

28 February 1945.

MEMORANDUM

From: Lt. R.E. Greenwood, USNR.  
To: OP-20-G-4.  
Subj: M8 and M9 Wheels - Request for.

1. In connection with recent studies in OP-20-G-4A, it is requested that 32 blank M8 and 16 blank M9 wheels be obtained with markings as described below.

2. MARKINGS ON M8 WHEELS. Place the wheel in an upright position and place an observer in front of the wheel. Then the observer can label right and left faces on each wheel. On the right hand rim of the M8 wheels place an alphabet so that when A is on top, G faces the observer. The letters should be so placed that they will be right side up for the observer. On the right hand rim engrave distinguishing marks, three or four A's on two wheels, three or four B's on a second set of two wheels, --- three or four N's on a fourteenth set of two wheels, and four wheels without distinguishing marks. It is requested that the design of these distinguishing letters or the engraving ink be different from the letters on the rim alphabet. On the left hand rim place another alphabet which runs in the opposite direction to that on the right hand rim, and which is upside down with respect to the observer. Place this new alphabet so that the A's on both right and left rim alphabets will be at same position on rim. (The N's will be at same positions also.) For the wheels marked with distinguishing letter A on the right rim, mark the combination AR on the left rim, BR on the B wheels, etc. Three or four such combinations should be marked on each wheel, except for the four wheels which do not bear a distinguishing letter. These AR, BR, etc. combinations should be upside down with respect to the observer (and hence upside down with respect to the distinguishing letters A, B, etc. on the right rim), and should be in the same style of engraving. Four knobs should be placed on right rim and four more knobs on left rim for each wheel. All knobs should be placed as follows:

Between	Z	and	A
Between	G	and	H
Between	M	and	N
Between	T	and	U

Notice that the knobs on the right rim will not always align up with the knobs on the left rim.

3. MARKINGS ON M9 WHEELS. Place the wheel in an upright position, and place an observer in front of the wheel. Then the observer can label right and left faces on each wheel. On the right hand rim of the wheel place an alphabet so that when A is

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on top, T faces the observer. Also place the letters so that they will be right side up for the observer. On this right hand rim, also engrave the distinguishing letters A, B, C, --- M, N on fourteen of the sixteen wheels, leaving two wheels without a distinguishing letter. It is requested that the design of these letters or the ink be different from that of the rim alphabet. It is further requested that about three or four A's be put on the first wheel, three or four B's on the second wheel, etc. On the left hand rim place an alphabet which runs in the opposite direction to that on the right hand rim, and which is upside down with respect to the observer. Place this new alphabet so that the A's and the N's on both old and new alphabets will be on same radii from the hub of the wheel. On the left hand rim, also engrave three or four AR combinations on the A wheel, three or four BR combinations on the B wheel, etc. These AR combinations should be upside down with respect to the distinguishing letters A on the right rim, and should be in the same style of engraving.

In addition to the lettering, the following horizontal markings are desired. For each wheel and for each rim alphabet, four horizontal lines are desired, to be placed between the rim alphabet letters Z and A, F and G, M and N, and S and T.

4. When this material is obtained, it is desired that it be delivered to OP-20-G-4E and that Lt. Greenwood of OP-20-G-4A be informed. Wiring specifications will then be given to OP-20-G-4E.

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MEMORANDUM

From: Lt. R. E. Greenwood, USNR.  
To: OP-20-G-4.  
Subj: Studies of R5W Enigma.

1. As a first step in the study of the R5W enigma it is recommended that a full set of M8 and M9 wheels be prepared with the necessary wiring. With these items it will be possible to use mechanical means in preparing cipher text samples for study. Such problems might be the wheel recovery for messages in depth, the wheel recovery from long cribs, recovery of settings for known wheel order, etc.

2. From time to time the Coast Guard cryptanalytic unit has been hampered in its work because the present bombe set-up makes no use of known turnover position. Frequently it has been possible to determine the turnover or wheel track, but this information is of no use in bombe operation. A bombe with variable turnover positions would be of some advantage to the Coast Guard unit, and also in attacks on the R5W enigma. It is recommended that two studies be undertaken:  
(1) Modification of present bombes to adjust turnovers and  
(2) Design of a new bombe with adjustable turnovers. These studies should be considered as long range projects.

3. Operational studies involving DUENNA do not appear advisable at present to the writer. DUENNA should be kept busy with high priority operational traffic at least until V-E Day.

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REVERSE WIRING SPECIFICATIONS FOR  
R5W ENIGMA  
(REVERSE FACE OF WHEELS IS RIGHT FACE)

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RIGHT FACE  
ALL WHEELS

LEFT FACE OF WHEELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A	M	X	Y	V	G	Y	L	O	G	D	Y	Q	B	O	
B	V	E	M	N	D	H	W	J	W	G	Q	H	X	H	
C	F	A	U	Z	A	X	M	P	U	K	V	K	K	E	
D	E	K	D	E	L	Z	T	Y	R	O	G	V	H	Q	
E	Z	V	Z	L	T	L	D	F	O	K	J	K	P	N	
F	N	B	C	F	H	U	I	C	V	S	A	C	W	F	
G	A	I	X	X	F	T	K	V	O	O	X	C	F	B	
H	J	T	W	Q	V	G	U	I	R	V	N	O	P	L	
I	H	C	B	M	I	S	S	N	K	U	F	S	T	X	
J	X	R	I	C	R	B	G	X	N	C	B	N	L	I	
K	B	F	N	A	M	N	N	M	I	N	N	I	C	S	
L	U	P	G	J	X	F	Y	B	X	F	S	K	M	I	
M	Q	W	S	U	Q	K	C	Q	M	J	B	B	F	E	
N	C	N	R	S	E	O	V	W	B	P	S	I	W	R	
O	K	U	E	I	Y	Q	H	R	I	A	Q	D	E	M	
P	W	D	V	P	W	E	A	S	K	E	R	R	U	V	
Q	R	J	T	B	J	C	F	H	E	J	Z	U	B	A	
R	O	S	O	T	Z	I	X	U	U	P	H	P	R	N	
S	Y	H	A	W	N	V	R	A	H	A	U	E	A	C	
T	G	Q	H	H	O	M	O	L	Q	H	P	H	N	S	
U	D	Z	P	K	S	D	B	N	C	X	W	W	Z	J	
V	L	M	O	G	B	A	E	H	F	M	O	V	J	Q	
W	T	G	F	D	K	J	Q	D	C	T	V	L	Z	Z	
X	P	L	K	R	P	P	P	X	F	W	O	D	O	V	
Y	I	Y	J	Y	U	W	Z	V	O	Z	M	L	U	W	
Z	S	L	J	Y	U	W	Z	V	A	R	M	L	O	W	

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