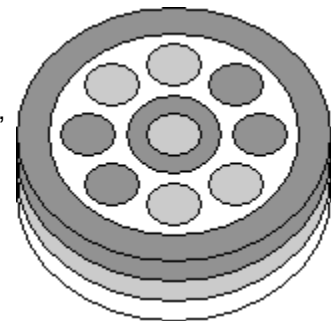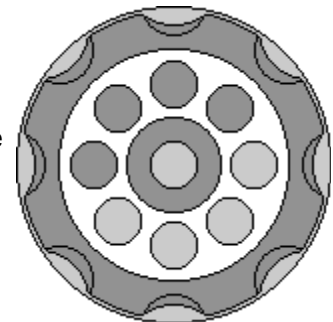# *Jaap's Puzzle Page*

Enigma / Combinescion

The Enigma puzzle is disc shaped with a picture or other design on the front face. There are two outer rings around the edge of the disc which can be turned, and this causes an internal mechanism to rotate various circular parts of the front face. The rotating parts of the front face are 8 small discs equally spaced around the edge, and in the centre one disc with a ring around it. In the picture on the right all the moving pieces are coloured light or dark grey, matching the colour of the outer ring they are connected to.

There is a little clip with the puzzle that can be attached to the edge so that it will not be accidentally mixed up.

The Combinescion puzzle is very similar to the Enigma, though it is shaped like a cylinder. The base and the two turning rings are simply three disks of the same diameter and about the same thickness stacked together. Another minor difference is that whereas the rings of the Enigma turn four adjacent small discs, the layers of the Combinescion each turn two adjacent pairs of small discs. This is illustrated in the picture on the right.

Note that unlike the Enigma, part of the pictorial design on the front of the Combinescion is generally also partly printed on the top layer ring, so not only do the small disks and the centre ring have to match up, the top layer ring must match too.

The combinescion was invented by Roman Massimiliano, patented 1 February 1996 WO 96/02307.

Solution to Enigma:

I have opened up the Enigma puzzle to count the number of teeth on the various cogs inside. This is not recommended, as it is hard to put back together correctly. The results are shown in the table below:

	light grey		dark grey	
Middle outer ring	105	(21)	Front outer ring	108 (4)
Edge discs	25	(5)	Edge discs	27 (1)
Edge discs	26		Edge discs	28
Centre disc	53		Centre ring	51

Solving this puzzle is quite easy.

a. Turn the front outer ring until the centre ring in the front face is correct.
b. If the edge discs that are also controlled by the front outer ring are not correct, then turn the front outer ring clockwise until the next time the centre ring is again correct. Repeat this if necessary, until all the parts controlled by the front outer ring are correct. This need not be done more than 28 times, since if the centre ring has done 28 revolutions then the small discs will have done 51 revolutions exactly and be in their original orientations.
c. Turn the middle outer ring until the centre disc in the front face is correct.
d. If the edge discs that are also controlled by the middle outer ring are not correct, then turn the middle outer ring clockwise until the next time the centre disc is again correct. Repeat this if necessary, until all the parts controlled by the middle outer ring are correct. This need not be done more than 26 times, since if the centre disc has done 26 revolutions, then the small discs will have done 53 revolutions exactly and be in their original orientations.
e. The front face should now be solved.

Note that the front outer ring will automatically be in the right position for the locking clip to be attached, because of the 4:1 ratio of cog teeth, and the fact that there are exactly 8 finger grips in the outer ring.

Solution to Combinescion:

The Combinescion could not be opened, so I deduced the number of teeth on the cogs from the gearing ratio's. The numbers are different to the Enigma.

	light grey		dark grey
Middle layer	80	Top layer	82
Edge discs	19	Edge discs	21
Edge discs	19	Edge discs	21
Centre disc	42	Centre ring	40

Solving Combinescion is similar to the Enigma:

a. Turn the top layer ring until its design matches up with the rest of the front face.
b. If the centre ring in the front face is not correct, then turn the top layer ring clockwise one full revolution clockwise. Repeat this until the centre ring is matched up correctly. You never need to turn more than 20 times, since if the top layer has done 20 revolutions then the small centre ring will have done 41 revolutions exactly and be in its original orientation.
c. If the edge discs that are also controlled by the top layer are not correct, then turn the top layer ring clockwise for 20 revolutions, until the next time the centre ring is again correct. Repeat this if

necessary, until all the parts controlled by the top layer ring are correct. This need not be done more than 21 times, so the total number of turns of the top layer is no more than 20·21=420.

d. Turn the middle layer until the centre disc in the front face is correct.

e. If the edge discs that are also controlled by the middle layer are not correct, then turn the middle layer clockwise until the next time the centre disc is again correct. Repeat this if necessary, until all the parts controlled by the middle layer ring are correct. This need not be done more than 19 times, since if the centre disc has done 19 revolutions then the small discs will have done 42 revolutions exactly and be in their original orientations.

f. The front face should now be solved.

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