of 1 mm thickness (5″ × 4″) were included which were earthed. This arrangement was done in order to improve the collimation. The number of counts from the entire region of the source deposit was scanned. The standard curve between thec ounting rate and distance has been shown in Fig. 4. The flat top of the curve explains the uniform deposit of the β-ray source. The size of the β-ray source deposit was estimated to be about 6 mm in diameter.

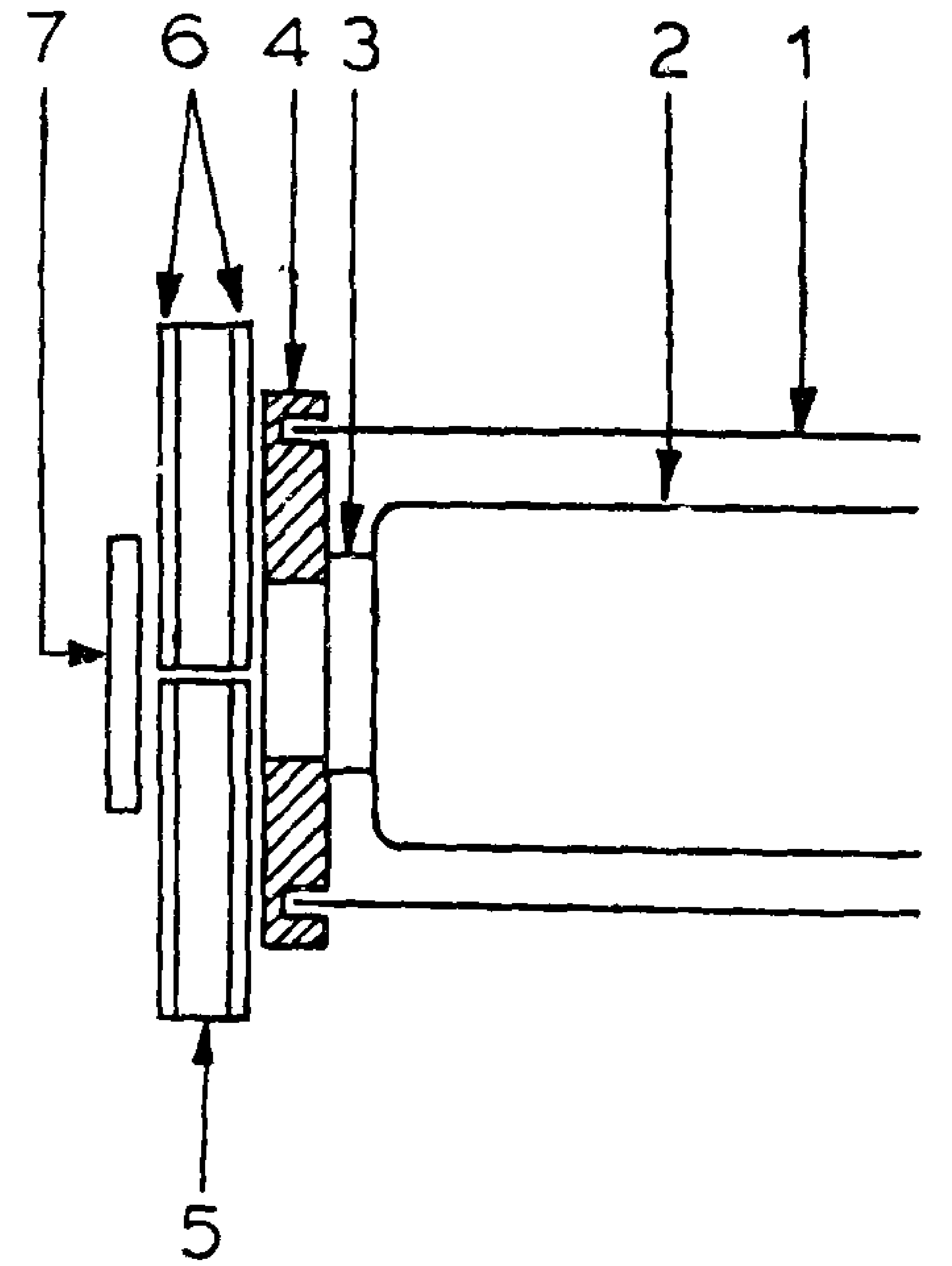

FIG. 3. Arrangement for the uniformity test of the β-ray source deposit prepared by electrospraying method. 1. Supporting brass rods, 2. Photomultiplier (EMI 9514B), 3. NE104 plastic scintillator, 4. Ebonite ring 5. Lead sheet of dimension (5″ × 4″ × ½″) and a hole of 0·5 mm diameter. 6. Copper sheets of 1 mm thickness (5″ × 4″). 7. Source deposited on the thin film fixed to aluminium ring. The ring is moved by a micrometer (not shown in the figure).

Conclusion

Both the methods are suitable to measure the uniformity of the β-ray source deposit. However, the latter method appears to be more convenient.

The author wishes thanks to Professor H. O. W. Richardson of Bedford College, London University, for his valuable discussions.

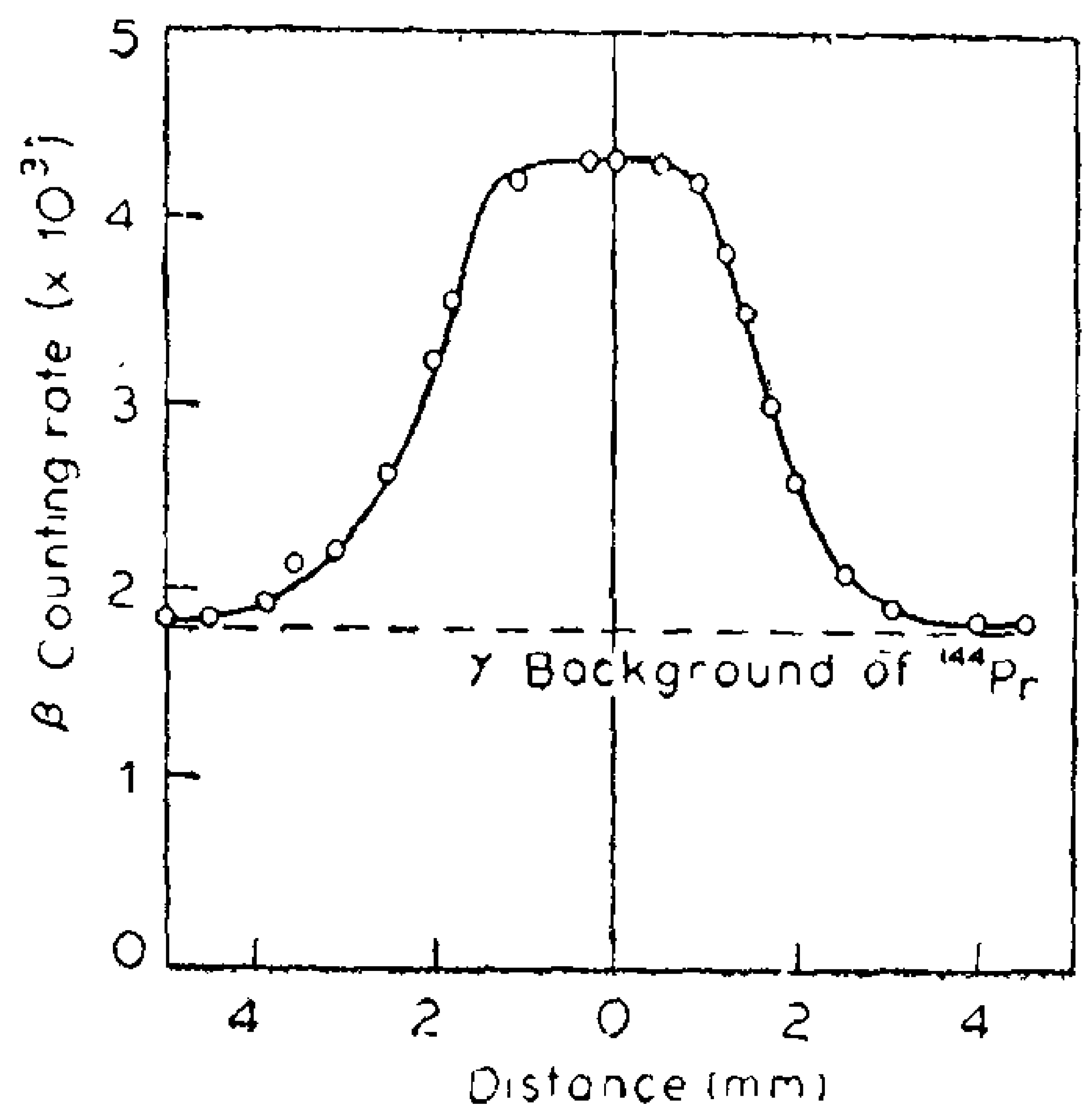

FIG. 4. Uniformity plot of ^{144}Ce source deposit.

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A POSSIBLE CAUSE OF MIDLATITUDE SPREAD-F DURING MAGNETIC STORMS

IT is widely considered that the disturbed ionospheric condition known as spread-F (appearance of diffuse echoes on ionograms) is due to partial reflections from small field aligned irregularities in F-region ionization.[1] However, following the work of King[2] in which he argued that spread-F, irrespective of latitude, is not due to partial reflections from small field aligned irregularities, but is due to total reflection from large sheets of ionization, opinions are divided in literature as to the cause of spread-F[3,4]. Recently, Nichol[5] noticed a close similarity in the occurrence of spread-F at higher midlatitudes and the formation of midlatitude inospheric trough in the Australian sector which lead him to suggest that spread-F at higher midlatitudes is due to multiple reflections off the steep ionization contours at the edges of the trough (reflection from the ionization gradients at the edges of the trough could cause spread-F due to the existence of several paths of total reflection). The very recent study of the author[8] also showed a close association between the occurrence of spread-F at Christchurch (43·65° S, 172·8° E, invariant latitude $\Lambda = 49·0°$ S) inside the trough zone and the latitudinal gradient in ionization around the equatorward edge of the trough (based on total electron content data at two stations one inside and the other outside the trough zone) in the Pacific sector, lending support to the work of Nichol. It is well known that enhanced geomagnetic activity leads to an increase in the occurrence of spread-F at middle latitudes with a delay of 0–2 days[6–8]. In view of the above considerations, it is felt worthwhile to examine the behaviour of spread-F at a higher midlatitude station (inside the trough zone) and the latitudinal gradient in ionization around the equatorward edge of the trough (depth of the trough) during geomagnetic storms. The objective is to see whether the enhancement in spread-F occurrence that follows the onset of geomagnetic storms is associated with an increase in the depth of the trough as would be expected if the occurrence of spread-F is due to the formation of the ionospheric trough.

The study is based on the published foF2 data at the two Australian stations, Canberra (35·3° S, 149·0° E, invariant latitude $\Lambda = 45°$ S) and Hobart (42·9° S, 147·2° E, invariant latitude $\Lambda = 54°$ S). It is known that during night time the midlatitude ionospheric trough has usually a width of 15–20° in latitude and centred around $\Lambda = 57°$[9–12]. Therefore, Hobart (at $\Lambda = 54°$ S) will usually be inside the trough zone while the more northerly station, Canberra (at $\Lambda = 45°$ S) outside the trough zone. The ratio of peak electron density (deduced from foF2) at Canberra to that at Hobart, N_C/N_H thus provides a convenient measure of the latitudinal gradient in ionization around the equatorward edge of the trough (depth of the trough corresponding to the F-region peak) at any particular time. This procedure to infer the depth of the trough is quite appropriate as the midlatitude trough is known to manifest above and at the F-region peak[13–15] and even below the peak[16]. The geomagnetic storms studied here cover a three-year period from July 1969 to July 1972 and have been so selected as to be preceded by low geomagnetic activity so that the effect of enhanced geomagnetic activity (that occurs during geomagnetic storms) can be inferred. Information about the geomagnetic storms, *i.e.*, times of sudden commencement (SSC), maximum values of the three hourly K_p index and daily A_p index during the various storms is presented in Table I.

TABLE I

Details of geomagnetic storms

Storm	Date	Time of SC (150° E.M.T.)	Maximum Value of K_p	Maximum Value of A_p
1.	26 July 1969	2153	7	45
2.	26 Aug. 1969	1435	6	21
3.	28 Sep. 1969	0725	7	90
4.	27 May 1970	1514	4	45
5.	17 Aug. 1970	0805	9−	115
6.	14 Dec. 1970	1154	8+	65
7.	17 Dec. 1971	0008	..	..
	18 Dec. 1971	..	7+	67
8.	7 Mar. 1972	0708	7+	45

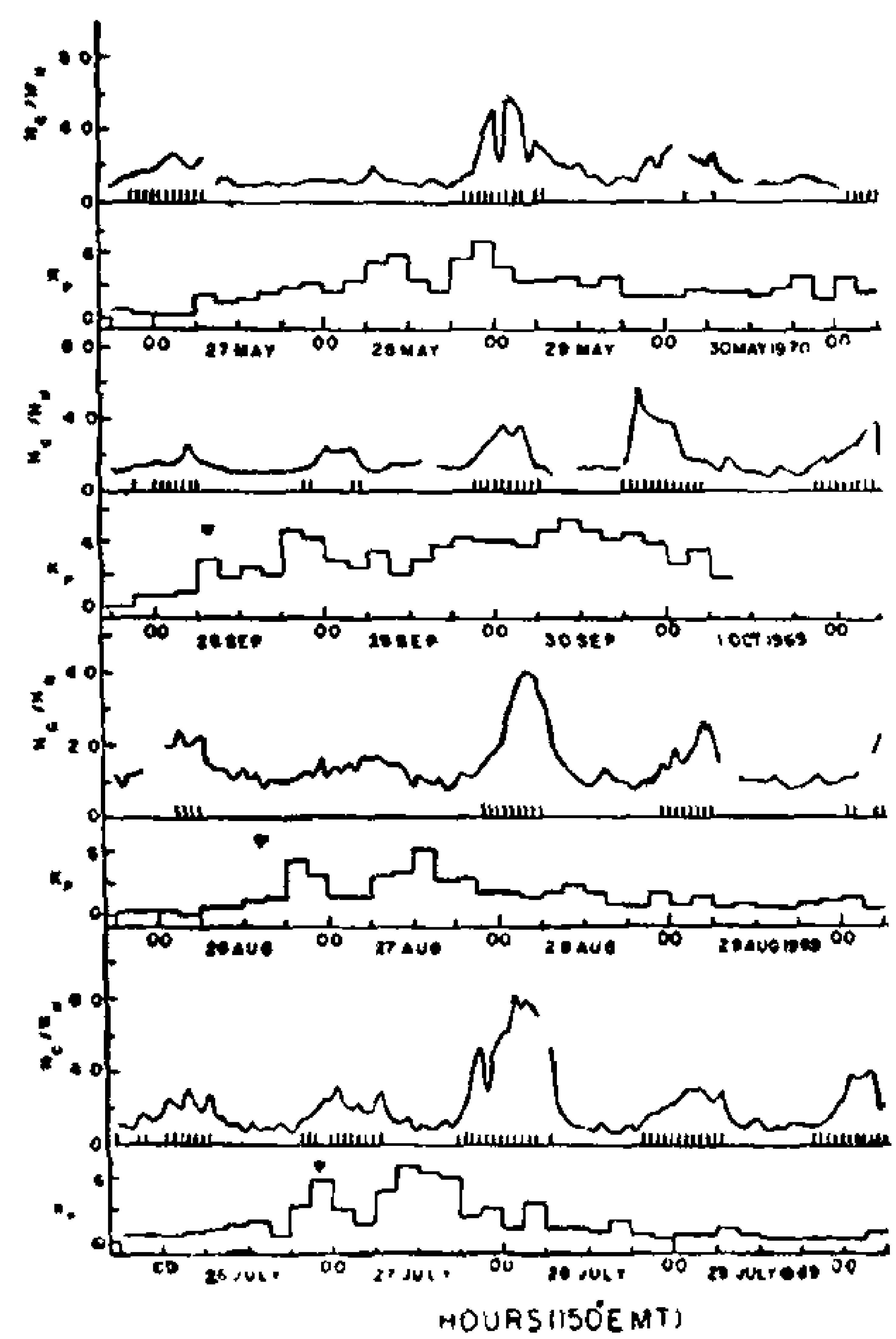

FIG. 1. Variation of K_p index and N_C/N_H for the storms of 26 July 1969; 26 August 1969; 28 September 1969 and 27 May 1970. The short vertical bars at the bottom of the N_C/N_H curves indicate the presence of spread-F at Hobart. (▼) indicates the time of the storm sudden commencement.

In Figs. 1 and 2 are shown continuous plots of the K_p index and the ratio N_C/N_H for the eight storm periods under consideration. The short vertical bars at the bottom of the N_C/N_H curves in Figs. 1 and 2 indicate the presence of spread-F at Hobart. It can be clearly seen from Figs. 1 and 2 that there is a conspicuous and rather consistent increase in the depth of the trough (N_C/N_H), either during the same night or the next night of the sudden commencement of the storm with a similar pattern of enhancement in the occurrence of spread-F at Hobart (storms 2–6 of Table I). The observed increase in the occurrence of the spread-F at Hobart after the initiation of the storm (storms 2–7 of Table I) is in agreement with the findings of the earlier statistical studies[6–8] that enhanced geomagnetic activity lead to an increase in (spread-F occurrence at midlatitudes with a lag of 0–2 days. It may also be seen from Figs. 1 and 2 that the occurrence of spread-F at Hobart during storm conditions is usually associated with relatively high values of N_C/N_H (1·5 and above). However, there is no one-to-one association between the occurrence of spread-F at Hobart and relatively high values of N_C/N_H when examined on a hour to hour basis. A good example of this is the behaviour during the night of 20–21 December 1971 (Storm 7).

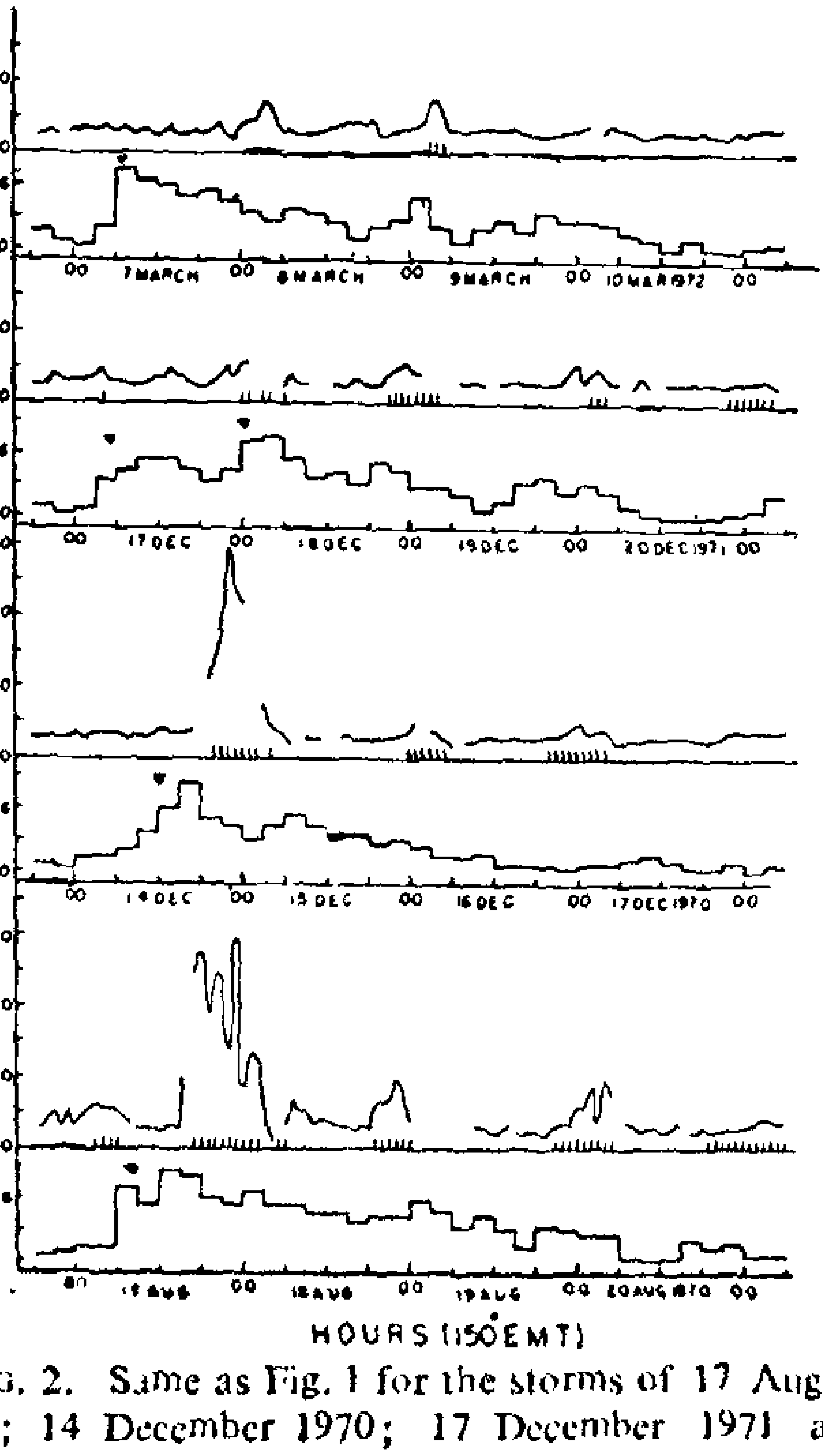

FIG. 2. Same as Fig. 1 for the storms of 17 August 1970; 14 December 1970; 17 December 1971 and 7 March 1972.

The above observations suggest that one of the causes (if not *the* cause) of the occurrence of spread-F at higher midlatitudes is the formation of the midlatitude ionospheric trough and the possible multiple reflections from the steep ionization gradients at the edges of the trough, lending further support to the work of Nichol[5] and the author.[6] The present study also suggests the need for further studies with more detailed information on the trough characteristics (using either foF2 or total electron content (N_T) data from a close network of stations around the trough zone) and the spread-F characteristics (using actual ionogram data to infer the type of spread-F configuration, extent of spread........etc.) to enable a better understanding of the role of the formation of the midlatitude ionospheric trough as a cause of spread-F in the trough zone.

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STUDY OF LANTHANIDE(III) AND THORIUM(IV) CHLORIDE COMPLEXES WITH THIOUREAS

UREA and thiourea are suggested for the complexation of certain lanthanide and actinide salts and it is concluded that the ligands are bonded through 'O' and 'S' atom respectively[1–4]. However a detailed spectroscopic study of lanthanides (III) and thorium (IV) chloride complexes of thiourea and its derivatives has not been made till now. So lanthanum (III), cerium (III) and thorium (IV) chloride complexes of thiourea, phenylthiourea, *o*-chlorophenylthiourea and