DON'T DISCLOSE IDENTITIES

From the beginning of these studies, the identities of the persons under study have been kept confidential. We look to you to carry on this trust. Please guard the privacy of the persons involved by substituting fictitious names, or code symbols for real names.

RELATION BETWEEN QUALITY OF OUTPUT AND
AVERAGE HOURLY OUTPUT
RELAY ASSEMBLY TEST ROOM

10 P

August, 1931

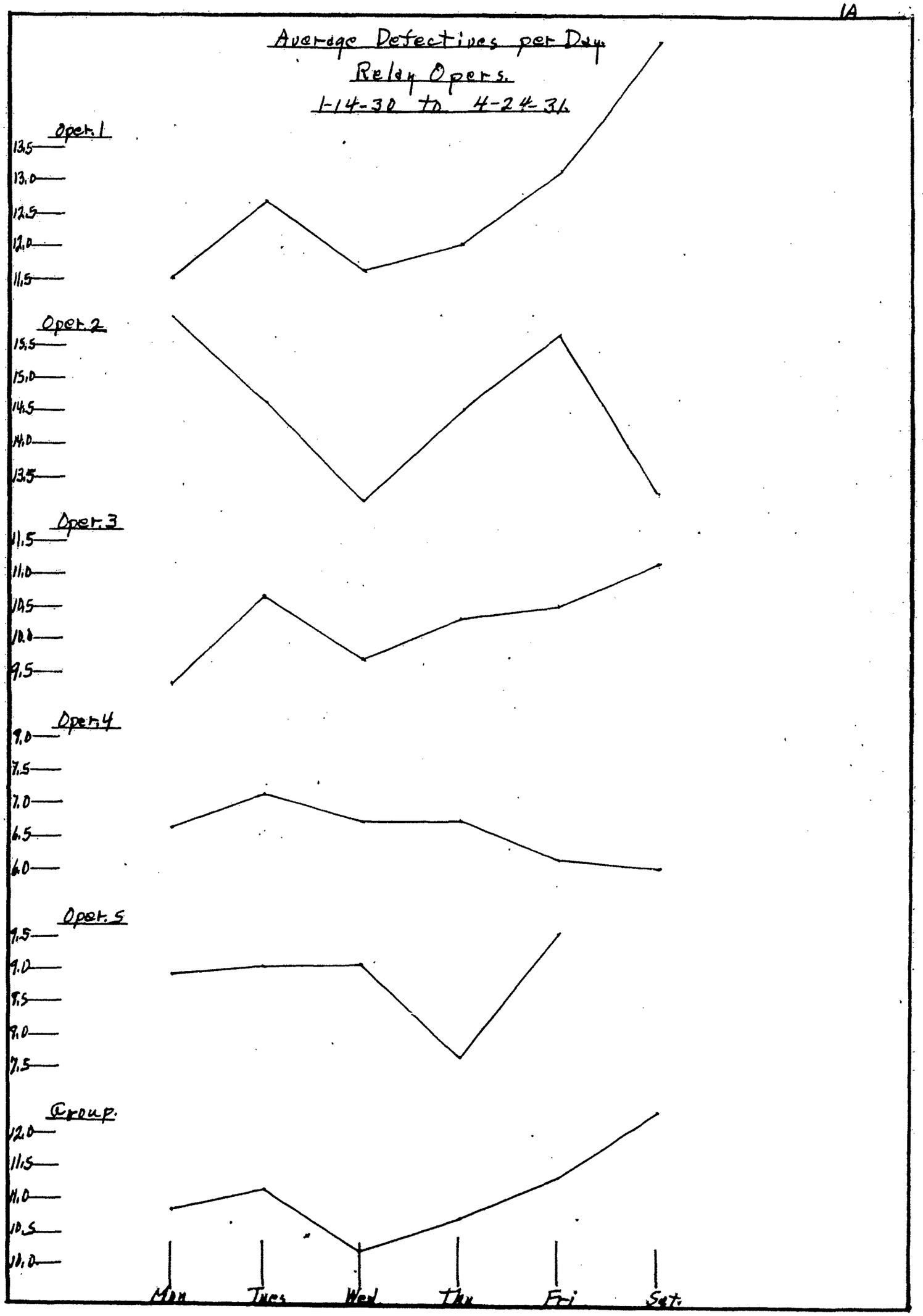
August 8, 1931.

RELATION BETWEEN QUALITY OF OUTPUT AND AVERAGE HOURLY OUTPUT - OUTPUT BY DAYS OF THE WEEK, HOURS OF SLEEP, WEATHER, AND VOLUME OF CONVERSATION

On May 15, 1931, a report was submitted entitled "Quality of Production - Relay Group, 6-16-30 to 4-24-31." This report described the findings of a study of the types of defects causing rejection of relays by the inspector and of the assembly habits of each operator.

The purpose of this report is to discuss the relation between quality of output and the following factors: average hourly output, day of the week, weather, amount of sleep the operator has had the preceding night, and volume of conversation. The data used are the inspector's records of rejections from 6-16-30 to 7-10-31 and the records of weather, output, sleep and conversation maintained by test observers for the same period.

The first step in this study was to learn whether records for the various days of the week could be regarded as comparable. The attached chart 1A shows the average number of rejections for each operator for each day of the week during the interval 1-14-30 to 4-24-31. While these curves display diverse tendencies, the group average indicates that Monday and Wednesday seem to be the days having the fewest defectives. The differences, however, are very small and for purposes of comparison are negligible.


Average Defectives per Day.
Relay Opers.
1-14-36 to 4-24-36
Oper. 1
13.5
13.0
12.5
12.0
11.5
Oper. 2
15.5
15.0
14.5
14.0
13.5
Oper. 3
11.5
11.0
10.5
10.0
9.5
Oper. 4
7.5
7.0
6.5
6.0
Oper. 5
9.5
9.0
8.5
8.0
7.5
Group.
12.0
11.5
11.0
10.5
10.0
Mon
Tues
Wed
Thu
Fri
Sat.

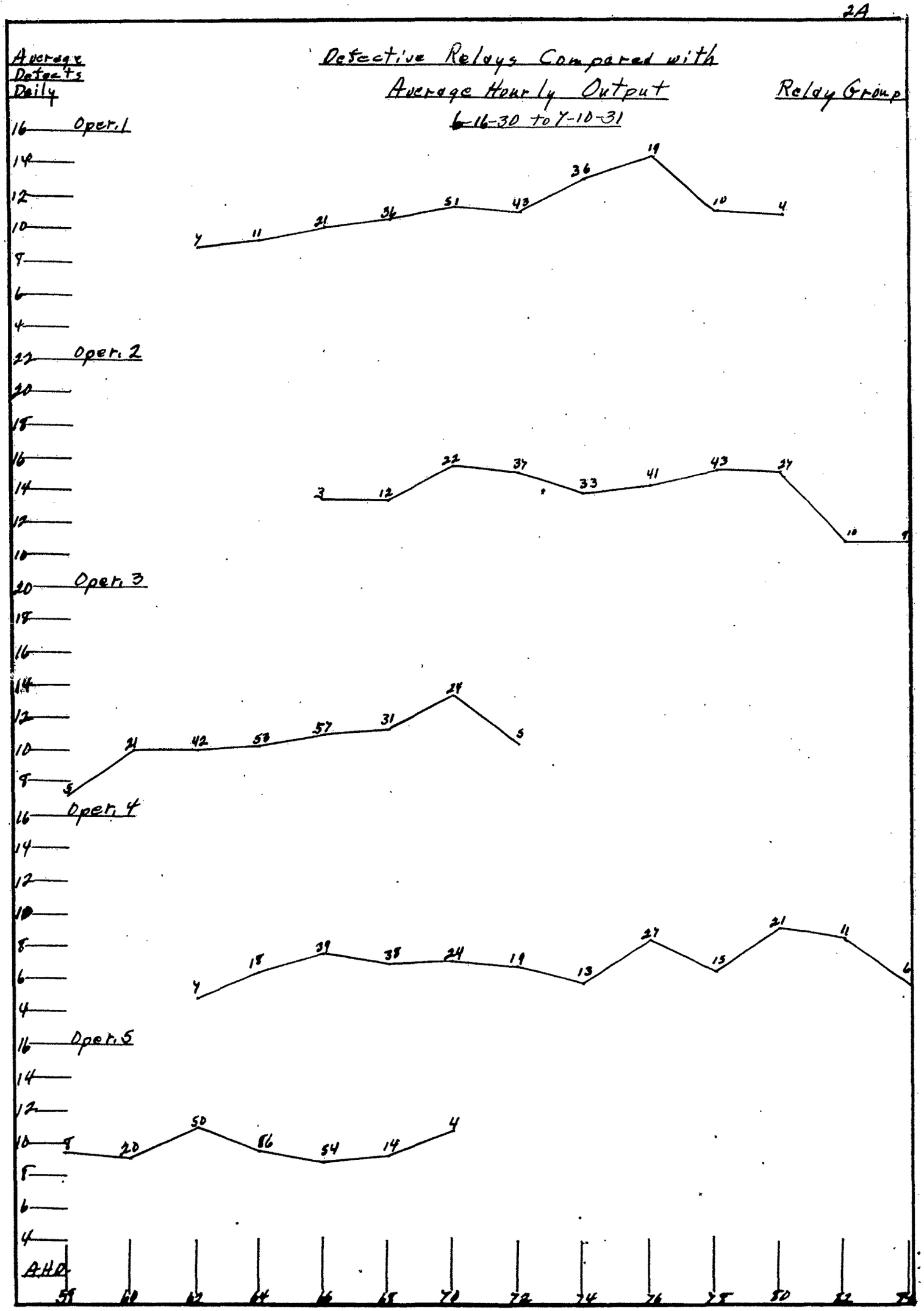
Sheet 2A shows the relation of quality and quantity of output. The chart shows the average number of relays rejected daily for each operator for all days in successive ranges of output. In the cases of Operators 1, 3,and 4, it is evident that rejections increase with output; Operator 2 shows very little trend; and Operator 5 has a tendency toward greater accuracy on her faster days. The following findings support these conclusions:

Operator 1 - for the 126 days of this study when her output was less than 72 relays an hour, Operator 1 averaged 10.6 rejections daily; for the 112 days when her output was 72 relays an hour or more, she averaged 12.2 rejections daily.

Operator 2 - for the 107 days when her output was less than 76 relays an hour, Operator 2 averaged 14.4 rejections daily; for the 130 days when her output was 76 or more relays an hour she averaged 14.6 rejections daily.

Operator 3 - for the 121 days when her output was less than 66 relays an hour, Operator 3 averaged 9.9 rejections daily; for the 117 days when her output was 66 or more relays an hour she averaged 10.7 rejections daily.

Operator 4 - for the 126 days when her output was less than 64 relays an hour, Operator 4 averaged 6.9 rejections daily; for the 112 days when her output was 72 or more relays an hour she averaged 7.4 rejections daily.


Defective Relays Compared with
Average Hourly Output
6-16-30 to 7-10-31
Relay Group
Average Defects Daily
Oper. 1
7 11 21 36 51 43 36 19 10 4
Oper. 2
3 12 22 27 33 41 43 37 10 9
Oper. 3
5 21 42 53 57 31 24 5
Oper. 4
4 18 39 38 24 19 13 27 15 21 11 4
Oper. 5
8 20 50 36 54 14 4
AHO
58 60 62 64 66 68 70 72 74 76 78 80 82 84

Operator 5 - for the 78 days when her output was less than 64 relays an hour, Operator 5 averaged 10.3 rejections daily; for the 158 days when her output was 64 or more relays an hour she averaged 9.2 rejections daily.

(The division was made in the above table at the point nearest the median.)

An increase in output would normally be accompanied by an equivalent increase in rejections and in general it is safe to say that until operators reach a speed at which the rate of rejections increases considerably more than at any of the higher speeds here recorded, they have not passed the point of maximum efficiency.

Sheet 3A is a graph showing average daily defectives for various weather conditions. Differences due to the sunniness or cloudiness of the weather, or to rain or snow are negligible. In the cases of Operators 1, 3, and 4, however, less defectives are assembled in mild and cold weather than on days which are warm or hot, while Operator 2 has more rejections on mild and cold days than on warm or hot days. The following table illustrates this:

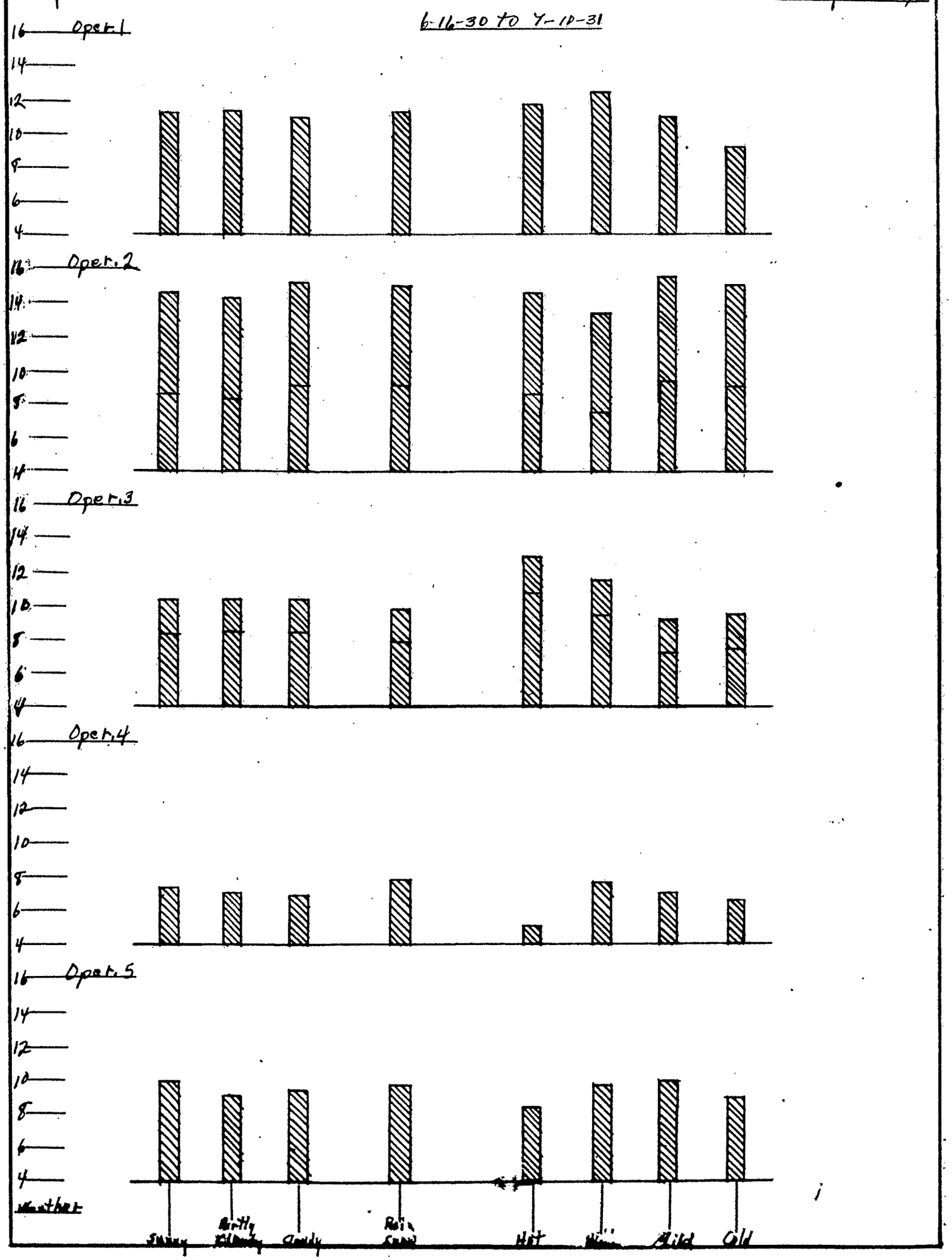
Average Defectives Daily

	Operators				
	1	2	3	4	5
Hot - Warm	12.2	13.4	11.6	7.5	9.6
Mild - Cold	10.5	15.3	9.1	6.9	9.6

Defective Relays Compared with Weather

6-16-30 to 4-10-31

Relay Group.



A day is designated according to the average temperature for the 24 hours as recorded in the daily newspaper and the temperature ranges are as follows:

"Hot" includes days when the temperature average is 80° or over.

"Warm" includes days when the temperature average is 60-79°.

"Mild" includes days when the temperature average is 32-59°.

"Cold" includes days when the temperature average is below 32°.

Sheet 4A gives the average number of rejections daily for days in successive ranges of sleep intervals. This graph shows no definite trends in the case of any operator.

Sheet 4B is based on a record instituted 10-20-30, which attempts to evaluate numerically the volume of conversation among test operators from day to day. For each quarter-day (the division is made at rest periods and noon recess) a figure ranging from 1 to 4 is assigned to each operator.

"1" indicates that the operator participated in less than 15 minutes of conversation.

"2" indicates from 15 to 45 minutes of conversation.

"3" indicates more than 45 minutes of conversation.

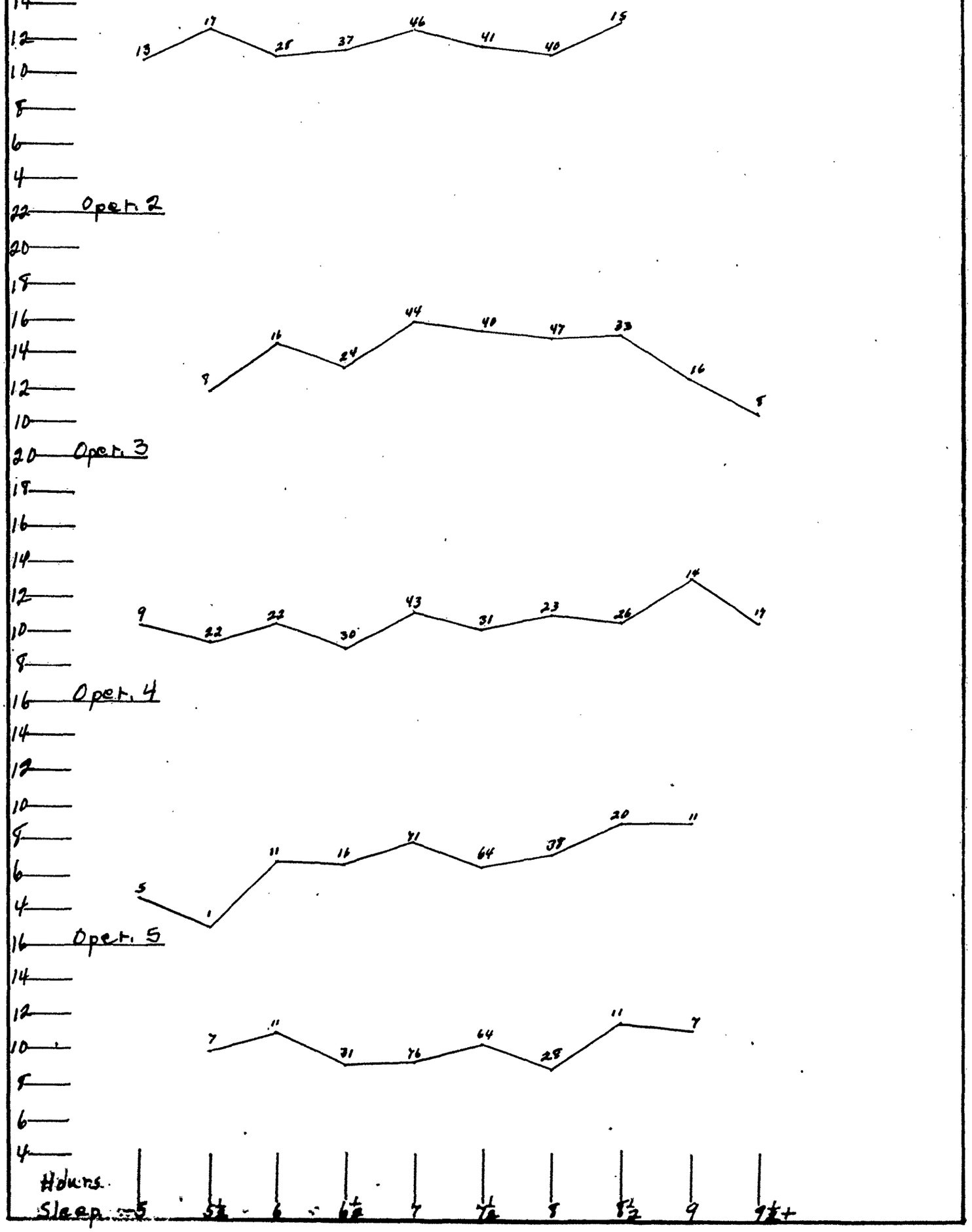
"4" indicates the same as "3", plus boisterousness - singing, laughing, and calling across to operators in non-adjacent bench positions.

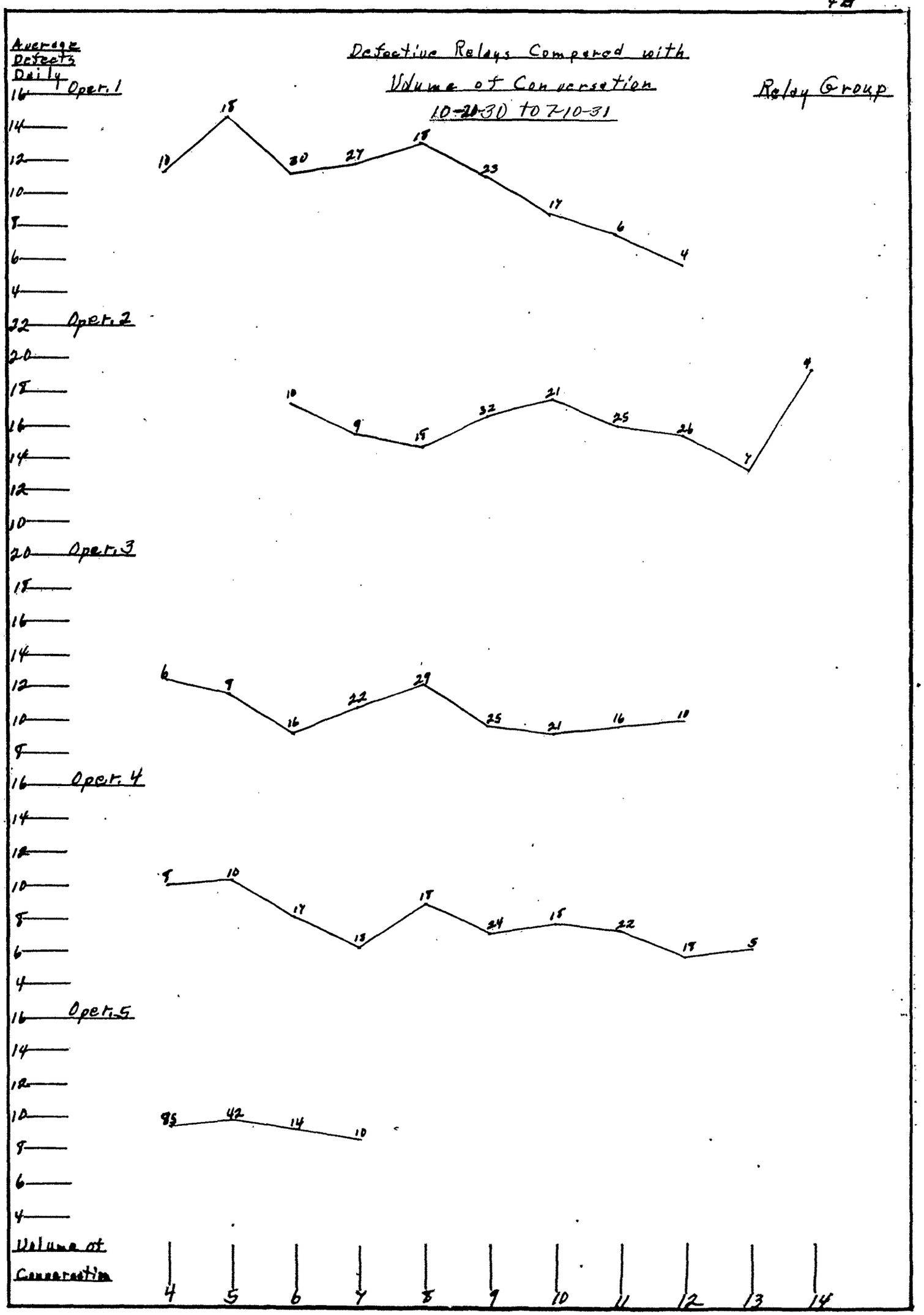
The figures used for graph 4B represent totals for a day, and could conceivably range from 4 to 16, though there were no

Defective Relays Compared with Hours of Sleep
6-16-30 to 7-10-31

Relay Group.

Average Defects Daily




Defective Relays Compared with Volume of Conversation
10-21-31 to 7-10-31
Relay Group
Average Defects Daily
Oper. 1
16
14
12
10
8
6
4
Oper. 2
22
20
18
16
14
12
10
Oper. 3
20
18
16
14
12
10
8
Oper. 4
16
14
12
10
8
6
4
Oper. 5
16
14
12
10
8
6
4
Volume of Conversation
4
5
6
7
8
9
10
11
12
13
14
18 30 27 18 23 17 6 4
10 9 15 32 21 25 26 7 9
6 9 16 22 29 25 21 16 10
8 10 17 13 18 24 15 22 18 5
9 42 14 10

totals above 14 in the actual figures. The record was suggested by a comment from the Layout Operator, "The girls will have a lot of repairs tomorrow; they've been so noisy this week." The chart shows, however, that in the case of every operator defectives decrease as volume of conversation increases. It is observable that often when operators are quiet they are absorbed in a reverie from which they are not easily aroused. It is probable that this state of reverie is less conducive to attention to the assembly process than is the state of alertness accompanying the conversational frame of mind.

D.A. 6-6088-3A

LC-ER