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FUEL RESEARCH INSTITUTE

OF SOUTH AFRICA

TEGNIESE MEMORANDUM
TECHNICAL

NO. 24 OF 1973

THE APPLICABILITY OF THE ROSIN-RAMMLER DIAGRAM TO REPRESENT THE SIZE DISTRIBUTION OF RUN-OF-MINE COALS

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The effects of mechanisation in coal mining were investigated by the N.C.B. Scientific Department and some data were published in "Second Symposium on Coal Preparation," 21st to 25th October, 1957, University of Leeds.

The annexed tables 1, 3, and 4 show the influence of various mining procedures on the size distribution of run-of-mine coal. Table 2, with only 3 usable size ranges, was omitted.

In most cases there was an increase in the smaller size ranges with the introduction of mechanical winning and loading devices. The Armstrong Air Breaker and the Loebbe-Hobel-Plough, however, produced greater proportions of large coal as compared to conventional getting by explosives and hand loading.

The size ranges given in the abovementioned tables, as well as the average percentages obtained from size tests, are considered to be on the low side for a thorough investigation with regard to the Rosin-Rammler distribution.

/2 .....

In Figure 1 the cumulative values of the screen analyses given in Table 1 were plotted in the Rosin-Rammler diagram. Most of the size fractions could be connected by a straight line. A somewhat higher deviation was observed in the plus 3,2 mm ($\frac{1}{8}$") fraction for all five samples. The screen analyses refer to the same seam and only the methods of winning and loading varied. Although the amount of fine coal in the range of 12,7 mm to 0 ($\frac{1}{2}$" x 0) fluctuated from 28,3% to 42,6%, there was a remarkably small difference in the slope of the lines in the diagram.

In Figure 2 the cumulative values from Table 3 are represented, also showing hardly any deviation in the slope of the connecting line for the same coal, regardless of the method of mining.

The screen analyses of six different coals mined in the conventional way as well as mechanically, from Table 4, are plotted in Figures 3, 4, and 5. There again, the slope of the lines is not much affected by the manner of mining.

In order not to coincide too closely, some of the lines in the diagrams were shifted by one or two cycles.

CONCLUSION

Size distribution is that property of particulate matter which is expressed by the relation between the amounts of different sizes of which it is composed. A material may have the same size distribution as another one which is much smaller or coarser than the first one. Both materials have the same size distribution constant n, but differ in their absolute size constant $\bar{x}$.

/3 .....

For instance, a coal containing grains of 1, 2, 3, 5, and 7 mm has the same size distribution as another one with 2, 4, 6, 10 and 14 mm, but the average size of the first one is linearly only half of the second one.

From the screen analyses represented in Figures 1 to 5, it appears that the size distribution of a coal does not alter with the method of mining which is applied in winning it. The absolute size constant $\bar{x}$, however, is greatly influenced by the methods of mining.

In Tables Nos. 5, 6, and 7 some data extracted from the Rosin-Rammler diagram are summarized.

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RESEARCH OFFICER

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TABLE 1

COLLIERY "A", SEAM "D", SIZING TESTS FOR VARIOUS METHODS OF HAND AND MECHANICAL LOADING

Size inch.	Conventional Cutting and Hand Filling	Samson Double Cut Panzer Conveyor	Loebbe Hobel	Anderton Disc Shearer	Meco-Moore
+3	27,5	25,7	29,8	15,1	19,5
3 - 2	9,1	8,7	10,3	7,0	7,8
2 - 1	17,4	15,1	17,0	15,7	16,7
1 - ½	15,4	15,0	14,6	19,6	16,7
½ - ⅛	13,9	14,9	14,4	19,9	17,9
⅛ - 0	16,7	20,6	13,9	22,7	21,4
½ - 0	30,6	35,5	28,3	42,6	39,3

Working thickness 4 ft. Coal moderately hard.
Tests carried out on one mine car per half hour for one day.

/Table 2 .....

TABLE 3

Size inch.	Colliery "R"		Colliery "M"	
	Conventional Method	Dosco Miner	Conventional Method	Disc Shearer
+6	7,4	2,5	-	-
6 - 4	5,2	3,6	25,5	4,9
4 - 2	11,2	6,7	12,3	7,3
2 - 1	14,8	9,6	16,4	15,3
1 - 0	61,4	77,6	45,8	72,5

/6 .....

TABLE 4

Size inch.	Colliery "R"		Colliery "S"		Colliery "L"		Colliery "K"		Colliery "H"		Colliery "M"	
	Con-vent. Method %	Disc Sheared %	Con-vent. Method %	Disc Sheared %	Con-vent. Method %	Disc Sheared %	Con-vent. Method %	Disc Sheared %	Con-vent. Method %	Dosco Miner %	Con-vent. Method %	Tre-pan-ner %
+6	34,8	9,2	26,5	3,0	16,1	2,2	31,2	3,8	7,8	3,1	10,2	5,4
6 - 4	10,5	7,4	10,9	1,4	6,5	1,0	13,7	3,8	9,6	3,0	3,7	2,0
4 - 2	12,6	12,0	15,2	3,8	20,5	9,3	14,6	9,2	18,2	7,1	18,7	14,1
2 - 1	11,4	14,2	14,2	12,4	16,4	19,4	9,2	12,8	13,7	11,7	16,1	14,8
1 - ½	9,8	17,8	10,0	20,3	16,5	18,0	7,2	12,4	13,8	14,9	18,0	18,1
½ - 30 Mesh	17,8	34,1	19,6	50,8	21,8	45,5	22,2	48,9	31,9	48,6	29,5	40,4
30 mesh-0	3,1	5,3	3,6	8,3	2,2	4,6	1,9	9,1	5,0	11,6	3,8	5,2
½" - 0	20,9	39,4	23,2	59,1	24,0	50,1	24,1	58,0	36,9	60,2	33,3	45,6

/Table 5 .....

TABLE 5 (Figure 1)

COLLIERY "A", SEAM "D"

Method of Mining	Rosin-Rammler Parameters		Oversize, mm		
	n	$\bar{x}$ (mm)	25%	50%	75%
Conventional Cutting and Hand-Filling	0,76	50	80	32	10
Samson Double-Cut Panzer Conveyor	0,70	50	78	25	7
Loebbe Hobel	0,77	56	82	35	12
Anderton Disc Shearer	0,76	28	45	18	5,5
Meco-Moore	0,70	35	60	20	5

/8 .....

TABLE 6 (Figure 2)

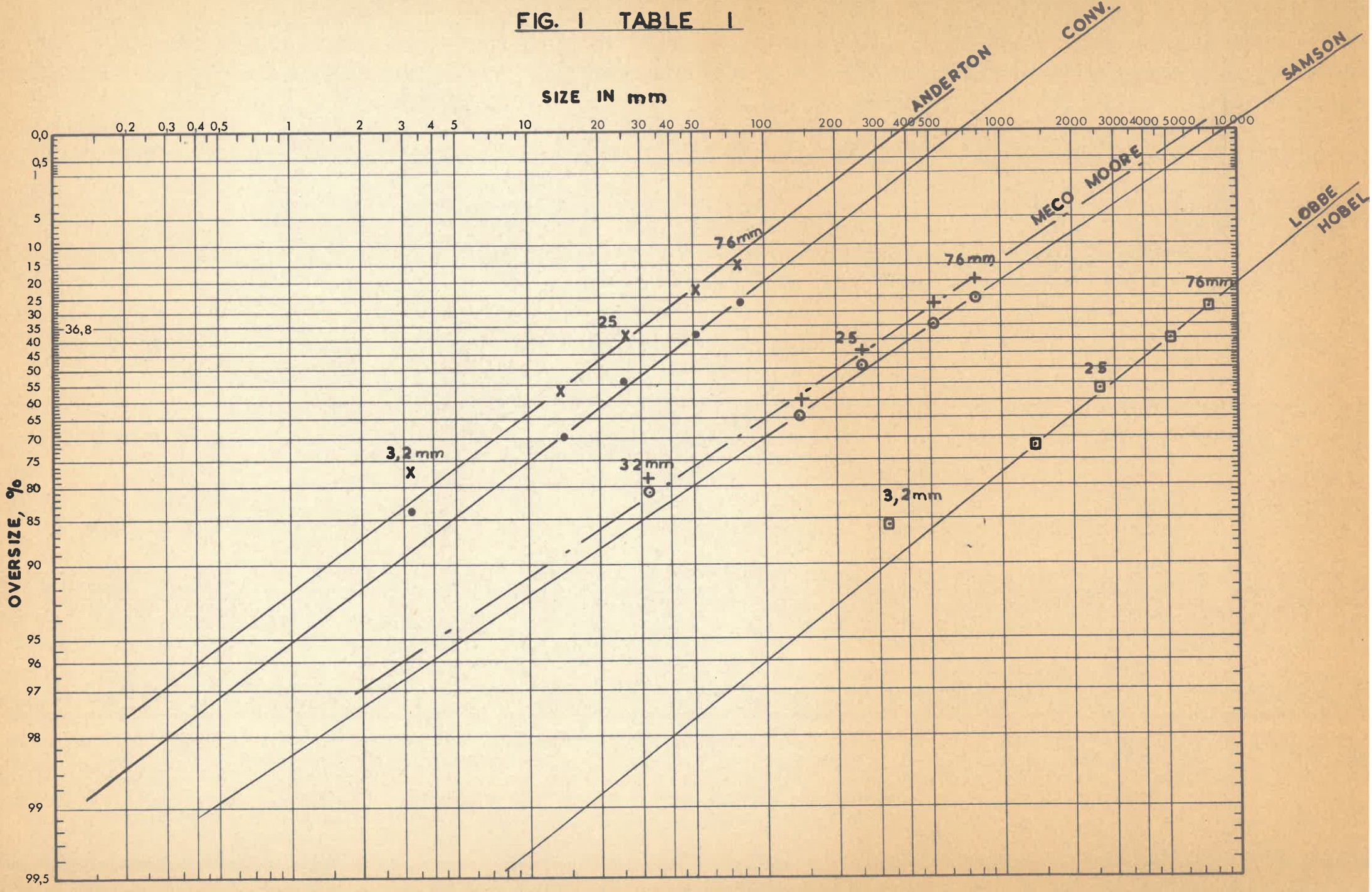
Colliery and Method of Mining	Rosin-Rammler Parameter		Oversize, mm		
	n	$\bar{x}$ (mm)	25%	50%	75%
Colliery "R"					
Conventional	0,54	27	50	14	3
Dosco Miner	0,54	14	25	7	1,5
Colliery "M"					
Conventional	0,60	60	100	30	7
Disc Shearer	0,62	18	28	9	2,2

/9 .....

TABLE 7 (Figures 3, 4, and 5)

Colliery	Method of Mining	Rosin-Rammler Parameters		Oversize, mm		
		n	$\bar{x}$ (mm)	25%	50%	75%
R	Conventional	0,61	140	230	77	18
	Disc Sheared	0,60	32	57	18	4
S	Conventional	0,62	100	160	53	13
	Disc Sheared	0,60	16	25	8	2
L	Conventional	0,78	72	105	45	15
	Disc Sheared	0,80	22	34	14	4,7
K	Conventional	0,56	125	200	70	16
	Disc Sheared	0,57	18	31	9,5	2,1
H	Conventional	0,66	45	70	25	6,8
	Dosco Miner	0,63	15	25	8	2,0
M	Conventional	0,76	45	68	27	9
	Trepanner	0,74	27	42	16	5

FIG. 1 TABLE 1


SIZE IN mm
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0,3
0,4
0,5
1
2
3
4
5
10
20
30
40
50
100
200
300
400
500
1000
2000
3000
4000
5000
10000
OVERSIZE, %
0,0
0,5
1
5
10
15
20
25
30
35
36,8
40
45
50
55
60
65
70
75
80
85
90
95
96
97
98
99
99,5
ANDERTON
CONV.
SAMSON
MECO MOORE
LOBBE
HOBEL
76mm
25
3,2 mm
32 mm
76mm
25
3,2 mm
76mm
25
3,2 mm

FIG. 2 TABLE 3

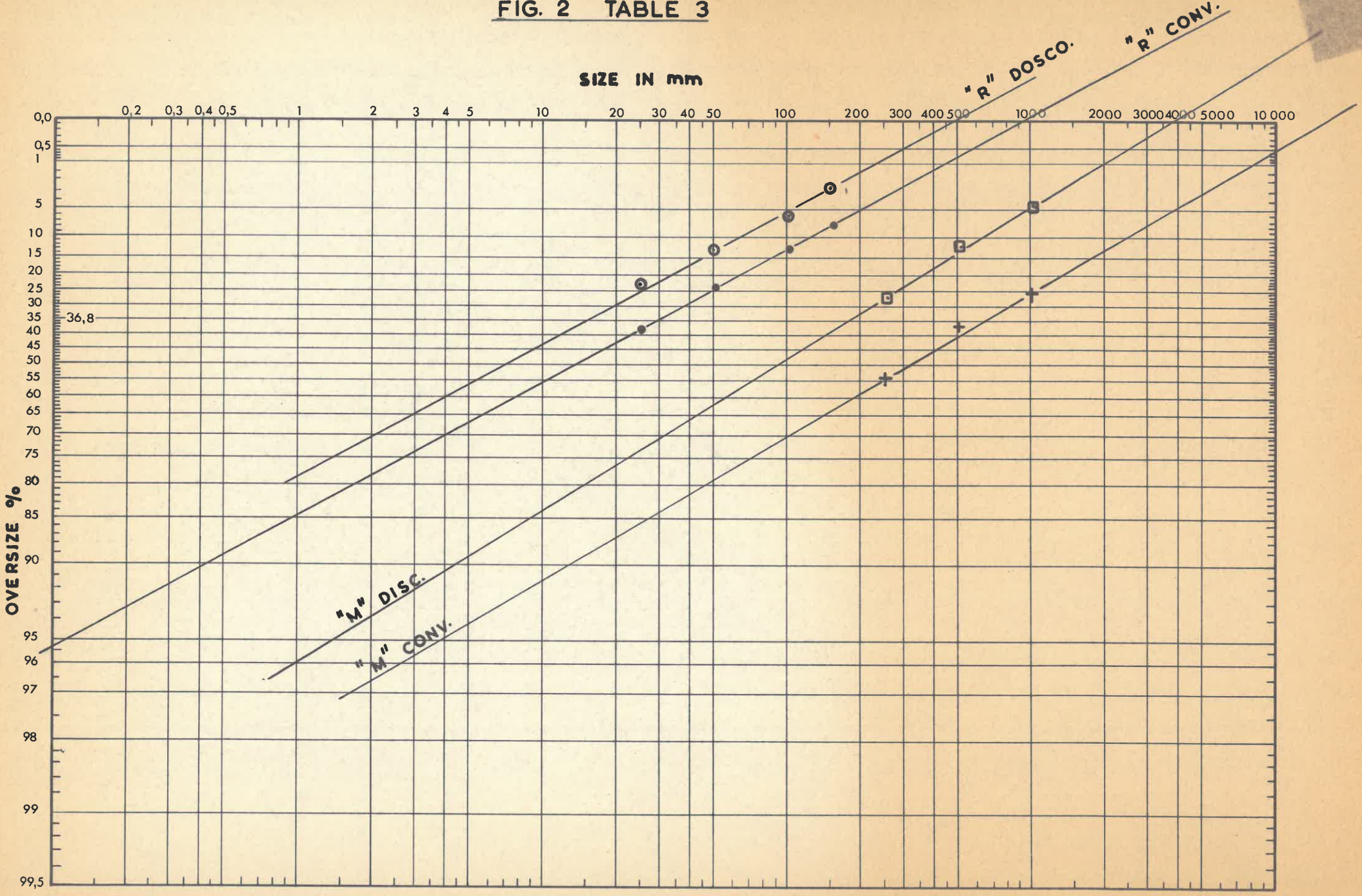

SIZE IN mm
0,2
0,3
0,4
0,5
1
2
3
4
5
10
20
30
40
50
100
200
300
400
500
1000
2000
3000
4000
5000
10 000
OVERSIZE %
0,0
0,5
1
5
10
15
20
25
30
35
36,8
40
45
50
55
60
65
70
75
80
85
90
95
96
97
98
99
99,5
"R" DOSCO.
"R" CONV.
"M" DISC.
"M" CONV.

FIG. 3 TABLE 4

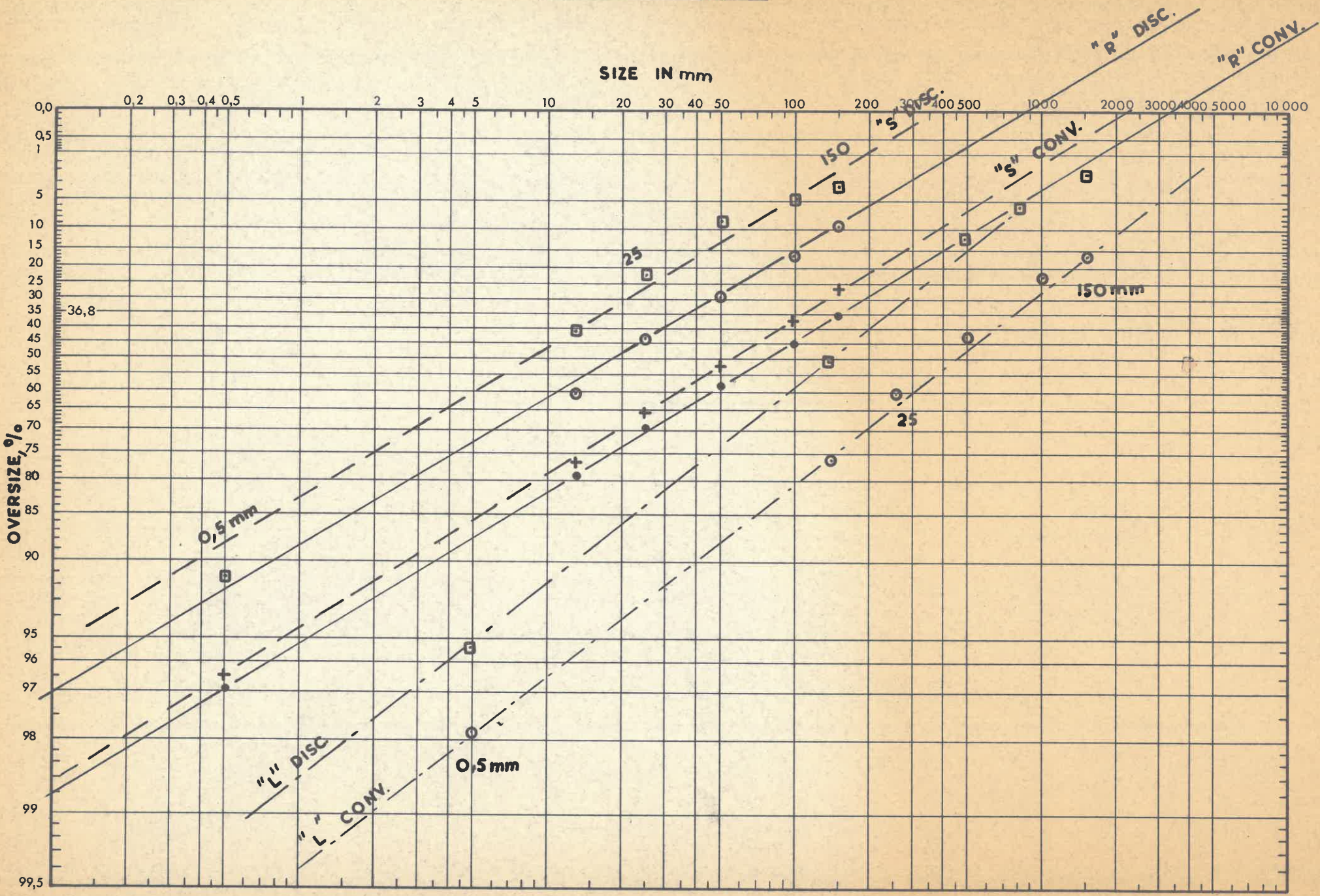

SIZE IN mm
0,2 0,3 0,4 0,5 1 2 3 4 5 10 20 30 40 50 100 200 300 400 500 1000 2000 3000 4000 5000 10 000
OVERSIZE, %
0,0 0,5 1 5 10 15 20 25 30 35 36,8 40 45 50 55 60 65 70 75 80 85 90 95 96 97 98 99 99,5
"R" DISC.
"R" CONV.
"S" DISC.
"S" CONV.
150
25
150mm
25
0,5 mm
"L" DISC.
"L" CONV.
0,5mm

FIG.4 TABLE 4

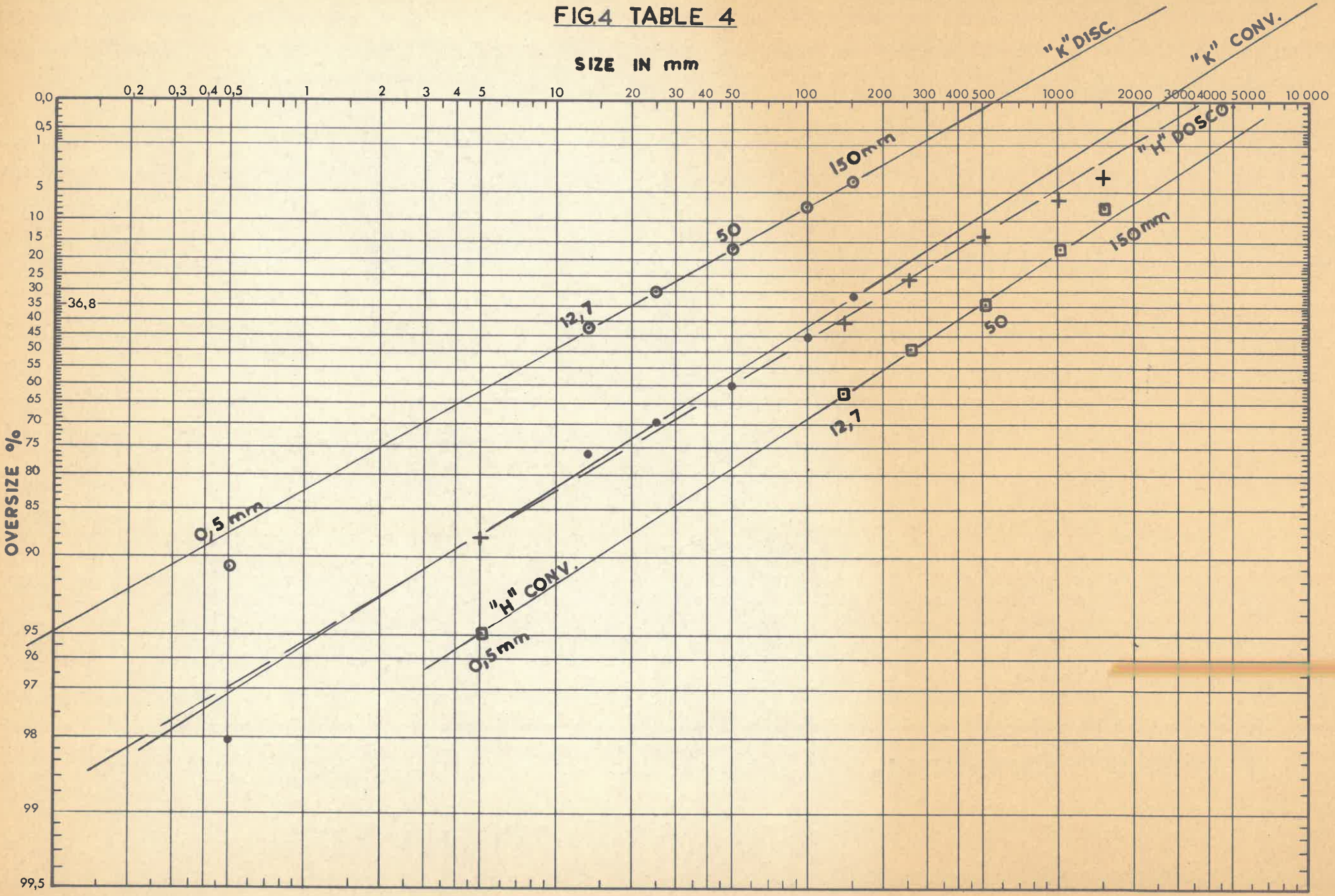
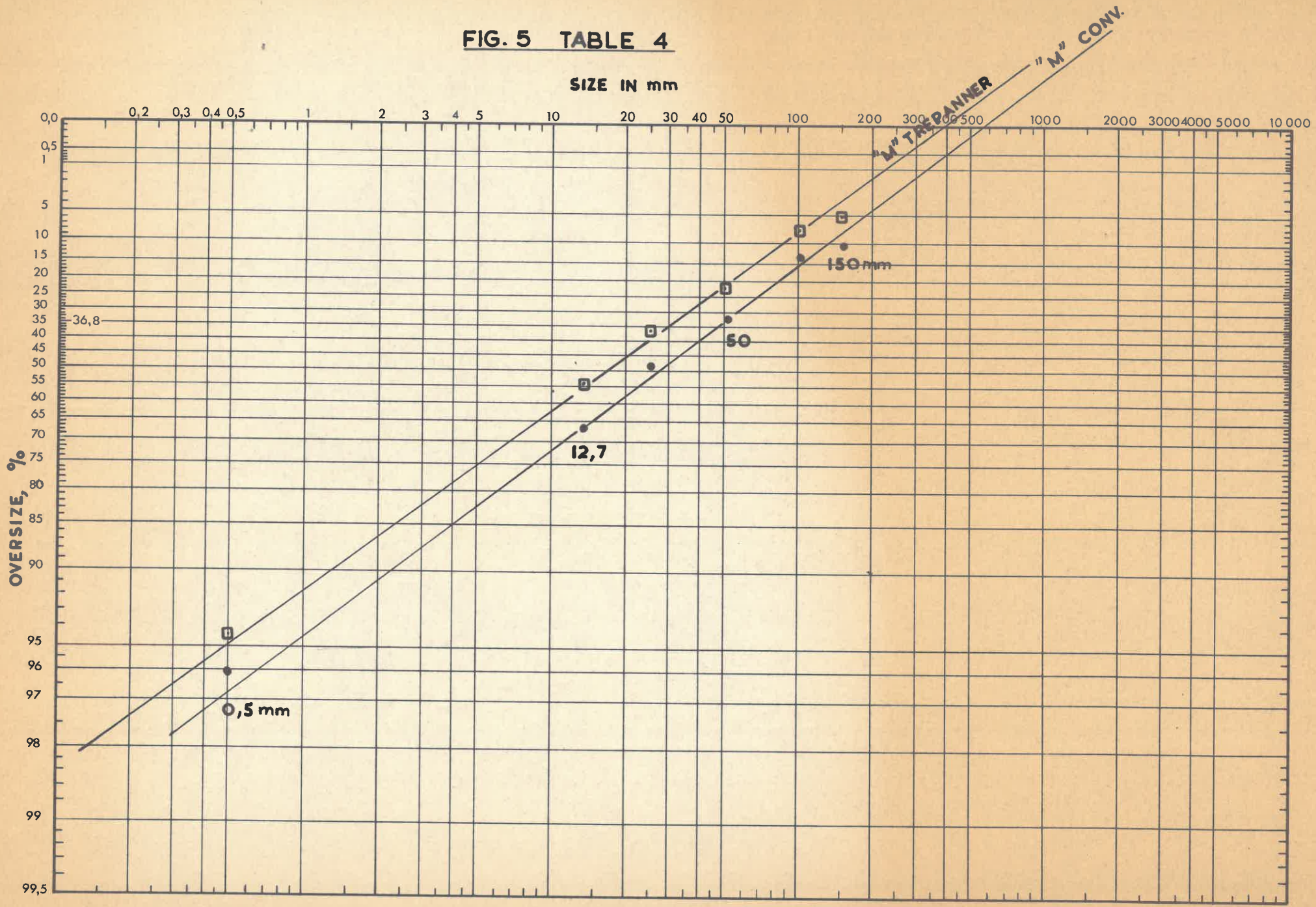

SIZE IN mm
0,2
0,3
0,4
0,5
1
2
3
4
5
10
20
30
40
50
100
200
300
400
500
1000
2000
3000
4000
5000
10 000
OVERSIZE %
0,0
0,5
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
96
97
98
99
99,5
36,8
"K" DISC.
"K" CONV.
"H" BOSCH
150mm
50
12,7
0,5 mm
"H" CONV.
150mm
50
12,7
0,5mm

FIG. 5 TABLE 4


SIZE IN mm
0,0
0,2
0,3
0,4
0,5
1
2
3
4
5
10
20
30
40
50
100
200
300
400
500
1000
2000
3000
4000
5000
10 000
0,5
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
96
97
98
99
99,5
OVERSIZE, %
36,8
"M" TREPANNER
"M" CONV.
150 mm
50
12,7
0,5 mm