International Journal of Engineering Research and Development
ISSN: 2278-067X, Volume 2, Issue 1 (July 2012), PP. 30-38
www.ijerd.com

The Magic Square from Myth to Mystery

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Abstract—From the ancient period, there was a huge, number of Mathematics, formula has been derived based on the numeric and the research is continuing. Math-Lovers love to evident new tricks for finding complete solution in an easiest way. In this paper, we proposed a novel methodology to arrange the successive numbers in a square form (i.e., n^2), whose sum is same in every possible direction (horizontal, vertical and diagonal too).

Keywords— natural number, successive numbers, north – East corner, anticlockwise.

I. INTRODUCTION

Can anyone tell me what is this famous artifact called? Or, who that eminent artist was who created such a beautiful thing? Okay okay, we are giving you the answers – that famous painting is called as “Melencolia I” and it originated from the hands of Albrecht Durer – a the-then (Am talking about 1514 AD – the time of Renaissance I guess!) renowned German artist.

And now you’ll be wondering as to why would we mention such a thing in the beginning of my math’s paper?

Okay. Let’s find the answer. Can you spot anything unusual in that painting? No? Let me help you. Actually we were talking about a small picture included at the backdrop of this painting – a picture depicting a square of 4 with some numbers imprinted on it. And here comes the surprises. Just try to figure out that square, you’ll find it’s actually a Magic Square. A square in which the sum in all directions are the same . Not only that, but also the middle of the last row contains the exact year the painting surfaced – 1514 AD. Isn’t that attractive?

Now let me introduce to you some more examples of these creepy squares. China, Tunisia, Spain, England, India, Japan, Russia and many more . The whole world differentially tried to unleash the mysteries of this mythical event from the very beginning. Some became successful, some unsuccessful. But till now no single attempt had been made by anyone to combine these squares in a single tune – in a single formula. Till now.

But I can promise you now that, you also can have fun of these squares. What you have to do is just to follow my outline and see the MAGIC!!

II. THE PROBLEM

Arrange the successive numbers in a square form (i.e., n^2), whose sum is same in every possible direction (horizontal, vertical and diagonal too) i.e.,

$$\mathbf{S = n/2\ [2a + (n^2 - 1)]}$$

Where, 1st term = $a \geq 1$
And $n \geq 3$

III. RESOLUTION FOR SOLUTION

Following calculations, it has been observed to have possibly a pair of cases:

1st Case:

							o							
						o	+	**o**						
				(	**o**	+	**o**	)	+	$\mathbf{E_1}$				
		{	(	**o**	+	**o**	)	+	$\mathbf{E_1}$	}	+	$\mathbf{E_2}$		
[	{	(	**o**	+	**o**	)	+	$\mathbf{E_1}$	}	+	$\mathbf{E_2}$	]	+	$\mathbf{E_3}$

…………... and so on.

Where, O and E denote odd and even numbers respectively.General form of n = $2^{(p-1)}(2r + 1)$

Where,

- p = number of operation
- and r = any natural number

For **O,** p = 1 then n = 3, 5, 7, 9, 11, 13, 15 ...

(O+O), *p = 2* *,* *n = 6 = 3+3*
= 10 = 5+5

$= 14 = 7+7$
$= 18 = 9+9$
…………

$(O+O)+E_1,$ $p = 3$, $n = 12 = (3+3)+6$
$= 20 = (5+5)+10$
$= 28 = (7+7)+14$
$= 36 = (9+9)+18$
…………..

$\{(O+O)+E_1\}+E_2,$ $p = 4$, $n = 24 = \{(3+3)+6\}+12$
$= 40 = \{(5+5)+10\}+20$
$= 56 = \{(7+7)+14\}+28$
$= 72 = \{(9+9)+18\}+36$
…………

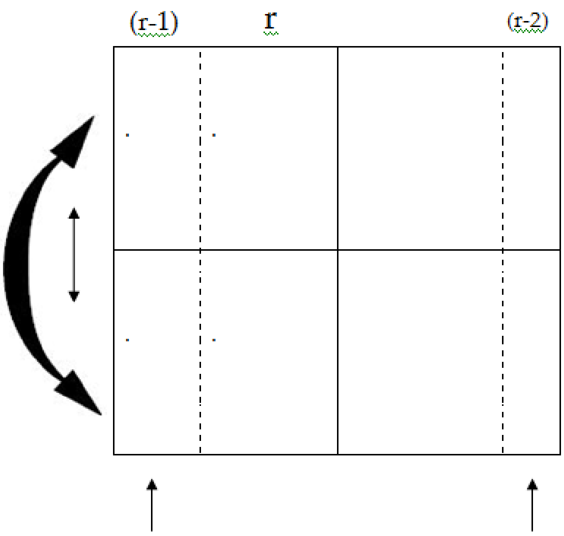
$[\{(O+O)+E_1\}+E_2]+E_3,$ $p = 5$, $n = 48 = [\{(3+3)+6\}+12]+24$
$= 80 = [\{(5+5)+10\}+20]+40$
$= 112 = [\{(7+7)+14\}+28]+56$
$= 144 = [\{(9+9)+18\}+36]+72$
…………………

A. Rule for (O) operation:

1st. Start from the middle of the main up-line.
2nd. always step forward towards North – East corner.
3rd. Come down facing any obstacle.
4th. Have a place at the end of the successive branch of down-line, only after getting a hurdle at the main up-line.
5th. similarly, have a place at the terminal point of the successive branch of the up-line only after getting an obstacle at the main down-line.

U P L I N E			D O W N L I N E
a_8	a_1	a_6	
a_3	a_5	a_7	
a_4	a_9	a_2	

B. Rule for (O + O) operation:



When $n = 6 = 3+3 = 0+0$ therefore, $r = (O+1)/2 = (3+1)/2 = 2$

$10 = 5+5$ $r = (5+1)/2 = 3$

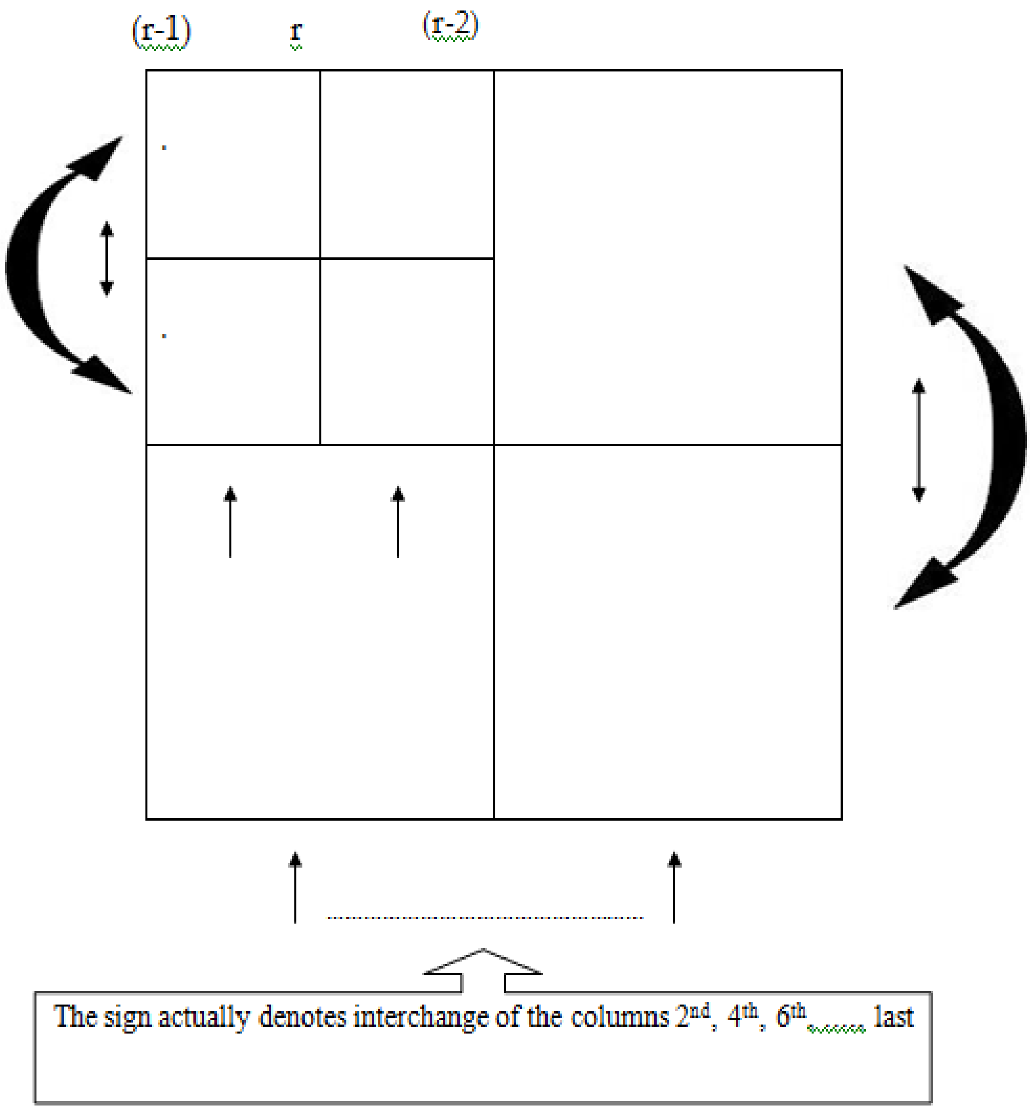
$14 = 7+7$ $r = (7+1)/2 = 4$

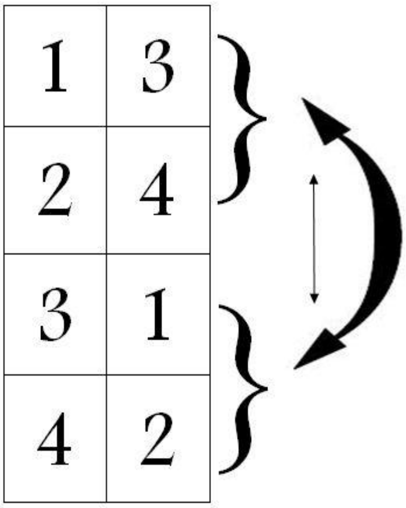
$18 = 9+9$ $r = (9+1)/2 = 5$ …………

1^{st}	3^{rd}
4^{th}	2^{nd}

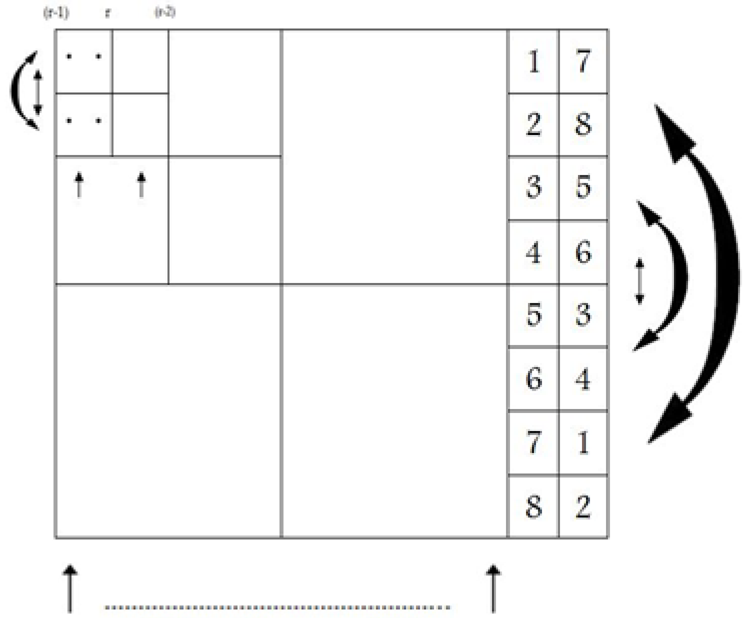
1^{st}. Fill in the grid.
2^{nd}. Interchange the column (r - 1) and (r - 2).
3^{rd}. Interchange the middle numbers of 1^{st} column of (r – 1) and r.

C. Rule for (O + O) + E_1:

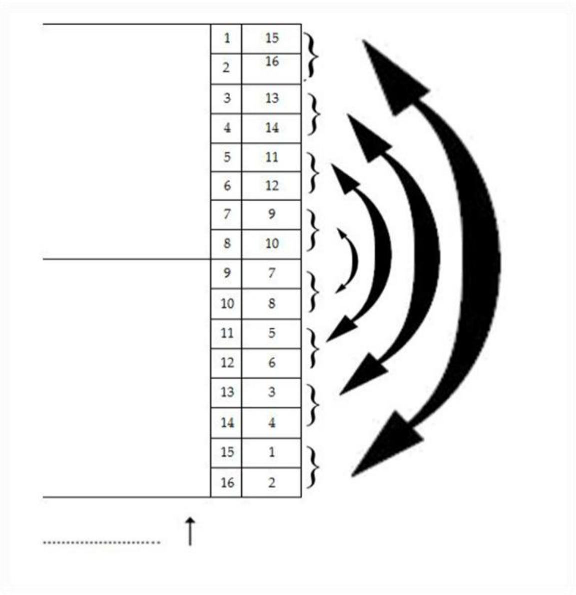




D. Rule for $\{(O + O) + E_1\} + E_2$:



E. Rule for [{(O + O) + E_1} + E_2] + E_3:



$$E$$

$$E+E$$

$$(E+E)+E_1$$

$$\{(E+E)+E_1\}+E_2$$

$$[\{(E+E)+E_1\}+E_2]+E_3$$

2^{nd} Case:

…………………………………..and so on.

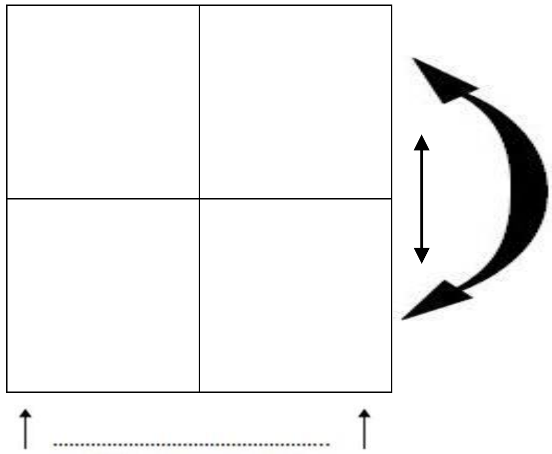
General form of $n = 2^{(p+1)}$

*For **E**,*	*$p = 1$*	*then*	*$n = 4$*
(E+E),	*$p = 2$*	*,*	*$n = 8 = 4+4$*
(E+E)+E_1,	*$p = 3$*	*,*	*$n = 16 = (4+4)+8$*
{(E+E)+E_1}+E_2,	*$p = 4$*	*,*	*$n = 32 = \{(4+4)+8\}+16$*
[{(E+E)+E_1}+E_2]+E_3,	*$p = 5$*	*,*	*$n = 64 = [\{(4+4)+8\}+16]+32$*
			….so on.

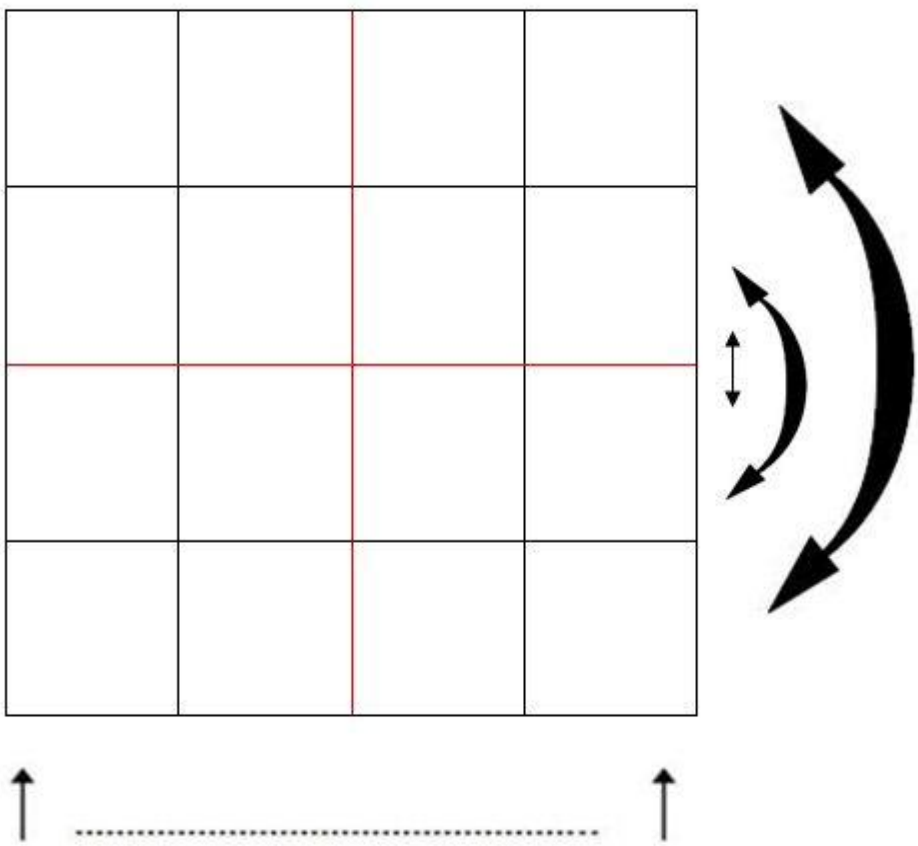
A. Rule for (E):

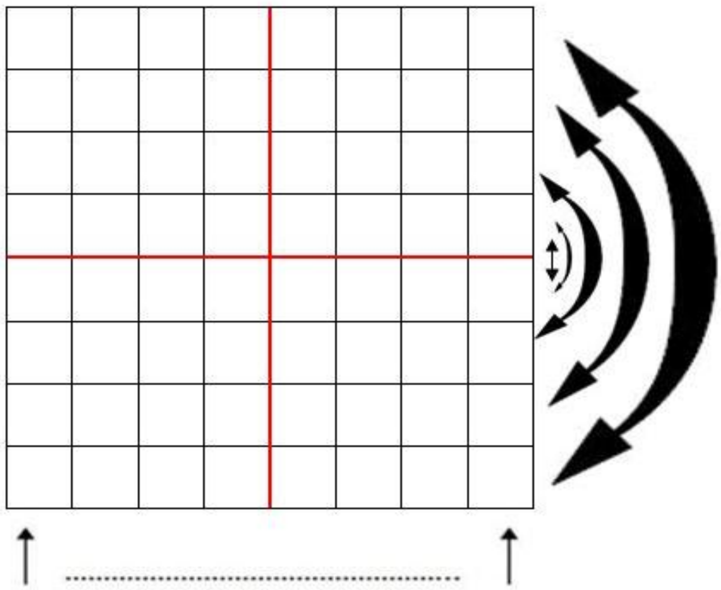
1st. Start from any position – horizontally or vertically.
2nd. First take 2½ places move and then straight another 2 places.
3rd. Then move perpendicular to the direction as taken in the earlier case.
4th. If restrained, drop down by 1 place.
5th. While moving in the opposite direction, if a hurdle is faced then make it move a place more.
6th. If the direction is anticlockwise, then rest at the left, otherwise on the right side.

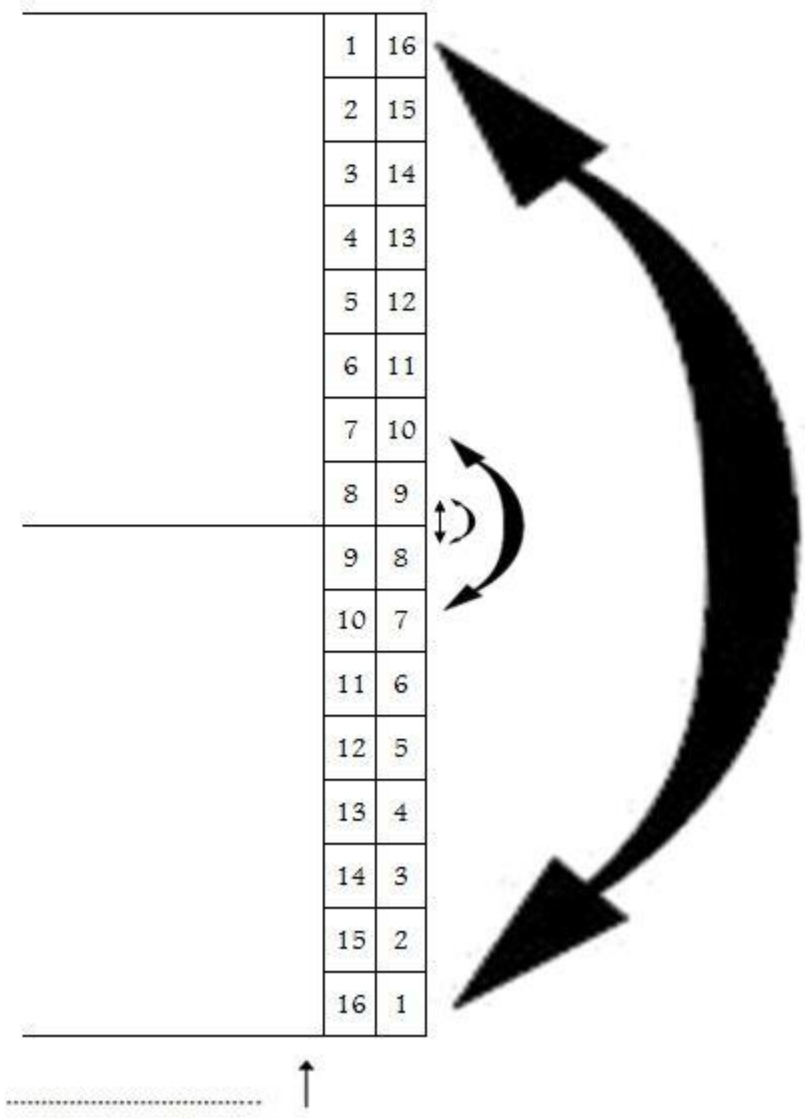
B. Rule for (E + E):



C. Rule for (E + E) + E_1:
D. Rule for {(E + E) + E_1} +E_2:
E. Rule for [{(E + E) + E_1} + E_2] + E_3:






1 16
2 15
3 14
4 13
5 12
6 11
7 10
8 9
9 8
10 7
11 6
12 5
13 4
14 3
15 2
16 1

IV. RESULTS

When n = 12 = (3 + 3) + 6

35	109	6	134	19	132	107	37	78	62	91	60
3	140	7	129	23	133	75	68	79	57	95	61
31	117	2	130	27	128	103	45	74	58	99	56
8	136	33	125	10	123	80	64	105	53	82	51
30	113	34	120	14	124	102	41	106	48	86	52
4	144	29	121	18	119	76	72	101	49	90	47
143	1	114	26	127	24	71	73	42	98	55	96
111	32	115	21	131	25	39	104	43	93	59	97
139	9	110	22	135	20	67	81	38	94	63	92
116	28	141	17	118	15	44	100	69	89	46	87
138	5	142	12	122	16	66	77	70	84	50	88
112	36	137	13	126	11	40	108	65	85	54	83

When n = 16 = (4 + 4) + 8

1	254	4	255	33	222	36	223	129	126	132	127	161	94	164	95
8	251	5	250	40	219	37	218	136	123	133	122	168	91	165	90
13	242	16	243	45	210	48	211	141	114	144	115	173	82	176	83
12	247	9	246	44	215	41	214	140	119	137	118	172	87	169	86
49	206	52	207	17	238	20	239	177	78	180	79	145	110	148	111
56	203	53	202	24	235	21	234	184	75	181	74	152	107	149	106
61	194	60	195	29	226	32	227	189	66	192	67	157	98	160	99
60	199	57	198	28	231	25	230	188	71	185	70	156	103	153	102
193	62	196	63	225	30	228	31	65	190	68	191	97	158	100	159
200	59	197	58	232	27	229	26	72	187	69	186	104	155	101	154
205	50	208	51	237	18	240	19	77	178	80	179	109	146	112	147
204	55	201	54	236	23	233	22	76	183	73	182	108	151	105	150
241	14	244	15	209	46	212	47	113	142	116	143	81	174	84	175
248	11	245	10	216	43	213	42	120	139	117	138	88	171	85	170
253	2	256	3	221	34	224	35	125	130	128	131	93	162	96	163
252	7	249	6	220	39	217	38	124	135	121	134	92	167	89	166

V. CONCLUSIONS

In this paper, we proposed a novel methodology to arrange the successive numbers in a square form (i.e., n2), whose sum is same in every possible direction (horizontal, vertical and diagonal too). Anyone can easily arrange the numbers from ZERO to INFINITE range of square with respect to detection. The result from the preliminary study indicated that the proposed strategy is effective to assess arranging problem in more precisely.

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