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AN INDIGENOUS "RAIN SIMULATION CHAMBER SYSTEM" TO PRODUCE SAMPLE RAIN OF VARIABLE RAIN RATE AND DROP SIZE

The paper deals with the design, development and fabrication of a laboratory model of a sample "rain simulation chamber". The system is capable of providing "sample rain" of variable characteristics. To a very great extent, the rain rate and drop size are controllable and calibrations are possible. The system has been successfully used to study the microwave attenuation due to rain.

2. Characteristics of rainfall vary with latitude, altitude, topography and season. These characteristics (the rain rate and drop size) will have considerable effect on signal propagation (mainly, at microwave frequencies). For studying these effects, field experiments at a number of stations having different types of rainfall characteristics for long periods, involving high cost, manpower and time are required. To avoid this and to get a clear understanding of the rain attenuation of microwaves, a better method is to simulate various types of rainfall in the laboratory and to study the effect of microwave propagation through it. Microwave attenuation in short and long link paths are being conducted in differents parts of the world and statistical data are collected for interpretation and prediction. However, a laboratory experiment to study the attenuation characteristics in detail under controlled environment has not been reported in literature. This paper presents design and development of a "rain chamber" system which can be used to simulate rainfall of different "rain rates" and "drop sizes".

3. The "rain chamber" consists of a "sample rain simulator set up" and an enclosure to restrict the sample rain within the chamber itself. It also helps in re-circulating the water through the "rain simulator". To measure the actual rain rate for each sample rain, a standard raingauge is utilised and the drop size distribution is estimated by the filter paper method. The drop impression obtained in the filter paper have been calibrated as per the laboratory conditions.

4. The "rain simulator" consists of a few circular plastic discs of one foot diameter mounted on a shaft which is rotated using an electric motor. The speed of rotation of the discs is controlled by a speed regulator of

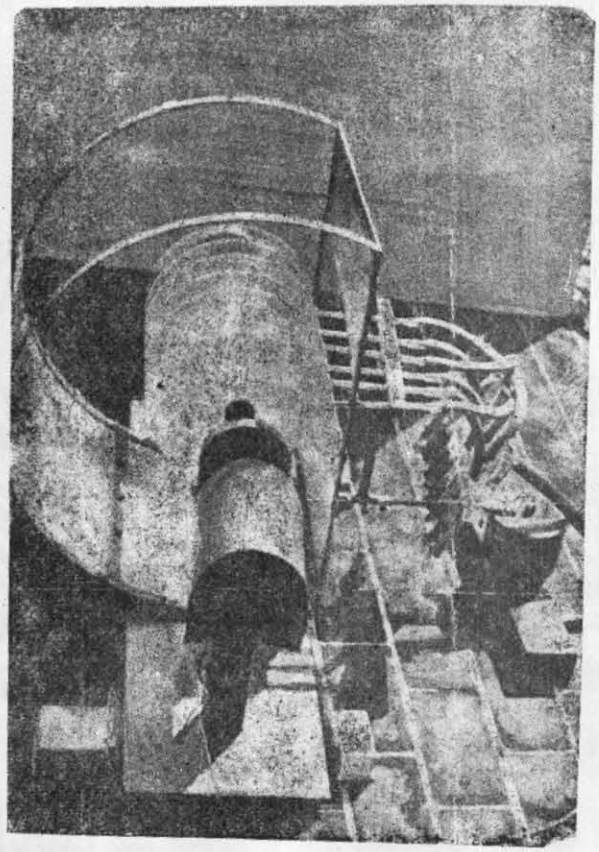

Fig. 1. Rain simulator

the motor. A jet of water parallel to the axis is directed to the rotating disc at a point near the periphery. This results in water drops being acted on by centrifugal forces. By choosing this point on the disc at one end of the diameter parallel to the horizontal line through the shaft, the resulting spray is made to fall on the other side of the disc. By controlling the speed of the disc and the pressure of the jet, the spray is made to fall a reasonable distance away from the disc. By arranging jets of water on both sides on a number of rotating discs, the resulting spray is made to resemble a "rain" over a wide horizontal area. The drop size and the rate of "rain", are controllable by adjusting the speed of rotation of the disc together with the adjustment of pressure heads of the jets. The speed of rotation of the discs depends on the speed of the motor which rotates the shaft. The regulator of the motor that controls the pressure of the jets. As seen above, this set up is capable of producing "rain" over a small area having different characteristics in "rain rate" and "raindrop size". The present system could produce water drops ranging from 0.3 mm to 2.5 mm in diameter very accurately. Table 1 presents the rain parameters obtined for sample rains simulated by

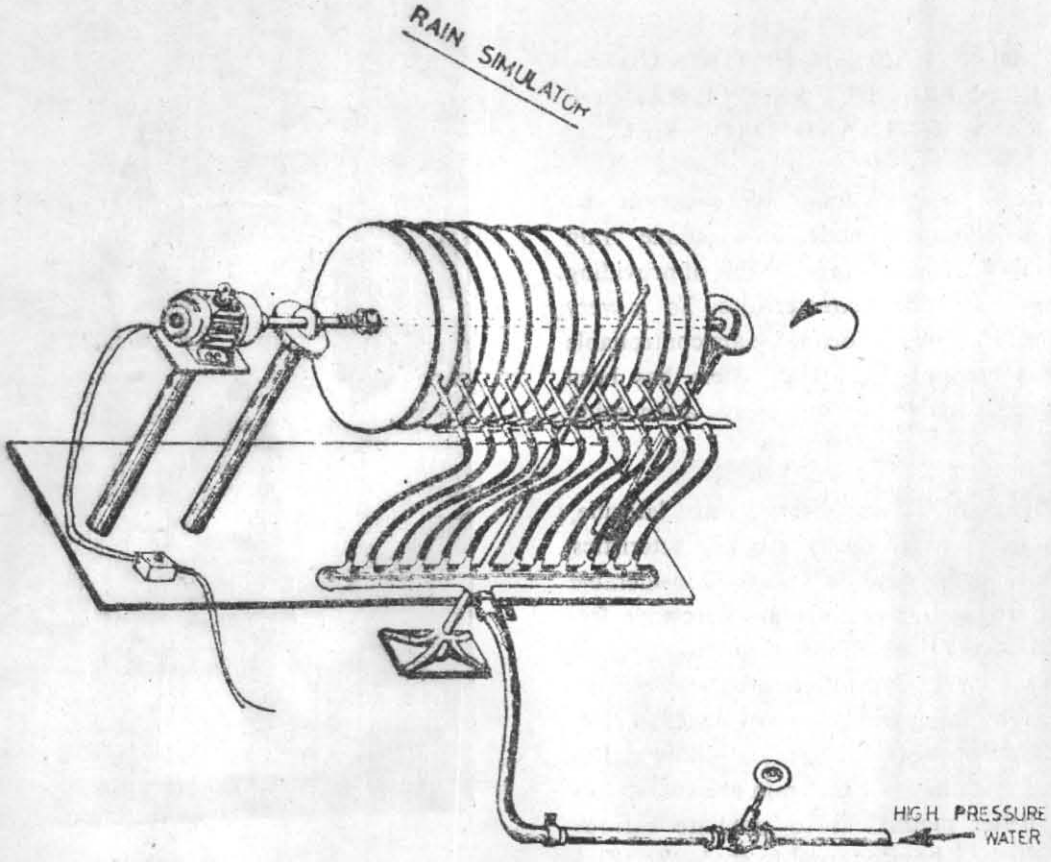

Fig. 2. Line diagram of rain simulator

TABLE 1

	Rain rate (mm)										
	40	50	60	70	80	90	100	120	140	160	180
Drop size (mm)	0.3	0.3-0.5	0.5-1.0	1.0-1.5	1.0-1.5	1.0-1.5	1.5	1.5-2.0	1.5-2.0	1.5-2.0	2.0-2.5
Attenuation (db)	0.54	0.67	0.79	0.91	1.03	1.16	1.28	1.57	1.85	2.10	2.35

the system. Here the microwave attenuation is measured by a transmission technique. By changing the diameter and number of the disc, the drops sizes can further be changed to any desired range of diameters.

5. A photograph of the 'rain simultor' is shown in Fig. 1 and its line diagram is shown in Fig. 2. The fabricated set up is now being used tostudy the effect of different rain rates and drop size on microwave propagation. It has been observed that the sample rain thus produced are possessing characteristics which are easily controllable by varying the speed of revolution of the disc-system and the jet-pressure.

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