Estimation of Rainfall by using "SSV's Rotating Pan Rain Gauge" Model

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Abstract – Rainfall is the main source of water and used for various purposes. A knowledge of the amount of rainfall, the intensity of rainfall and the distribution of rainfall is extremely useful for irrigation engineers and all other involved in the development of water resources. The amount of rainfall is expressed as the depth of water in centimeters which would accumulate on a level surface if the rainfall were retained where it fell. The intensity of rainfall is the depth of rainfall per unit time. It is usually expressed in the cm/hour or mm/hour.

The rainfall at place can be measured by rain gauge. The rain gauge may be classified into broadly two different types such as Non recording & recording type of rain gauge. In this paper we were going to study about " SSV's rotating pan rain gauge". This is mainly recording type rain gauge having recording arrangement which gives the rainfall intensity and the duration of the rainfall, besides giving the total depth of the rainfall. There rain gauge mainly more useful than non recording type of rain gauge. In this respective SSV's rain gauge we were going to study the mechanism and working of model to successfully collect the data about the depth and intensity of rainfall.

Key Words: Rainfall estimation, recording type of Rain gauge, rainfall depth, rainfall intensity.

1.Introduction :

The rainfall estimation is done by usually two different rain gauges such as non recording type of rain gauge and the recording type of rain gauge. The non recording type of rain gauges are used for the measurement of the amount rainfall by collecting rain water over period of time. In non recording type of rain gauges of the two types are quite common:

1. Symons rain gauge
2. IMD rain gauge.

The recording type of rain gauge have recording arrangement which give the rainfall intensity and the duration of rainfall , besides giving the total depth of rainfall. These rain gauges are more useful than the non recording type of rain gauges. The following three types of recording type of the rain gauge are :

1. Tipping bucket rain gauge
2. Weighing bucket rain gauge
3. Float type rain gauge.

In this study the making and working of SSV's rotating pan rain gauge is going to be done as explained further.

SSV's Rotating Pan Rain gauge :

The figure of SSV's rotating pan rain gauge is given in fig.1 :

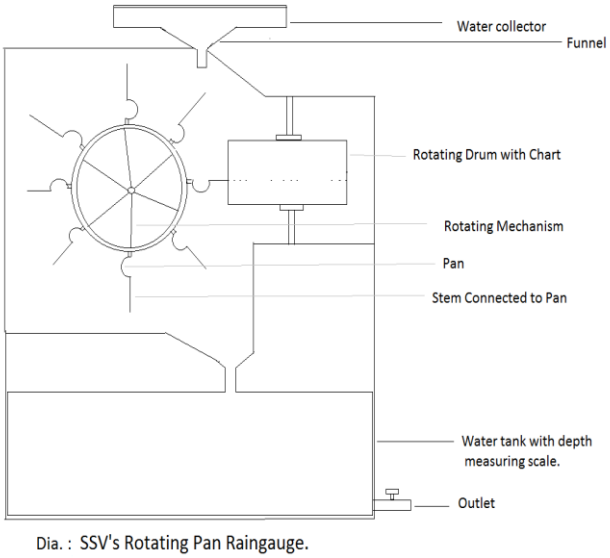

Fig.1 SSV's Rotating Pan Rain gauge.

2. Making of SSV's Rotating Pan Rain gauge :

The SSV's rotating pan rain gauge consist of water collector, funnel, rotating drum with chart, pan rotatoe with stem, water tank with depth measuring scale and base outlet.

Next we study the making and working of the each part of rain gauge.

1) **Water Collector** : The water collector is placed at the top portion of the rain gauge vessel. The water collector is internally covered with rubber material so that there is no any rainfall wastage by jumping action of rainfall droplets from metal collector. This jumping action of water droplet will cause the change in rainfall depth. The water collector should have the collector area of 20cm x 20cm.

2) **Funnel** : The water collector is connected to the top of the funnel type metallic sheet which having the side slope of 2:3 (H:V). the collected water is passed to rotating pan via funnel.

3) **Rotating pans with stem :** The semi circular pans are attached to the rotating wheel made of thick fibre. The pans having the volume capacity of 250 ml. there are total eight number of pans are attached over the surface of rotating sheet. The rotating sheet is rotating automatically around the shaft. The stem is connected to each pans. They mainly used as the pen to create dot on the rotating chart. The central sheet is rotating around horizontal axis. The pans are made up of stainless steel so that they will not get corroded due to water action. The figure of SSV's rotating pan is given in fig.2 :

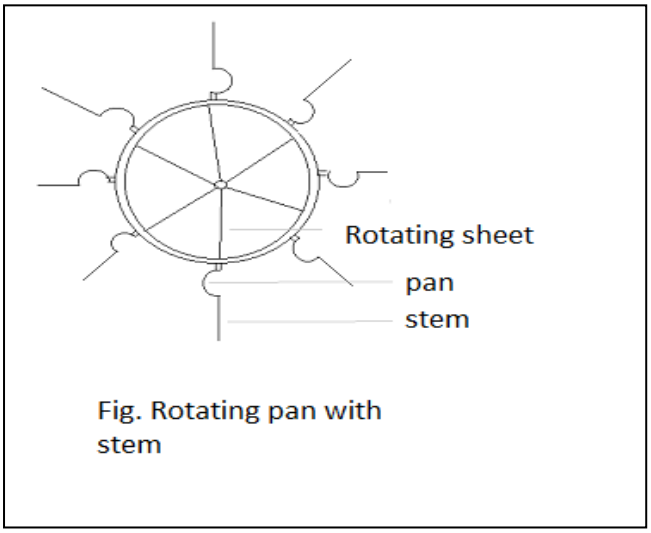

Fig.2 Rotating pan with stem

4) **Rotating drum with chart :** the rotating drum is there which is mainly rotating with clock mechanism. The drum is rotating horizontally around the vertical axis. The plane chart is stick over the rotating drum. The position of rotaing drum with chart and the rotating pans with stem is adjusted in such a manner that the stem will create a dot on the rotating chart while working of rain gauge. The figure of SSV's rotating drum with chart is given in fig.3 :

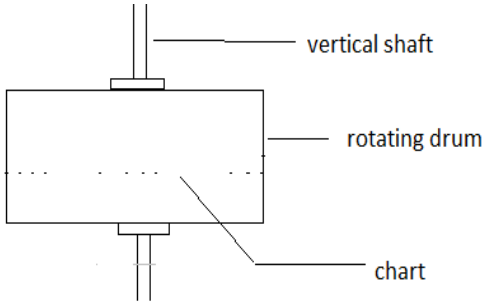

fig. rotating drum with chart.

Fig.3 Rotating drum with chart.

5) **Water tank with vertical depth measuring scale :** The rain gauge consist of lower tank which is useful to collect the water from rotating pans for 24 hours. The water collected in the tank gives the water depth which is measured by manually using vertical scale attached to the lower water tank. The water tank is made up of metal but one side of it is made up of glass so it is useful to check whether tank is completely filled or not.

6) **Drainage Outlet :** The rain gauge consist of Drainage outlet for the removal of water from the lower tank. In case of heavy rainfall or continuous rainfall there is highly chances of water entering into upper chamber from lower water chamber. So outlet is used to regularize the depth inside the lower water tank.

3. Working of " SSV's rotating pan rain gauge" :

The rain gauge is placed on the plane terrain having a concrete base of 20cm depth as a foundation. The precautions should be taken that there is no any external factors influence the rainfall reading. The first rain fall reading is taken at the on the first day morning 8:00 am by taking the rainfall depth in lower water tank. A old chart is replaced with new chart so the rainfall intensity for next 24 hours should be determine.

When the rainfall will start the water will get collected into exposed surface of water collector. Then the water will pass through funnel and it will get stored into the pan attached to the rotating sheet. As the pan is completely filled with water it will automatically goes down (change its position due to gravity) and the empty pan come to the position of older pan. Even though at the time of

changing the position of older pan the dot mark is created on the chart present on the rotating drum. When the older pan changes its position due to inclined plane stored water will get flushed and get stored in lower water tank.

The dot marks on the chart gives the intensity of rainfall. As the Dots on the chart are very close to each other it will clarify that the time taken by pans to completely filled with water is less. Its concluded that the rainfall intensity is high and vice versa.

After every 24 hours the chart should be changed so that there is no any overlapping of dots, it will cause the obstruction to rainfall intensity measurement.

The total water collected in the lower water tank gives the depth of rainfall accumulated in that 24 hours. The rainfall depth should be taken 4 times in a day after every 6 hours span in rainy season and in winter and summer twice a day. So that there is less chances of overflowing of lower water tank into upper tank. So in this case we check the working of SSV's rotating pan rain gauge by taking the rainfall depth accumulated in 24 hours by taking 4 times readings with span of 6 hours.

4. Observations :

Table no. 1 given below shows the value of water level in cm observed in lower water tank over 24 hours duration.

Table.1 Depth of water level observation.

Sr. No.	Time	Depth Of Water In lower water tank
1	8.00 am (1st day morning)	0.00 cm
2	2.00 pm (same day afternoon)	4.20 cm
3	8.00 pm(same day evening)	7.54 cm
4	2.00 am (2nd day morning)	11.80 cm
5	8.00 am (2nd day morning)	13.10 cm

- Depth of rainfall in 24 hours =

(Water level observed at initial time in lower water tank – water level observed at final time in lower water tank)

= 13.10 cm – 0.00cm

= 13.10 cm

- Rainfall intensity = Depth of rainfall / time

= 13.10 cm / 24 hours

= 0.54 cm/ hour.

For this whole day up to 13.10cm depth of rainfall occur. Hence we get the rainfall depth of 0.54cm/hr.

The dots present on the chart or the spacing between the dots give the idea of rainfall intensity.

5. CONCLUSIONS :

- This SSV's Rotating pan rain gauge is effectively applicable to measure the rain fall depth and rainfall intensity.
- The rotating pan mechanism increases the accuracy of readings taken during intense rainfall by avoiding the actions taken to empty the pan.
- Because of the instant replacement completely filled pan with empty pan the rainfall depth loss is eliminated.
- The total five number of times the rainfall depth in lower water tank is measured which gives the effective readings by avoiding the excess overflow of water from lower water tank.
- In this SSV's rotating pan rain gauge the total five number of times reading are taken with 6 hour interval from 1st day morning 8.00am to 2nd day morning 8.00am.
- After the observation we get that there is total 13.10 cm of rainfall occur in 24 hours.
- The rainfall intensity is getting by two ways, that is by calculation method and another one is chart method.
- The calculation gives the rainfall intensity of 0.54cm/hr by dividing water depth by number of hours.
- In case of chart the spacing of dots gives the intensity of rainfall for particular hour in 24 hours.
- By this study we get that this 'SSV's rotating pan rain gauge' working effectively so it can use in future to measure the rainfall depth and rainfall intensity.

6. REFERENCES

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