CHAPTER V

RESULTS

The calibration of head-discharge performance curve of the designed orifice having a diameter of 12.5 m.m. is shown in Fig. 8. The desired flow rate of each run could be obtained from this curve.

The variation of theoretical horsepower required for discharging various volumetric flow rates at a given constant head of 3.10 m. is tabluated in Table 1.

An experimental set-up of the entire system for a specific aerator given operational conditions is shown in Fig. 5.

The experimental data obtained are shown in Table A-1 to A-35 of APPENDIX A. The overall oxygen transfer coefficient obtained at different flow rate and tray spacing varied from 15 cm. to 35 cm. as shown in Table 2 and Fig. 9. Dissolved oxygen measured (C_L) and dissolved oxygen deficit ($C_s - C_L$) under each tray layer at different flow rate and tray spacing of 30 cm. are shown in Table 3 to Table 6 and Fig. 10 to Fig. 13.

The results of overall oxygen transfer coefficients and oxygen transfer rates computed from the experiment at various volumetric flow rates and volume aerated for a given tray spacing of 30 cm. are shown in Table 7, Tig. 14 and 15. The results of overall oxygen transfer coefficients determined by the method of least squares and the values of oxygen transfer rates computed at spedified operational conditions are least in APPENDIX C.

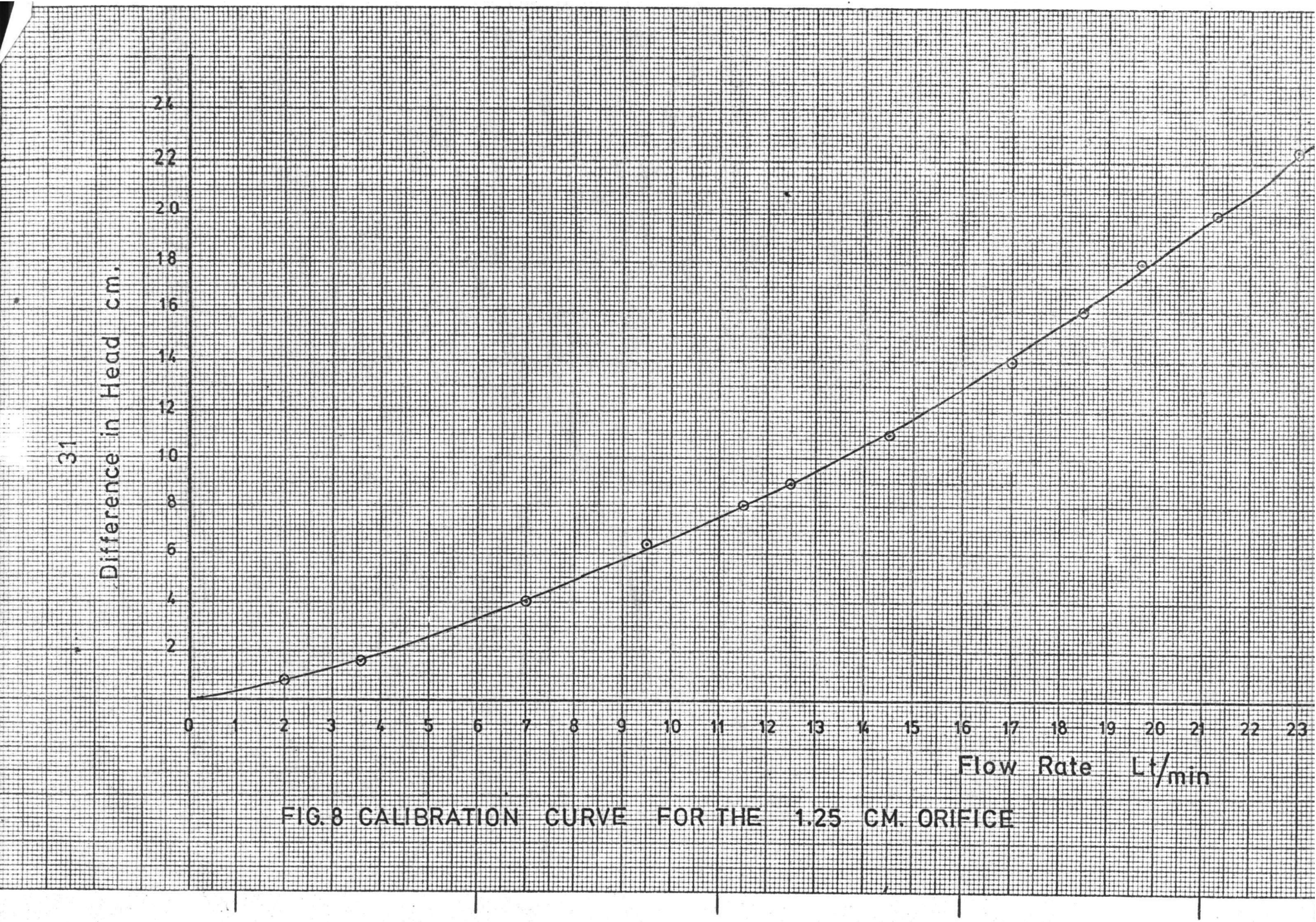

FIG. 8 CALIBRATION CURVE FOR THE 1.25 CM. ORIFICE

Table 1

Flow rate and net power consumption for specified aeration operational conditions

Flow Rate l/min	Head of Water m	$\frac{\text{ft-lb}}{\text{min}}$	Net Power w	Horse Power hp
9.6	3.10	211.642	4.7843	0.006413
12.0	3.10	264.552	5.9805	0.008017
14.6	3.10	321.872	7.2762	0.009754
19.7	3.10	434.306	9.8179	0.013161
23.0	3.10	507.058	11.4623	0.015365

Table 2

Overall oxygen transfer coefficient ($K_{La\ 20^{o}C}$) for specified aeration at various flow rate and tray spacing.

Flow Rate l/min	Tray Spacing cm	Temp. ^{o}C	$K_{La\ 20^{o}C}$ hr^{-1}	$K_{La\ 20^{o}C}$ day^{-1}
19.7	15	28.5	1.896	45.504
14.6	15	29.0	1.698	40.752
9.6	15	29.0	1.596	38.304
19.7	20	29.8	1.776	42.624
14.6	20	29.2	1.698	40.752
9.6	20	29.2	1.590	38.160
19.7	25	29.0	1.776	42.624
14.6	25	29.0	1.776	42.624
9.6	25	28.0	1.674	40.176
19.7	30	28.0	1.866	44.784
14.6	30	28.0	1.794	43.056
9.6	30	27.5	1.710	41.040
19.7	35	28.0	1.902	45.648
14.6	35	28.5	1.758	42.192
9.6	35	28.5	1.716	41.184

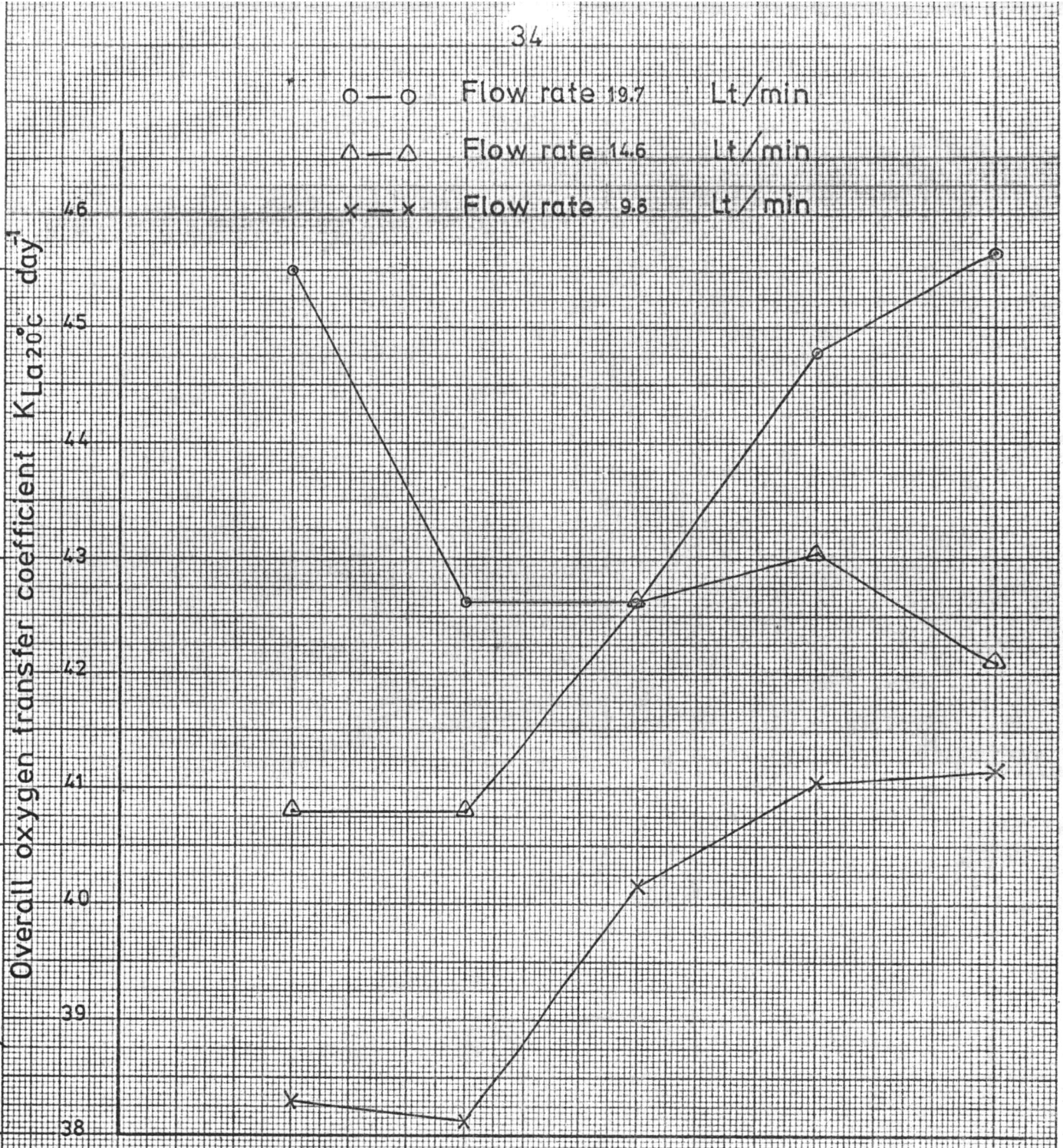

FIG. 9 RELATIONSHIP BETWEEN OVERALL OXYGEN TRANSFER COEFFICIENT $K_{La\,20^{\circ}c}$ day^{-1} AND TRAY SPACING

Table 3

Dissolved oxygen measured (C_1) and dissolved oxygen deficit ($C_s - C_1$) below layer trays

Sample : Tap Water

Operating Condition : Tank Temperature = 28.2°C

Depth of Water = 0.20 m

Volume of Water = 0.90 m^3

Flow Rate = 19.7 l/min

Tray Spacing = 0.30 m

Oxygen Saturation Value C_s = 7.88 mg/l

No. of Tray	D.O. Measured C_1 mg/l	D.O. Deficit, $C_s - C_1$ mg/l
1	0.30	7.58
2	3.00	4.88
3	4.25	3.63
4	5.65	2.23
5	6.55	1.33
6	7.25	0.63

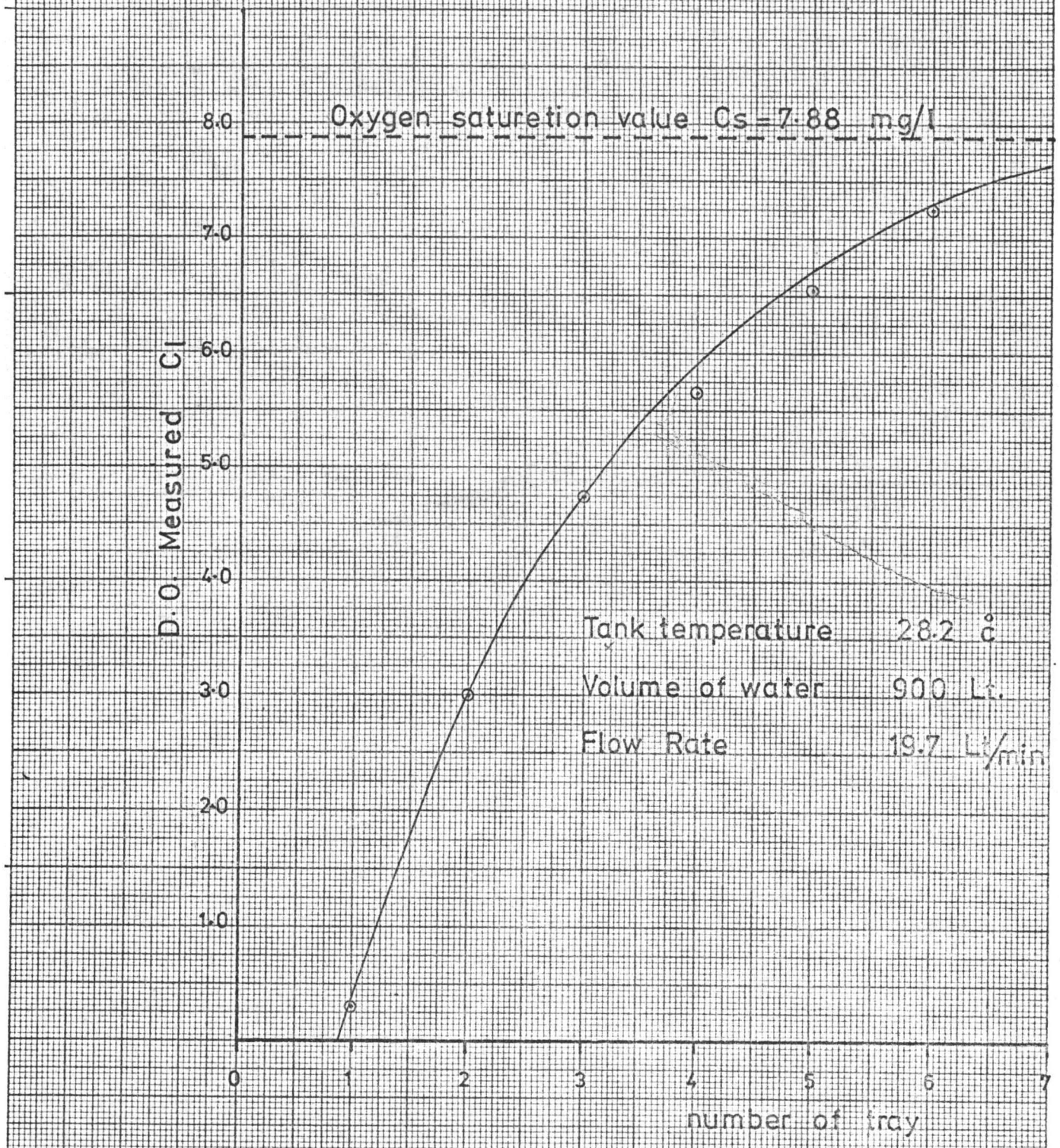

FIG. 10 RELATIONSHIP BETWEEN D. O. MEASURED Cl AND NUMBER OF TRAY

Table 4

Dissolved oxygen measured (C_1) and dissolved oxygen deficit ($C_s - C_1$) below layer trays.

Sample : Tap Water

Operating Condition : Tank Temperature = 28.2°C

Depth of Water = 0.20 m

Volume of Water = 0.90 m^3

Flow Rate = 14.60 l/min

Oxygen Saturation Value C_s = 7.88 mg/l

No. of Tray	D.O. Measured C_1 mg/l	D.O. Deficit, $C_s - C_1$ mg/l
1	0.25	7.63
2	2.75	5.13
3	4.50	3.38
4	5.65	2.23
5	6.80	1.08
6	7.10	0.78

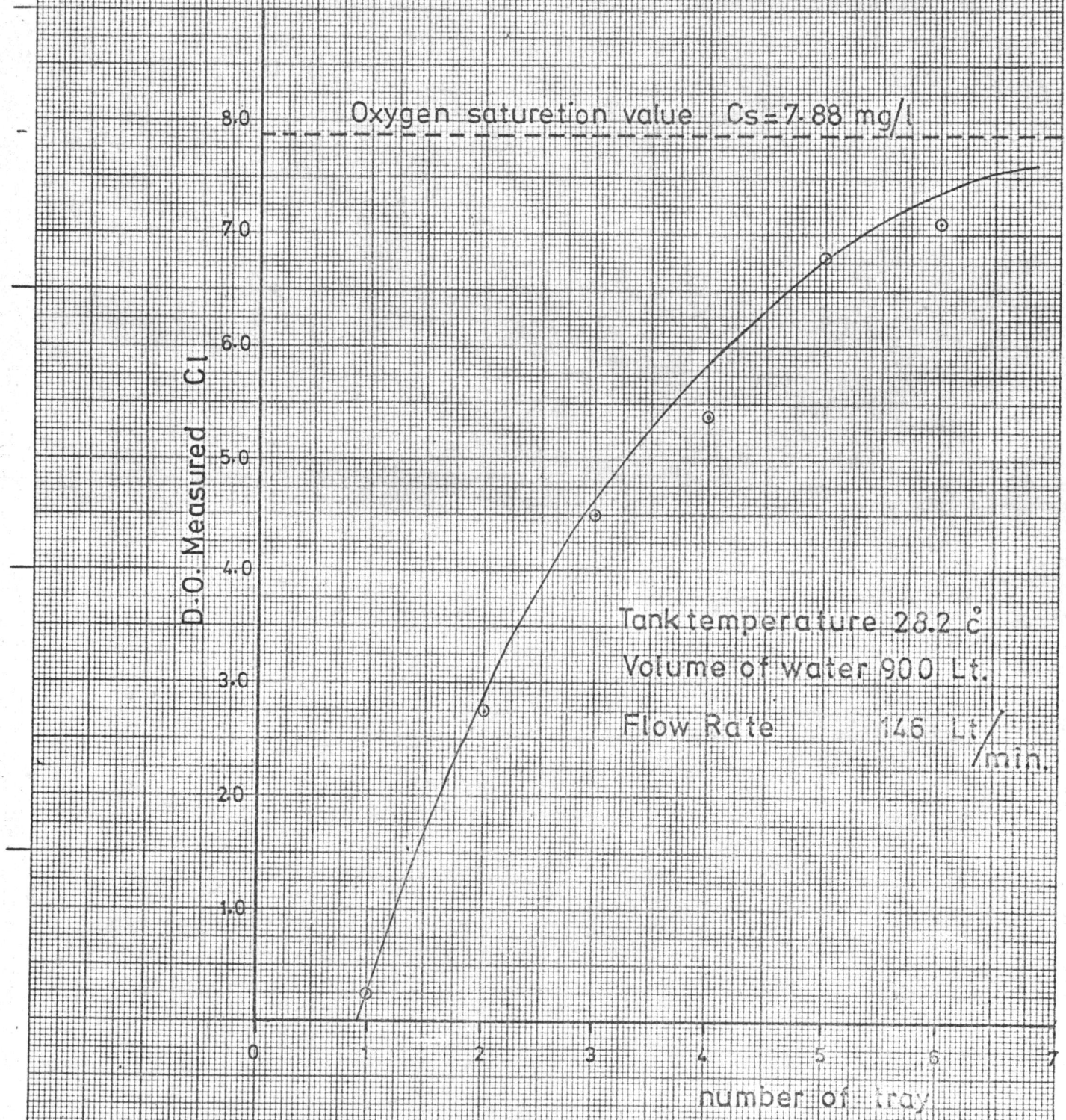

FIG-11 RELATIONSHIP BETWEEN D.O. MEASURED C_t AND NUMBER OF TRAY

Table 5

Dissolved oxygen measured (C_1) and dissolved oxygen deficit ($C_s - C_1$) below layer trays.

Sample : Tap Water

Operating Condition : Tank Temperature = 28.2°C

Depth of Water = 0.20 m

Volume of Water = 0.90 m^3

Flow Rate = 12.0 l/min

Tray Spacing = 0.30 m

Oxygen Saturation Value C_s = 7.88 mg/l

No. of Tray	D.O. Measured, C_1 mg/l	D.O. Deficit, $C_s - C_1$ mg/l
1	1.0	6.88
2	3.2	4.68
3	5.0	2.88
4	6.0	1.88
5	6.7	1.18
6	7.3	0.58

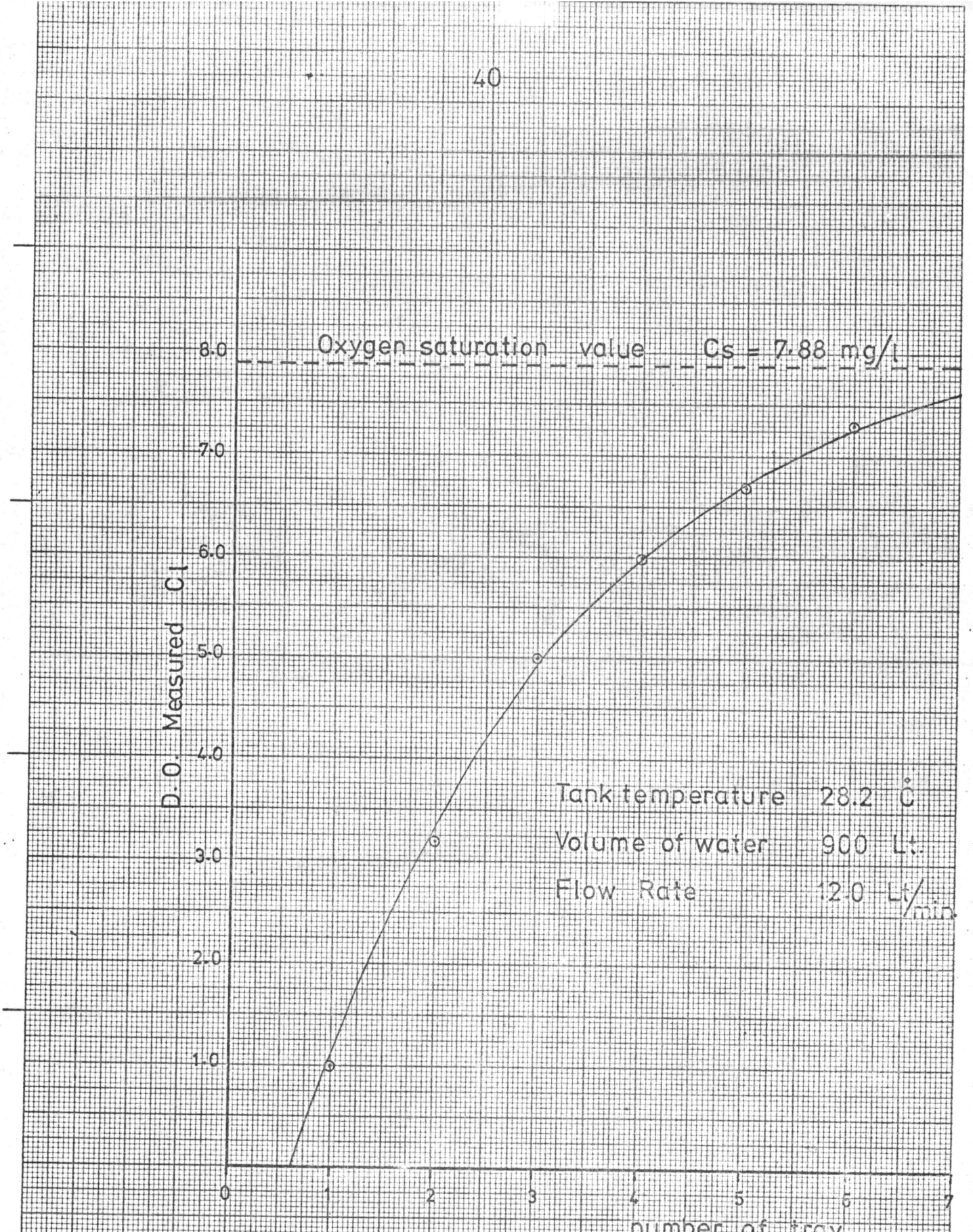

FIG. 12 RELATIONSHIP BETWEEN D.O. MEASURED Ct AND NUMBER OF TRAY

Table 6

Dissolved oxygen measured (C_l) and dissolved oxygen deficit ($C_s - C_l$) below layer trays.

Sample	:	Tap Water		
Operating Condition	:	Tank Temperature	=	28.2°C
		Depth of Water	=	0.20 m
		Volume of Water	=	0.90 m^3
		Flow Rate	=	9.6 l/min
		Tray Spacing	=	0.30 m
		Oxygen Saturation Value C_s	=	7.88 mg/l

No. of Tray	D.O. Measured, C_l mg/l	D.O. Deficit, $C_s - C_l$ mg/l
1	1.80	6.08
2	3.30	4.58
3	5.150	2.73
4	6.20	1.68
5	7.20	0.68
6	7.40	0.48

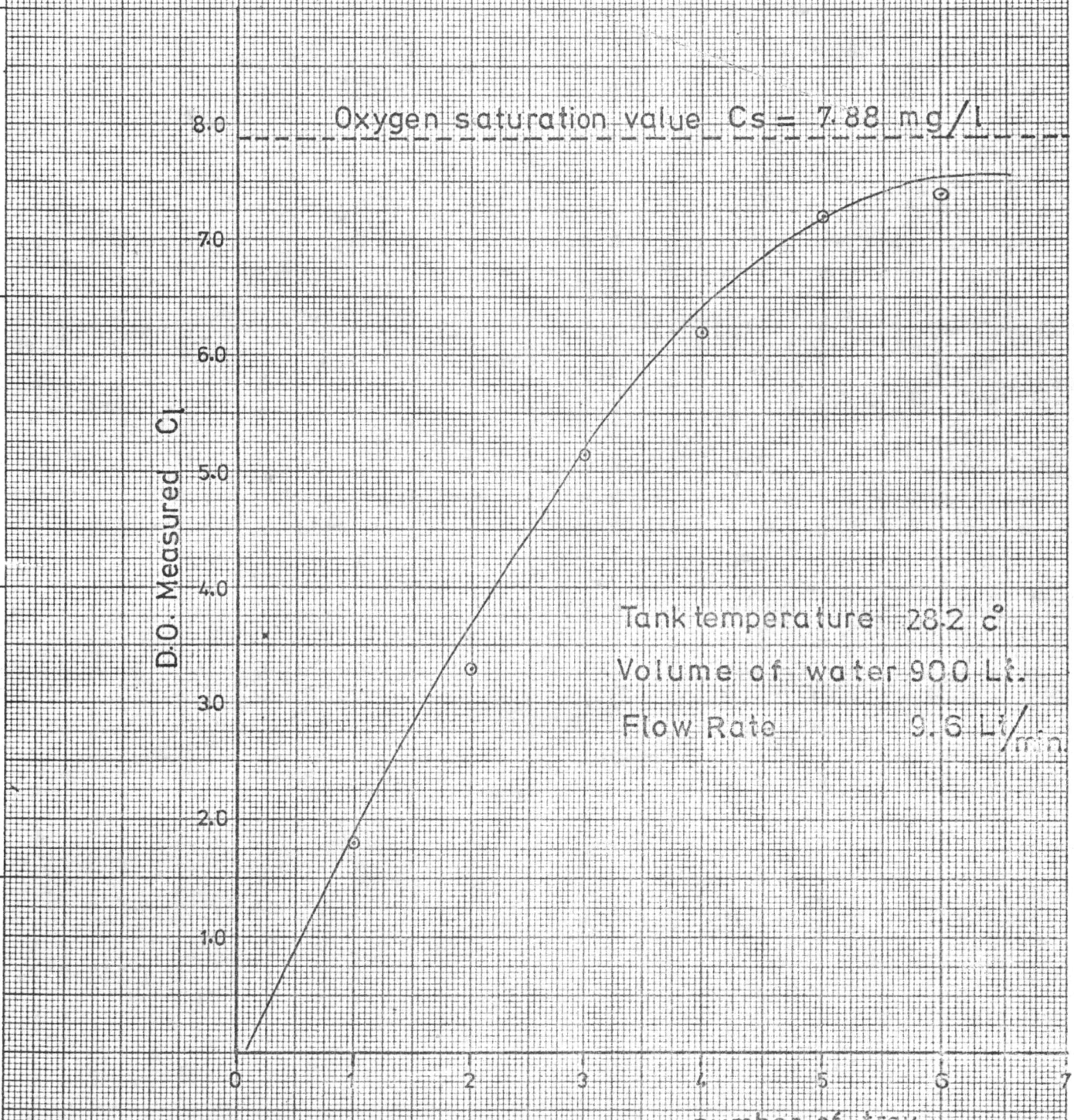

FIG. 13 RELATIONSHIP BETWEEN D.O. MEASURED C_t AND NUMBER OF TRAY

Table 7

Overall oxygen transfer coefficient ($K_{La\ 20^{o}C}$) and oxygen transfer rate at various water flow rate and volume aerated (tray spacing = 30 cm).

Flow Rate l/min	Vol; of Water l	$K_{La\ 20^{o}C}$ hr^{-1}	Oxygen Transfer Rate	
			lb O_2/hr/hp	Kg O_2/hr/Kw
19.7	1,300	1,284	2.572	1.564
14.6	1,300	1.080	2.634	1.601
12.0	1,300	1.026	3.117	1.895
9.6	1,300	0.876	3.366	2.046
23.0	1,100	1.800	2.443	1.485
19.7	1,100	1.608	2.400	1.459
14.6	1,100	1.314	2.744	1.668
12.0	1,100	1.212	3.262	1.983
9.6	1,100	1.506	4.726	2.873
23.0	900	2.190	2.149	1.307
19.7	900	1.866	2.419	1.470
14.6	900	1.794	3.247	1.974
12.0	900	1.746	3.154	1.917
9.6	900	1.710	4.602	2.798

Table 7 (cont.)

Overall oxygen transfer coeficient ($K_{La\ 20^oC}$) and oxygen transfer rate at various water flow rate and volume aerated (tray spacing = 30 cm).

Flow Rate	Vol. of Water	$K_{La\ 20^oC}$	Oxygen transfer rated	
l/min	l	hr^{-1}	lb O_2/hr/hp	Kg O_2/hr/Kw
23.0	700	2.976	2.331	1.417
19.7	700	2.574	1.901	1.156
14.6	700	2.676	3.429	2.085
12.0	700	2.532	3.800	2.310
9.6	700	2.262	4.136	2.515
19.7	500	3.396	2.560	1.556
14.6	500	3.042	2.887	1.755
12.0	500	2.904	3.334	2.027
9.6	500	2.180	3.447	2.096

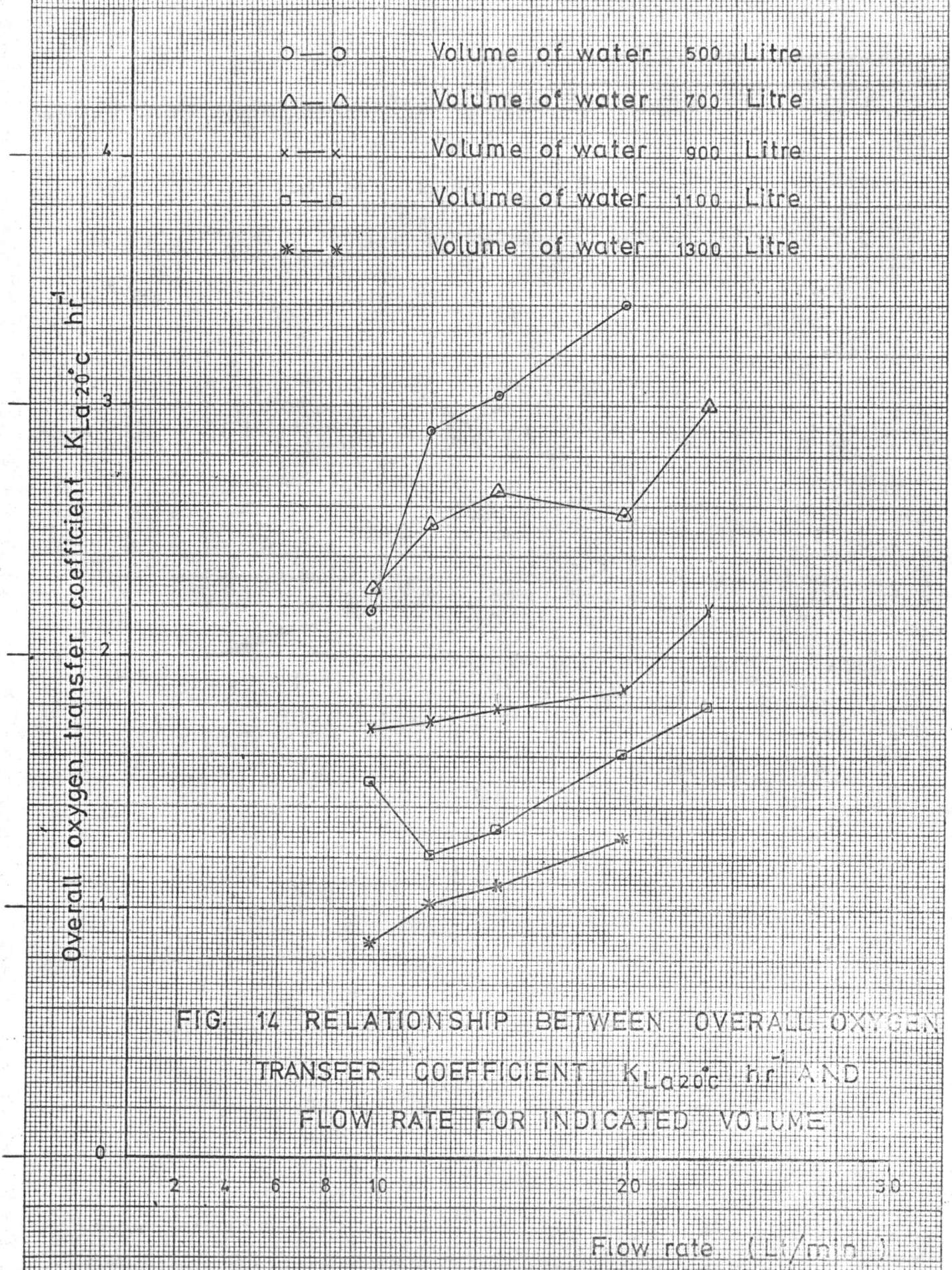

FIG. 14 RELATIONSHIP BETWEEN OVERALL OXYGEN TRANSFER COEFFICIENT $K_{La20^\circ C}$ hr^{-1} AND FLOW RATE FOR INDICATED VOLUME

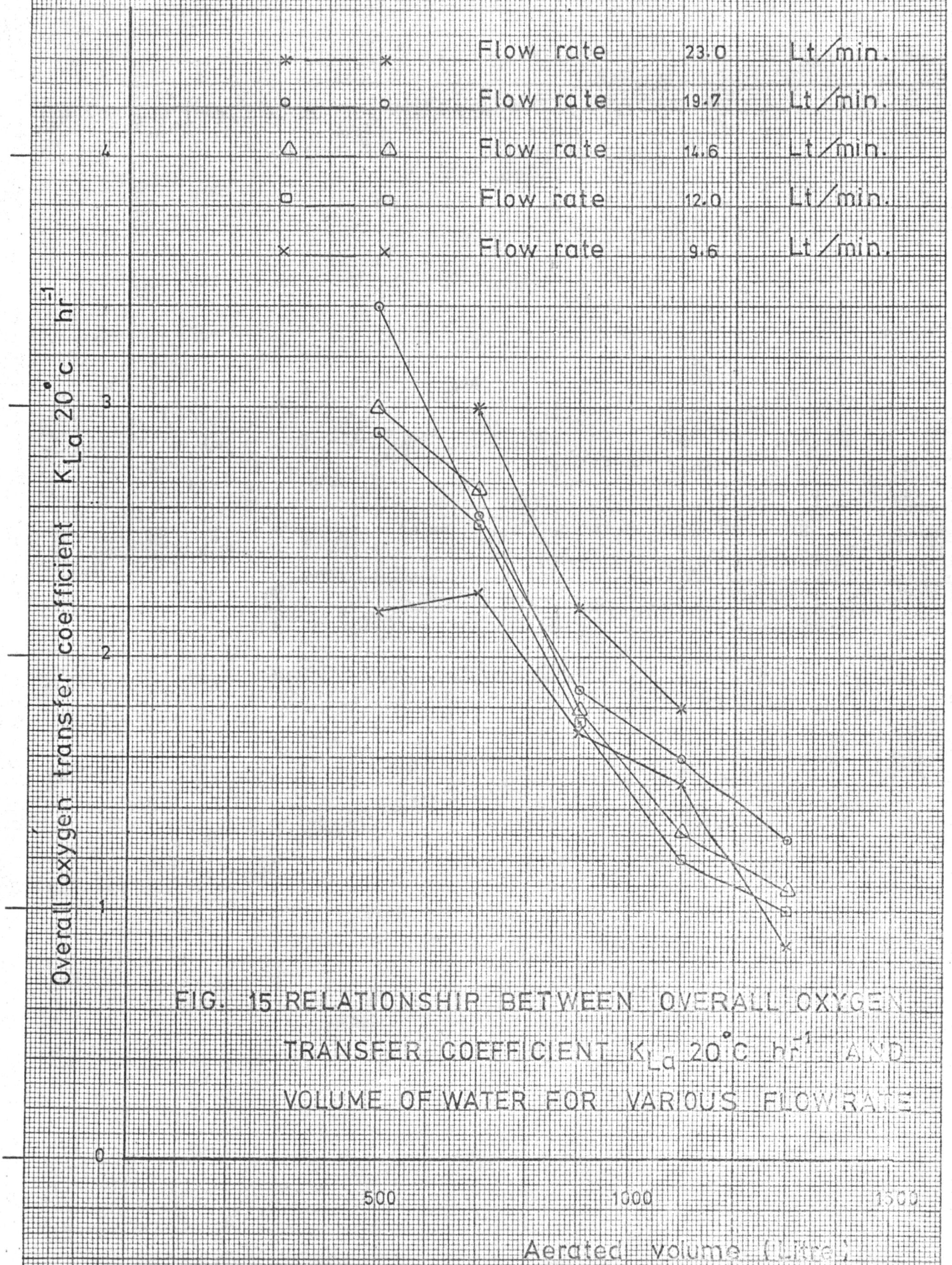

FIG. 15 RELATIONSHIP BETWEEN OVERALL OXYGEN TRANSFER COEFFICIENT K_La 20°C hr^{-1} AND VOLUME OF WATER FOR VARIOUS FLOWRATE