage of water, all the fields on an outlet ought to suffer equally. If the water supply has been sufficient the failure can be due to abnormal causes, such as frost, hailstorm, floods etc. In such cases also the failure cannot be confined to certain fields only. Individual isolated fields can suffer on account of either of the following two causes :—

(*i*) *Wara Shikni*. For this, the injured party can claim damages for the failed crop from the aggressor in a civil court.

(*ii*) By negligence on the part of the cultivator himself.

In both cases *kharaba* remission ought not to be granted on principle.

On the above considerations it is proposed that the present system of granting *kharaba* remission be abolished altogether. And in its place the following *kharaba* rules may be introduced.

(*i*) For failure due to shortage of water supply :—

The cases of shortage will be generally known beforehand, as under the proposed system of water distribution the record of daily discharge of every outlet will be kept by the engineering staff. In all such cases the *zilladar* will be required to make a field to field inspection of these outlet chaks and to prepare lists of fields which in his opinion require remission. No applications from *zamindars* will be necessary, but if any applications are received they will be forwarded to the *zilladar* as usual.

After the *zilladar* has submitted his report, a percentage check will be made by the S.D.O. and the Canal Deputy Collector. The case will then be submitted to the Divisional Canal Officer for orders.

The Divisional Canal Officer will consider the extent of the failure and will order a percentage remission of revenue to be granted to the outlet chak as a whole. The remission may be, say two annas in the rupee, four annas in the rupee, and so on.

(*ii*) For local failure of crops due to frost, hail storm etc :—

For such local calamities, the *zilladar* will prepare lists of fields requiring remission, on receipt of applications from the *zamindars* just as it is done at present. At least 50% of the field will be checked personally by the S.D.O. and the Deputy Collector. If the difference is found more than 10%, the whole area will be checked by higher officers and suitable action taken against the *zilladar*.

The *zamindars* shall not be allowed to cut the crop till final orders of remission have been passed by the Divisional Canal Officers.

(*iii*) For widespread failure of crops or deterioration of crop outturn the general remission will be granted by the Civil Department as it is done at present.

Conclusion.

It will be abundantly clear from the foregoing paragraphs, that the new system is designed to uproot the evil of illegal gratification and corruption amongst subordinate revenue staff. The proposed system of assessment and *kharaba* remission will automatically eradicate these evils, by taking away from the *patwaris* and the *zilladars*, the unduly large powers that they wield at present. If this object can be achieved it will be worth all the risks involved in trying this new experiment.

Incidently the proposal of fixing masonry flumes in watercourses will greatly facilitate equitable distribution of water.

Moreover the new system will provide a useful measure of the efficiency of the engineering staff in a sub-division. For, as described in paragraph 8, the *zamindars* will not be charged for extra water if their outlets draw more than permissible. But they will be charged less if the outlet is below permissible. Thus any unequal distribution of water will lead to loss of Government revenue. The net average value per cusec realized will be a ready means of comparing the efficiency of various S.D.O's. on a canal system.

In view of so many obvious advantages, it is hoped that the system will be tried on a large experimental scale. By trial, and trial alone can its real worth be judged.

APPENDIX A.

CONSTRUCTING FLUMES IN WATER COURSES.

Object of design.

It is generally admitted that at present the best known method of observing outlet discharge is by means of " The Portable Wooden Flume." But it takes a long time to observe one single discharge of an outlet and even then the observed discharge will be correct only if the observer knows all the possible sources of error and avoids them. It may be stated without any fear of contradiction that in actual practice more than 50% of outlet discharges reported by the subordinates are unreliable.

The object of constructing flumes in water courses is to provide quick and reliable method of observing discharges of outlets.

The Design.

The formula of design of an open flume is

$$Q = C\ B\ H^{3/2}$$

In the case of small flumes the value of C is equal to 3.0 provided B is not less than 0.40. Therefore

$$Q = 3\ B\ H^{3/2}$$

For the sake of standardization and simplicity of design it is proposed to make

B (in feet) = Q (Discharge in cusecs).

$$\therefore\ 3\ H^{3/2} = 1{\cdot}0.$$

or H = 0.48 ft.

The value of H in the design is thus constant and equal to 0.48. To design the flume it will only be necessary to make the discharge of the outlet in cusecs equal the width of the outlet in feet.

The design is so simple that it may be described as fool-proof.

The gauge.

A special gauge is designed for the proposed flume as shown in the type design Plate I. The gauge reading shows the percentage of the permissible discharge of the outlet, that is to say,

If the reading is1.0, the discharge is equal to permissible.

If the reading is 0.9, the discharge is 90% of permissible.

If the reading is 0.8 ,, 80% ,, ,, ,,

If the reading is 1.1 ,, ,, 110% ,, ,, ,,

and so on.

The advantage of this gauge will be self-evident.

To show at a glance whether an outlet is above or below permissible it is proposed to paint the gauge in red for discharge below permissible and blue for discharge above permissible.

Estimated cost.

The estimated cost of one water course flume works out to about Rs. 40 inclusive of the cost of the special enamelled gauge.

Working head.

The minimum modular working head of the proposed flume will be 20% of H or about one *hissa* only. This is not likely to interfere with the working of outlets in the majority of cases. In special cases of outlets with very low working heads, the outlet itself can be of the open flume type with H=0.48.

Advantages of the watercourse flume.

In addition to providing a reliable means of discharge observation of outlets, the proposed flume will be very helpful at the time of re-modelling outlets. For, if an outlet begins to overdraw, the simple raising of the crest of the watercourse flume will reduce the working head and consequently the discharge of the outlet. This of course applies to wooden shoots, pipe and orifice outlets only. In the case of A.P.Ms. the outlet itself can be adjusted at a small cost, so that in such cases the flume can be left untouched.

Another advantage of the flume will be that it will satisfy that *zamindars* better than any other existing outlet. The fact that the width of the outlet will be equal to the discharge, the *zamindars* can satisfy themselves that justice has been done to all. At present they have no visible means of knowing if the outlet is correctly constructed.

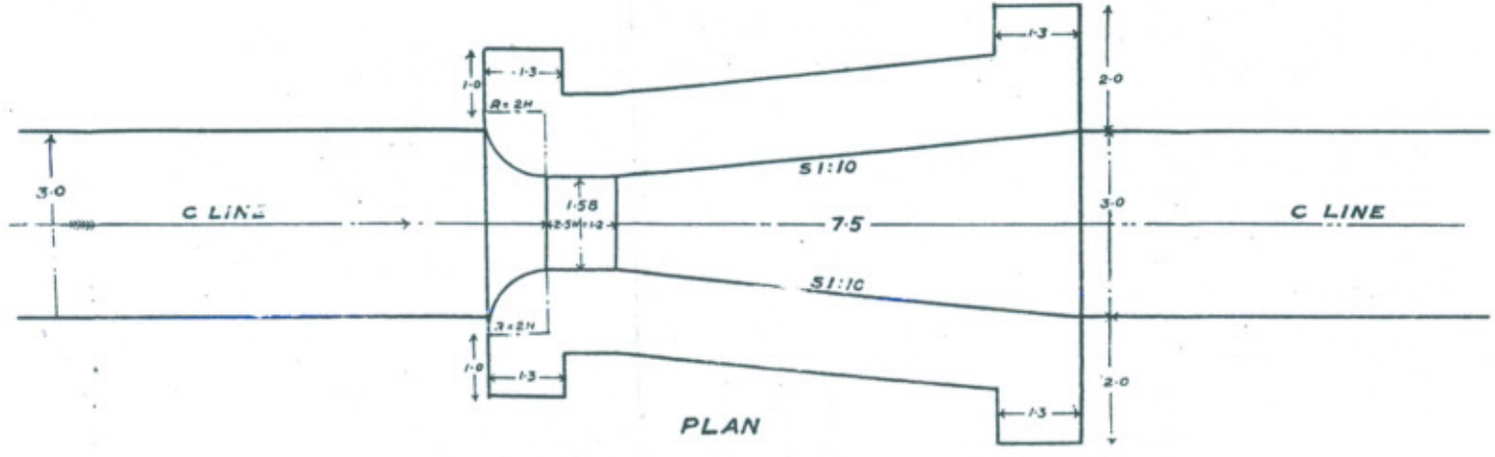
Type design.

A type design of the proposed flume is given in Plate I.

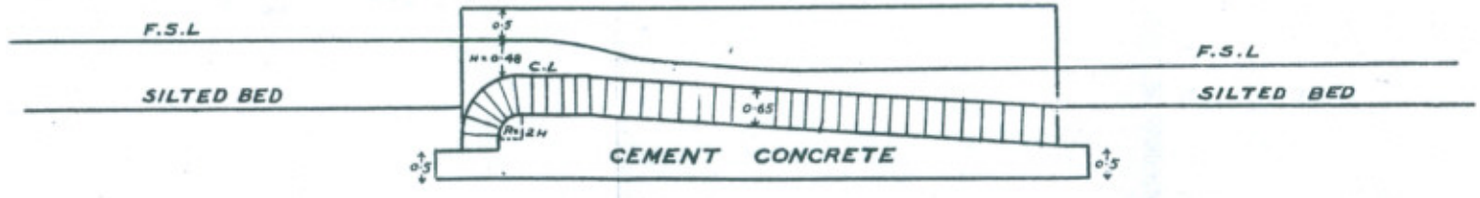
PLATE NO 1
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TYPE DESIGN OF WATER COURSE FLUME

SCALE 1/25



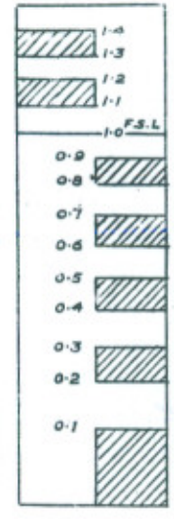
PLAN



LONG SECTION

GAUGE

SCALE 1/2



DISCUSSION.

The **author**, in introducing the paper, stressed the importance of the assessment of canal revenue at Volumetric Rates. He believed that its introduction would be a great reform affecting the welfare of millions of people and it would usher in a new era of prosperity and contentment for the Zamindars as well as an increase in the Government revenues.

He did not claim his scheme to be original. The subject was first introduced by the late Mr. F. W. Schonemann, Superintending Engineer in 1913, in a report submitted by him to the Government of India after his inspection tour of Engineering Works in France and Spain. He had reported that a system of volumetric assessment for canal water was in force in Spain and that it had been working satisfactorily for the last 1000 years. Mr. Schonemann had seen no reason why the best features of that system could not be introduced in the Punjab with advantage.

The idea at once caught the imagination of the Government of India and in June 1915 they wrote to the Punjab Government to give the system a trial. Subsequent events were common history. A committee of Superintending Engineers met at Murree in 1915 to consider the question and it favoured the adoption of the new system. But due to the Great War, the practical experiments could not be started till after the historic Conference which was held at Simla on 12th and 13th September 1917 on this subject. This conference was attended by many distinguished officers of the Civil, the Irrigation and the Agricultural Departments. Public was represented by the late Sir Ganga Ram and the Hon'ble Sir Jogindar Singh.

Many a fine argument was advanced by various members in favour of the proposed system. The officers of the Civil Department were specially enamoured of it. It would be significant to note that no member spoke in favour of the existing system of crop acreage assessment. The conference decided the adoption of the volumetric assessment as an experimental measure.

A start was accordingly made in October 1917, when a contract was entered into with Sir Jogindar Singh for supply of water at Volumetric Rates. The contract was for an area of about 4000 acres in Montgomery District, Lower Bari Doab Canal and a small minor called Nanushahid Minor was exclusively set apart for this purpose. Later on some other big land owners followed this example and accepted volumetric assessment.

The author did not think it necessary to go into details about the actual working of the system. The results were well known to all those interested in the subject. The system did not spread on the

scale anticipated by the conveners of the Simla meeting. Even eighteen years after the start, the position did not change materially. The results were disappointing considering that the sytem had many obvious advantages and that the best efforts had been made in this direction by many eminent Engineers.

There must be a reason for this failure. There were some who had come to believe that the system was unworkable. Others contended that the present-day zamindars with an entire lack of co-operation among themselves were totally unprepared to accept any system of volumetric assessment. But the author differed from either view. He maintained that the system was workable and that it was entitled to another trial to prove its efficiency before it was definitely discarded.

The reason for its past failure was not far to seek. He quoted the words on this subject of Mr. P. J. Fagan, I.C.S., the late Financial Commissioner of the Punjab. In a note dated the 15th December, he wrote "Unless the volumetric distribution and payment extended, beyond the distributary outlet, to the individual irrigator, to the field water course and to the field, the possible advantages of a volumetric system would be lost to a considerable if not to a large extent."

This was exactly what had actually happened. The experiments had been tried in the case of large land owners only and no attempt had so far been made to extend the system to individual irrigators. The result had been a failure as was foreseen by Mr. Fagan.

The whole problem resolved to extending the system to petty zamindars. If this could be done the problem would be solved. The paper was an attempt to achieve this end. Under the existing system a cultivator took during his turn the whole supply of a water course. It was therefore obvious that from the exact discharge of the watercourse and the duration of supply to a zamindar, on his turn, the exact quantity of water consumed by him could be worked out. For recording the discharge of outlets a reliable meter had been designed by the author, the full description of which is given in Appendix A, Pages 27 and 28 of the paper. The gauge reading of the meter gave the discharge of an outlet at any moment. This device would be found of immense value not only for the purposes of volumetric assessment, but also for equitable distribution of water and he pleaded for the possibility of its general adoption on all irrigation channels.

This solved half the problem. The next consideration was the recording of the actual duration of a turn or wari consumed by each individual irrigator. If there was a fixed warabandi on an outlet which was scrupulously observed by all the shareholders, there would be no further trouble. It was only in the case of warashikni that it would be necessary to devise means to record the actual duration of waris taken by each shareholder.

The proposed system of recording the actual waris consumed, is described in some detail in the paper. The author did not claim any finality for these proposals. They would of course need much further elaboration and examination in detail before being presented to the public. But he was convinced that it was not beyond the ingenuity of able engineers and administrators to modify the proposals where necessary to suit administrative requirements.

The author found that time to be the most suitable for introducing volumetric assessment. The monster of waterlogging was staring the engineers in the face and it was most desirable that every effort should be made to induce zamindars to be less wasteful in the use of canal water by spreading the same quantity over a larger area. But under the present system of payment on crop acreage basis, the zamindar had no incentive for trying to economize the use of water except a motive of which the force was reduced by the facts that extension of irrigation over a wider area involved the payment of more revenue and that it might lead to the reduction of the size of his outlet.

Then again due to the recent heavy fall in prices of agricultural produce the zamindar could ill afford to extend his irrigated area, for he could not be sure if it would pay him to do so. An example would illustrate his point. The total charge for wheat including land revenue was, say, Rs. 10 per acre. For instance a cultivator with 25 acres grew 10 acres wheat giving a yield of 10 maunds per acre or 100 maunds in all. If he were to grow 15 acres the yield might go down to 8 maunds per acre and he would get 120 maunds or 20 maunds more than before. For this he would have to pay Rs. 50 more revenue. He might therefore hesitate before extending his area.

On the other hand under volumetric assessment every acre increase in an irrigated area meant corresponding gain to the zamindar without having to pay an additional revenue. The author concluded by inviting valuable criticism, and felt sure that the subject would get the consideration it deserved. He could find no justification for postponing what he regarded as a most valuable reform, the development of that progress which had taken place from a mere hole in the bank of a Distributary to Mr. Crump's A. P. M. but had so far stopped short there. It was high time that the old fashioned crop acreage system of assessment which had outgrown its utility was discarded and the logical and scientific volumetric assessment was substituted.

Mr. **B. S. Talwani** complimented the author on his doing a yeoman's service in presenting his paper which had drawn the attention of the Irrigation Engineers to a subject which was as important as purely engineering theories and formulae. The importance of assessment of revenue could be very well imagined, when it was realized that one single canal system in the Punjab, say, the Lower Chenab canal, brought in an annual gross income of about two crores of rupees. But

unfortunately much attention was not being given to this subject by the engineers, who thought it purely a concern of zilladars and patwaris only.

Mr. Erry in his paper had found the disease but like a quack his diagnosis and prescriptions could not cure a patient. In order to make the patient panic-stricken he had rather exaggerated the trouble.

He had found too much fault with the equitable distribution of water. Every effort was being made by engineers to make the distribution as equitable as possible. In fact the remodelling of channels which was done at such a cost was simply to attain that very purpose. In his opinion at least 75 p. c. of the outlets of a channel worked equitably. But in spite of that, annual Efficiency Diagrams told a different tale. This could not change even if cent per cent outlets might work equitably, or even if Mr. Erry's proposals were introduced. Mr. Erry would be wrong to think that these diagrams showed the distribution of supply. Even if equal supplies had been delivered through two outlets, the Irrigation figures might still be different. These figures depended upon so many factors, such as the quality of land, the quality of seed, husbandry, the way of working, the agricultural knowledge and even the class of agriculturists.

A " Jangli " who had been grazing camels for all his life could not be expected to show the same irrigation figures, as a " Jat " or an " Arain " whose profession since his forefathers has been agriculture. In such a case if the assessment was made at the volumetric rates, both the zamindar and the Government would suffer. A good zamindar would get more and pay less and a bad zamindar would pay more and get less. It could not be called equitable distribution.

As regards the amount charged for the water supplied and the remission of crop failures, Mr. Erry had not got a single word to say against either the present system or its working. His objections were against the men working the system. He said " the practical objections against the system are the large powers that have of necessity to be given to the patwari staff." In the case of remission he said " the existing system thus gives unduly large powers to the zilladars." In the conclusion too, he claimed " that the new system is designed to uproot the illegal gratification and corruption amongst the subordinate revenue staff ". But the new system proposed by him was not mechanical that would do away with the subordinate staff. In that too, the patwaris and zilladars would work. Even the gauge readers would have a share in the determination of revenue. By introducing the system of " Pahar " the author had increased the chances of corruption. On page 24 he remarked that in the new system, " the opportunities to a patwari to deliberately make false entries will be very little. There are only eight pahars in a day and if a patwari does not enter the wari actually taken by any one irrigator he must of necessity wrongly charge it to *some one else* and the latter will certainly not keep quiet over it." Mr. Talwani

believed that the opportunities of corruption would be much more. If a patwari would make wrong entries he would take all steps possible not to let the aggrieved party know about it. With pahar as the proposed unit of time, wrong entries might easily remain undetected. On the contrary as in the present system during the period of six months that a crop ripened a patwari's wrong entries might be detected any time. The result would be that a powerful and influential zamindar, with the help of a fradulent patwari, would gain more but pay less which was still worse than gaining more and paying more.

The most defective idea in the proposed system was the unit of " Pahar ". In the present system when the unit of time was full crop season, the chances of corruption were much less. The crop was there for at least 3 months. A minimum area in a sub-division varying from 12000 to 14000 acres per crop was checked by all the officials, and if this checking work was done conscientiously by all concerned, most of the deliberate or undeliberate errors of patwaris would be detected.

The second drawback in the proposed system was that there was absolutely no differentiation between good farming and bad farming. If the same revenue was to be charged for the same quantity of water irrespective of the quantity and quality of crops, there would be a tremendous loss of revenue to the Government and a great discontentment amongst zamindars themselves, and the result would be the most unequitable and unjust distribution of assessment.

The system of assessment of revenue at volumetric rates was preferable for its simplicity and its easy working. It was a cut and dry scheme based on scientific lines least suited to the present conditions of irrigation in India, even if the method proposed by Mr. Erry was adopted. It would be possible to build new outlets, fix new gauges, but it would not be easy to reform irrigators or change their holdings. This system could be practicable only where firstly the holdings were very large as those in U. S. A., Canada or Australia and secondly where mechanical irrigation was done on scientific lines by educated men. In India both the conditions were not fulfilled. This system was being adopted even where the first condition could be obtained. The canal water was supplied to Railway tanks, Forest Department or even big landlords by volume.

Slight variations in the discharge through an outlet from day to day and its exact measurement would make the system popular with the public. It could be made possible by introducing better type of outlets like open flume or A.P.M. Secondly the price of a cusec should be so calculated that it would be favourable to the Government as well as zamindars. This value would be different from canal to canal, yet it would be possible to fix it if effort was made.

The time factor of crop must not be changed. Mr. Erry's unit of cusec pahar might appear simple, but was most difficult to adopt, if not altogether impracticable.

Mr. **Vidya Rattan** observed that while examining any system of assessment, it should be constantly kept in mind that Irrigation Works in India were never intended as commercial ventures. Any profits that accrue from such works would therefore be regarded as incidental. The greater and more elevated object of all irrigation projects was to contribute to the wealth and well-being of the people. The principle of assessment should therefore be not as in business, to charge for every ounce of water supplied, regardless of the ultimate value of that ounce in terms of matured crop, but, on the other hand, to make the zamindar pay to the Government a reasonable portion of the proceeds of his produce for benefits derived from the water supplied by the Government. That was one main objection against volumetric assessment.

The too often used argument against the present system as also employed by the author was that the irrigator gave ten waterings to a crop where he should give one, *i.e.*, his methods were wasteful. A little reflection would show that in most cases this charge would not hold, Where the soil was good, the holdings compact, and the irrigators keen, as on the Lower Chenab and the Upper Bari Doab, the results showed that a cusec actually irrigated more acreage than it should according to the full supply factor. Not only that, very often it was noticed that the cultivator ruined his crop by applying the available supply to a greater acreage of land than it could reasonably mature. When such was the case the irrigator could not be called too wasteful.

Examining the author's argument a little further, Mr. Vidya Rattan said that according to the author the present system of assessment took no account of the exact quantity of water used for a unit area, and therefore the charges levied were not proportional to the quantity of water supplied. In order to set right this iniquity he suggested building a meter of supply at the head of each water course.

In equity the charges levied could be proportional to the quantity of water supplied only when water was delivered to each cultivator at the beginning of his fields, and some kind of gauge or meter was fixed for each one of the cultivators, and not otherwise.

To illustrate his point Mr. Vidya Rattan assumed 100 cusecs entering the canal out of which only 56 were actually delivered to the tail zamindar. The rest was lost in the Canal, the distributaries, and village water courses. The loss in village water courses was the maximum, *i.e.* 22 per cent. Since the gauge was fixed at the head of a water-course for each one cusec recorded by this gauge, only 56/78 cusec or nearly $\frac{3}{4}$ cusec reached the tail. Adopting the cusec pahar unit for levying charges and recording the cusec at the head of a watercourse means that the tail zamindar would pay 50 p. c. more for the same quantity of water compared with his more fortunate brother at the head. Such a system therefore stood self-condemned.

Mr. Vidya Rattan was doubtful if any improvement in check-mating corruption would result from the proposed system. If at present the Patwari Sahib could repudiate the existence of a crop that was sown, matured, and cut, he could with less fear of detection, increase or decrease the cusec pahars. The supply was not always continuous on account of the rotational closure and other causes ; the number of cusec pahars could not therefore be the same for a particular cultivator. And as at the end of a crop the total number of cusec pahars would be considerable, a small error made by the patwari, however intentional, would not be easily found. It is only in case of those outlets where warabandi is fixed under Section 68 that the patwari would have to be careful. And that too at periods when the supply was uninterrupted. In case of outlets where the waris would be customary or fixed by the zamindars themselves and in period of interrupted supply he could do as he liked because the illiterate zamindar would never bother to keep record of his day to day wari, and even if he did he would not be believed, in the same way as the author stated in his paper. "When the demand slips are presented to the cultivator at the end of crop and if the poor zamindar then objects to the assessment, it is much too late for any one tc arrive at the truth."

In another way corruption might, if anything, increase. For where there were before, the patwari and the zamindar, there would now be a gauge reader also, who would demand the price for under-reading or for not over-reading the water supply.

Mr. Vidya Rattan suggested to make the outlet itself a meter of supply. The author himself was thinking of its possibility, when he stated that for such outlets as have a low working head, the outlet itself could be an open flume and the W. C. flume dispensed with. Therefore it would not be desirable to incur the expense of building a double set of outlets and the recurring cost of maintaining such.

Mr. Vidya Rattan was doubtful if one hissa would make the flume modular. One hissa or more would be lost upto the vena contracta alone.

$$\text{Loss of Head at Entry} = 1{\cdot}5\left(\frac{A}{Al}\right)^2 . \frac{V^2}{2g.}$$

$$\text{As } Q=B, \frac{A}{Al} = 2$$

and assumung a vel : of 1 ft. sec. in the W. C., loss works out to O. I.

Mr. Vidya Rattan concluded that the proposed arrangement

(1) was definitely more expensive involving the construction of a double set of outlets ;

(2) involved avoidable loss in working head with its effects on command.

(3) involved increased cost of maintenance of outlets.

(4) involved in land widths as the watercourse flume would have to be built in the W. C.

(5) required larger establishment, necessitating the employment of 15 to 29 Gauge readers in such sub-divisions.

Against these shortcomings, the advantages of check-mating corruption, and ensuring equitable distribution as shown, appeared to be very doubtful.

Mr. **G. R. Sawhney** was not sure if the volumetric rates system, as suggested by the author, would ever be followed wholesale on the various canals in the Punjab, especially on the lines suggested by him.

He suggested that the considerations 1 and 2 on page 1 would be more workable if they were to be read as follows.

1. "That every share-holder on a certain canal or distributary gets water proportional to the area of his holding."

2. "That charges levied were strictly proportional to the quantity of water allotted to each share-holder."

The contract supply, which was only another name for Mr. Erry's water distribution and assessment of revenue, was tried on the Lower Bari Doab. The zamindars were encouraged in every possible way to take water on contract basis, but all encouragement and exertions only resulted in a very few big estates or farms and Montgomery and Okara Municipalities taking advantage of the system which confirmed his belief that this system could only suit the exclusive owners or managers of the land on an outlet. Hence unless and until the outlook and mentality of the owners of smaller holdings in the Province would undergo a very material and unexpected change, it seemed unlikely that Mr. Erry's dream would ever come true. The allotted time being very short, the speaker could not discuss this question at length. He disagreed with the author in the abstract as well as in the detail. He believed that a Canal Patwari, rogue that he was taken for granted to be, could easily and within reasonable limits be kept under control if his work was properly checked and supervised. With slackened control, the procedure proposed by the author would surely result in much more corruption and consequent trouble to an engineer as well as zamindars in whose interest presumably the author had taken up the cudgels. The speaker remarked that all the same Mr. Erry's scheme and proposals formed very interesting reading and might one day help in some way to improve the present system of assessment.

Mr. **M. D. Mithal** asserted that the author was labouring under a delusion, when he said that a patwari's work was capable of no check, even though the checking time ranged from the time the crop was sown

to that after it was cut. Instead he advocated a procedure which could admit of neither check nor correction. He based his demand on day to day discharges on each watercourse. In rising and falling supply in a channel it would be difficult for one man to read 20 outlets with modularity impaired. The attempt in the past had been to reduce the number of gauge readers.

The author, by advocating no charge for excess of water from an outlet, suggested punishment to the Sub-Divisional Officer for his inactivity whose hanidcaps were a less number of subordinates and inadequate funds. Demands for larger funds and more work from everybody sounds like burning a house to kill a rat.

The **author**, winding up the discussion, said that Mr. Talwani's objection to the volumetric assessment on the ground that a good zamindar under this system would pay less and get more while bad zamindars would pay more and get less was far from correct. Each man would pay the same for the same quantity of water. That a good zamindar derived more benefit by dint of good husbandry was but natural and should not be grudged. It was the very aim of volumetric system to ensure that a good zamindar reaped the full benefit for his labours, which was not possible under the crop acreage assessment.

Mr. Talwani's reasoning for his illogical conclusion that if the same revenue was charged for the same quantity of water there would be tremendous loss of revenue and great discontent among zamindars was rather obscure. The author informed him that this was exactly what was aimed at even under the crop acreage assessment. The crops, like rice and sugarcane that required more water, were charged high rates while crops like gram that required less water were assessed at low rates. A little consideration would show that there was really nothing wrong with the principle of charging the same amount for the same quantity of water. The difficulties imagined by Mr. Talwani would not arise in practice.

As regards Mr. Talwani's statement that under the proposed system, a Patwari would have more opportunities of making false entries, he forgot that Patwaris lived in a village at the mercy of zamindars. Corruption paid only so long as it meant robbing the Government and sharing the profits between a Patwari and Zamindars. If he would start robbing Peter to pay Paul he would soon find life in the village not worth living. Moreover rules could be so framed as to make copies of a Patwari's record freely accessible to all Zamindars to enable an aggrieved party to lodge a complaint.

Mr. Vidya Rattan was wrong to believe that an ultimate benefit to a zamindar in terms of matured crops would be less under volumetric system than it was under the acreage assessment system. In practice it would be exactly the reverse. The volumetric assessment would be a great incentive to economy in the use of water and would thus give a larger area of matured crops per unit of water supplied.

Mr. Vidya Rattan's contention that under the present system, the Zamindar was not wasteful might be due to his gauging the efficiency in terms of a sanctioned full supply factor. The author informed him that in Jullundur and Hoshiarpur Districts where irrigation was done from wells alone one cusec irrigated 1000 acres or more as compared to 352 acres on the Lower Chenab Canal.

He found some justification in Mr. Rattan's criticism that the Zamindars at the tail end of a watercourse ought not to be charged the same per unit of time as the Zamindars in the head reach. But it was not difficult to remedy. The total charge levied on a holding consisted of the Water Rates and the Land Revenue. Water Rate for purposes of simplicity could be uniform for all, but Land Revenue, which even at present varied from holding to holding on account of the quality of soil could further take account of the distance of a holding from the outlet.

Mr. Ratna while criticizing the water course flume seemed to have missed the point altogether. The proposed flume with its simple gauge would afford a ready and visible means of accurately knowing the defects in the distribution from day to day and month to month in a way that no other form of outlet afforded at the present moment. No doubt outlets could only be altered only twice a year, but that was more than ample. The present arrangement made it difficult to alter the outlets even once in two years, because making each time a complete hydraulic survey and observing discharges and working heads of outlets would take more often than not such a long time that the period fixed for alterations to outlets would elapse and the operations would have to be repeated next crop.

Mr. Rattan's assertion that pipe outlets were a thing of the past was incorrect. Almost all the S. V. P. Canals and many older Canals had still got pipes. The latter were no doubt being gradually replaced with A. P. Ms. costing on the average about Rs. 120 per outlet. The point stressed in the paper was that if W. C. Flumes were built at a cost of about Rs. 40 each, there would be no need to build A. P. Ms. The arrangement, besides being cheaper, would be better than A. P. Ms.

Mr. Sawhney's difficulty of extending the system to petty landlords might be due to his confusing the proposed system with that contract system in force on the Lower Bari Doab Canal and other canals. If the unit of assessment was adopted as a cusec-Pahar the system could be easily applied to a small holding as to a large estate.

The author thought that Mr. Mithal offered criticism without a careful study of the paper. Mr. Mithal's objection to the proposed system of assessment on the ground that it could neither admit of check nor correction, was far from correct. The necessary checks to be exercised by zilladars and other officers were described in the paper. In fact a zilladar being relieved from the drudgery of field partals,

would be in a better position to exercise surprise checks on the work of a patwari which was far more effective than the fixed routine he had now to follow.

Mr. Mithal was wrong to believe that the author's proposal, not to charge for excess water was made simply to punish a sub-divisional officer. It was made on the considerations of justice. Each outlet was designed to give correct required discharge for the area it served. Any excess over it must unavoidably be wasted. It would therefore be iniquitous to charge a zamindar for water which he never demanded and for which he could find no use.

It was simply stated in the paper that the amount of revenue realized would form a useful measure of the efficiency of a sub-divisional officer. No great imagination was required to apply it similarly in case of a division stating that the revenue realized per division would determine the efficiency of a division as a whole.

Mr. Mithal was wrong when he believed that the proposed system would increase demand for funds and more work for everybody. The work as a whole could not increase by doing it in a systematic way. It would rather considerably decrease in course of time and would leave more leisure and peace of mind to everyone concerned.

Concluding the author regretted that the point regarding the stoppage of corruption had not been properly appreciated. The author described corruption as of two kinds. One where the Government revenue was touched and shared between the officials and zamindars and the other where one man was favoured at the expense of another, the official having been bribed to do so.

It was the first of these two which was more prevalent in the Irrigation Department and was responsible for the leakage of a considerable proportion of the Government revenue. No one had contested the fact, that the proposed system would completely eradicate this form of corruption. As regards the other form of corruption, resort must be had to law and the ingenuity of legislators and administrators to devise means to protect the poor against the rich.

The watercourse flume had not received as much notice as it deserved. Apart from volumetric assessment, which involved a question of principles, the proposed flume was a most useful device which could easily compete successfully with A. P. Ms. Replacing the existing pipe outlet with the proposed flume instead of with an A. P. M. was a matter for serious consideration.