

Carrés Magiques au Degré n . By Général E. Cazalas. Paris, Hermann, 1934. 191 pp.

It is a relief to find a book or memoir on the subject of magic squares which is not a mere collection of specimens with no attempt at unification and analysis. This work by General Cazalas is an attempt, and a very successful one, to bring these interesting and baffling forms into some sort of unified theory.

The author has undertaken to put on a solid analytical basis the results announced in 1906 by G. Tarry who, by the use of what he called "numeral series," was able to arrive at results of astonishing generality in constructing squares characterized not only by the fact that the sum of the elements in any row or column or in the two main diagonals should be constant, but also by the further property that the sum of the squares and the sum of the cubes, etc., of the elements in any of these lines should also be constant. Thus, for example, the square of order 9 which follows is not only magic in the ordinary sense, but the sum of the squares in any of the lines is also constant.

0	64	47	14	75	31	25	62	42
34	17	78	36	19	56	50	3	67
59	39	22	70	53	6	72	28	11
69	52	8	74	27	10	58	41	21
13	77	30	24	61	44	2	63	46
38	18	55	49	5	66	33	16	80
48	4	68	35	15	79	37	20	54
73	29	9	57	40	23	71	51	7
26	60	43	1	65	45	12	76	32

To illustrate the method of "numeral series" we give a square of order 5 constructed with the "keys" (11) and (32).

00	11	22	33	44
32	43	04	10	21
14	20	31	42	03
41	02	13	24	30
23	34	40	01	12

The symbol ab stands for $5a+b$, a and b taking values from 0 to 4. In ordinary notation the square would read:

0	6	12	18	24
17	23	4	5	11
9	10	16	22	3
21	2	8	14	15
13	19	20	1	7

This is a magic square of the ordinary sort, using, however, the numbers from 0 to $n-1$ instead of the numbers from 1 to n as is customary.

In the construction it is seen that the elements in any horizontal row are obtained from the one on the left by the addition of the numbers of the "key," multiples of 5 being thrown out as they arise. Similarly the elements in any column are obtained from the one above by addition of the numbers of the