Reprinted from the Journal of the Institution of Engineers (India) vol II Part ST No. S I, July, 1977

Multi-slide Coating Gadget for Measurement of Cloud-droplets

S K Sharma, *Student**

A multi-slide coating gadget (MSCG) is fabricated for coating glass slides with Magnesium Oxide (MgO) smoke for measurement of cloud-droplets. Slides coated using the present gadget are found to be more suitable than slides coated manually.

INTRODUCTION

Knowledge of microphysics of clouds is necessary for proper understanding of cloud growth and precipitation development. Any success of the artificial rain making experiment is very much dependent on such knowledge. The mode of distribution of cloud-droplets inside the cloud determines whether a cloud will precipitate or not. Enlargement of the width of the droplet spectrum by injecting hygroscopic nuclei of giant size into the cloud is the way by which a non-precipitating cloud is converted into one which can yield rain (Kapoor, et al, 1976). All clouds do not precipitate in the natural way due to deficiency of the number of cloud-droplets especially in the required size range. Enhancement of precipitation by artifical rain making is dependent on selecting suitable cloud and treating them. Hence knowledge of dirtribution of cloud droplet is essential for conducting artificial rain making experiment. For this purpose the measurement of cloud-droplets is a major requirement in cloud physics and weather modification.

Sincere efforts were made to get a suitable device for obtaining droplet samples from aircraft since early fifties (May, 1950; Frith, 1951; Brown and Willet, 1955). The cloud-droplets present in a sample of cloud air are collected by impaction, by exposing a glass slide for a known time, in the cloud while flying in it. The glass slide is coated with a thin uniform film of Magnesium Oxide (MgO) so that the cloud-droplet may form craters by impaction (Squires and Gillespie, 1952). It is felt necessary to make a convenient and reliable gadget for coating the glass slides uniformly with MgO smoke. So far the coating was being done mannually as suggested by May (1950). This paper describes an instrument employed for coating the glass slides and discusses its superiority over the previous method of coating done mannually.

DESCRIPTION

Multi-side Coating Gadget (MSCG)—*Vide Fig 1*—meant for coating eighteen glass slides with MgO simultaneously and uniformly, is made up of two rectangular brass plates each with dimensions 330 mm × 140 mm × 5 mm. Lower plate (L) act as base for holding the upper plate (F) with the help of

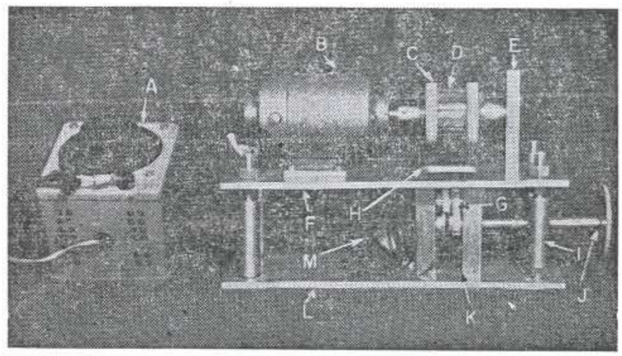

Fig. 1 Multi-Slide Coating Gadget (MSCG)

four brass pillars (1). One AC motor (0.5 HP) (B) is screwed to the upper plate. One rectangular brass block (E) is also screwed which acts as a support to the aluminium slotted cylinder (D). This cylinder can rotate freely in between the motor and supporter at the desired rpm with the help of a variable auto-transformer (A). On the periphery of the revolving cylinder eighteen equidistant slots of dimensions 38 mm × 3 mm × 6 mm are cut. These slots can accommodate eighteen stainless steel slide-carriers (*Fig* 2). Glass slides each of dimensions 25 mm × 3 mm × 1 mm can be fixed on these slide-carriers with the help of double sided scotch tape. All the eighteen slide-carriers, after fixing glass slides over them, are inserted in the slots. These are then firmly

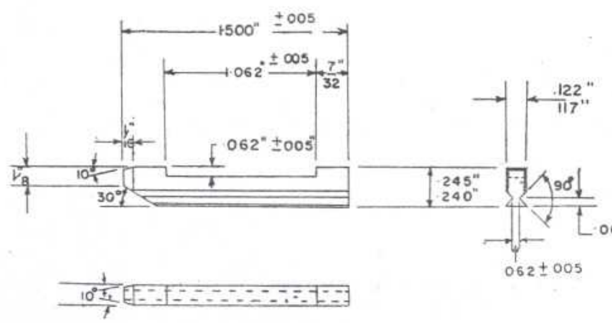

Fig. 2 Blue print of slide-carrier (Clague, 1965)
(Dimensions are in inches)

*Shri Sharma is with Indian Institute of Tropical Meteorology, Puna 440001 screwed on both the sides with the help of two aluminium covering caps (C). This arrangement is done to prevent the slides from coming out of the slots while cylinder is in rotation. This unit is then subjected to coating by MgO through a rectangular hole (H) in the upper plate. vertically beneath the revolving cylinder. This hole is meant for passage of MgO smoke for deposition on the revolving glass slides.

The magnesium ribbon 3 mm × 0.1 mm (M) is fed through the gear arrangement attached to the base. Two spar gears (G) each having 26 teeth over 24 mm diameter brass blanks, are supported one over the other with the help of two shafts. These shafts are held in between two rectangular brass pillars (K) each having square cross-section of 20 mm and length 85 mm. The lower gear acts as driver and the upper one as driven. These two rectangular pillears are firmly screwed to the base plate. After passing through the gear arrangement held directly below the rectangular hole of upper plate, the magnesium ribbon is allowed to burn in order to facilitate the passage of burnt smoke properly for deposition on the slides.

OPERATION

120 volts on variable auto-transformer is found suitable for rotating the slotted cylinder along with eighteen slide firmly gripped in this cylinder. A 15 cm long piece of magnesium ribbon is then instered in the feeding mechanism at the bottom. Some portion of the ribbon is further fed so that the tip of the ribbon can ignite from the other side with the help of candle flame. Once the ribbon starts burning the smoke is being deposited uniformly on the revolving glass slides. To enable the ribbon to burn continuously, feed is given with the help of a circular disc (J) till the whole of the ribbon burns. A fine coating of about 1-2 μm thickness, which is required for collection of could-droplets, is deposited on the glass slides. These eighteen slide carriers are then removed one by one very carefully after unscrewing the aluminium caps cautiously. These slide-carriers are then instered in the magazine of Cloud Droplet Sampler-MK III, vide *Fig 3*. Thus the magazine becomes ready for exposure.

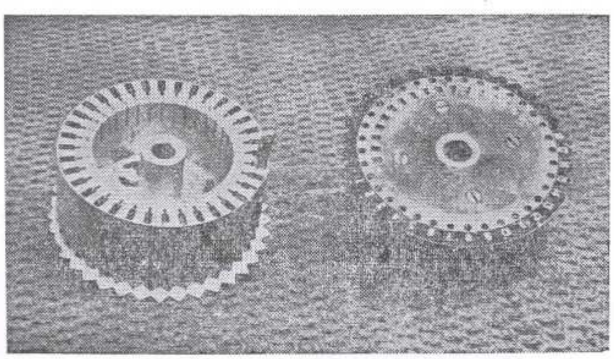

Fig. 3 Magazine being used in Cloud-Droplet Sampler - MK III (Clague 1965). It accommodates 18 coated slide-carriers.

Fig 4 shows microphotographs of a slide coated mannually and another coated by the gadget, on both of which cloud-droplets have been impacted.

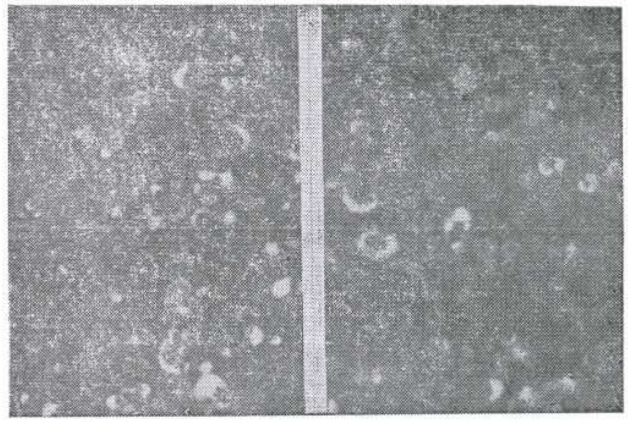

Fig 4 (a) Microphotograph of slide-coated mannually after cloud-droplets' impaction.

Fig 4 (b) Microphotograph of slide-coated by gadget of cloud-droplets' impaction.

RESULT OF COMPARISON

One set of six glass slides was coated mannually and another set of equal number of slides by the new gadget. The thicknesses of the coating were measured by weighing the slides. The results are given in the *table*.

TABLE SHOWING THE COMPARATIVE STUDY OF MAGNESIUM OXIDE COATING DONE MANNUALLY WITH GADGET M S C G

Slide	Weight With coating (gm)	Weight Without coating (gm)	Difference of collumns 2 and 3 (μm)		Thickness of coating (μm)
1	2	3	4		5
		Coating done mannually			
1	3.6654	3.6648	600		2.419
2	3.6945	3.6940	500		2.016
3	3.7835	3.7830	300		2.016
4	3.6987	3.6978	900		3.661
5	3.6779	3.6771	800		3.226
6	3.7105	3.7078	2700		10.887
				Range	8.871
		Coating done with gadget			
1	3.7301	3.7298	300		1.210
2	3.7307	3.73045	250		1.008
3	3.7623	3.7620	300		1.210
4	3.7810	3.78065	350		1.411
5	3.7374	3.73715	250		1.008
6	3.6612	3.6610	200		0 807
				Range	0.604

It is seen that the range of variation of coating over the slides is 8.871 μm in the case of mannual coating and 0.604 μm in the case of gadget coating. It may be seen from the table that the coating obtained by the gadget is appreciably uniform. Wastage of magnesium ribbon is also reduced considerably by this new technique.

This gadget will be used to coat glass slides during the future cloud seeding experiments.

ACKNOWLEDGEMENT

The author thankful to the Director, Indian Institute of Tropical Meteorology, Poona, for allowing him to carry out this work in the Institute.

REFERENCES

1. Edward N. Brown and jack H. Willett. 'A Three-slide Cloud Droplet Sampler'. *Bull. of American Meteor. Soc.*, vol 36 no 3, March 1955, p. 123-27.

2. K R May. 'The Mesurement of Airborne Droplets by the Magnesium Oxide Method'. *Jlr. of Scientific Instruments*, vol 27, 1950, p. 128-130.

3. L F Clague. 'An Improved Device for Obtaining Cloud Droplet Samples'. *Journal of Applied Meteor.*, vol 4, August 1965 p. 549-551.

4. P Squires and C A Gillespie. 'A Cloud droplet sampler for use on aircraft'. *Quart. Journal of Royal Met. Soc.*, vol 78, 1952, p. 387-393.

5. R Frith. 'The Size of Cloud Particles in Stratocumulus Cloud'. *Quart. Journal of Royal Met. Soc.*, vol 77, 1951, p. 441-444.

6. R K Kapoor. S K Paul, A S Ramchandra Murty, K Krishna, S K Sharma and Bh. V Ramana Murty, 'Mesurements of Cloud Droplets Size Distributions in Seeded Warm Cumulus Clouds'. *Journal of Pure and Applied Geophysics*, vol 114, 1976, p. 379-392.