

HOPPITY TRANSCENDED (Peggity, or Non-stoppity)

Note: To avoid confusion, in what follows the 1st and 2nd indicators mean the groups transmitted and the message setting is the decode of the 2nd indicator.

With the present machinery, the only use that can be made of the ringstellung being known, is to fix the turnover. But in fact if the ringstellung is known then any particular position for the encoding of a message implies a particular value for the message setting. Therefore, if we run a crib we can throw out bombe-stops using the three constatations of the 2nd indicator, which are known for any particular bombe stop but different for different bombe-stops ('variable constatations'). This throwing out could be done instantaneously on the bombe if three stationary enigmas were added, set at the known positions at which the message setting was encoded, and plugged one side to the fixed letters of the 2nd indicator, the other side successively to the appropriate values of the message setting, these values changing as the bombe moves from position to position

a b c d e f g h i j k l m

Example	ANR C J X	A Z J E K B J M L G S Q H
	$\alpha\beta\gamma$	B E T R I E B S S P R U Q
ringstellung THR		

Settings ZZ turning over to ZA

If the menu is written out for hoppity in the ordinary way, so that the position at the beginning of the message is always ZZZ, then for a bombe-stop xyz we have $\alpha = T - x$, $\beta = H - y$, $\gamma = R - z$, and we can use three links

The middle one may act as a closure or as an extra link according to the value of y, the other two may act as extra links or as subsidiary two-chains according to the values of x and z. I have calculated by questionable methods that testing through these links will have a reduction factor of 25 for stops and 75 for steckers.

For this to be used in reducing bombe-stops it is necessary to be able to plug the variable side of the enigma into different rows of the diagonal board as fast as the corresponding wheels of the ordinary enigmas take up different positions. It might be possible to do this by hand for the slow wheel, stopping the bombe at the end of every 1/26th of a run and replugging for the new value of (, but obviously this cannot be done for the faster wheels, and Oliver has suggested the following mechanical way of changing the plugging quickly.

Consider the middle enigma J_____β.

The input, say, is plugged to the J row of the diagonal board, and each line of the output is joined to the outer ring of commoned terminals of a commutator, the 'a' line to the 'a' commutator and so on. The plates of the inner row of the 'a' commutator are joined to the 'a' lines of the appropriate rows of the diagonal board (plates of the 'b' commutator to the 'b' lines, etc.), and a pair of brushes joined straight to each other runs round connecting the outer ring in turn to each plate of the inner ring, hence joining the 'a' line of the enigma output to the 'a' line of each row of the diagonal board successively. 26 such 'wheels' or 'plugging wheels' will, therefore, plug the whole output successively into the different rows of the diagonal board. Actually two plugging wheels can be combined in one, dealing with two output lines at once (the red and the green in the diagram); so for each variable constation we need 13 plugging wheels, and perhaps a separate diagonal board. If the plates are lettered according to the rows to which they are connected, and arranged so that the alphabet reads clockwise, then (for the J_____β link) the brushes should be set on the H plate and should move on one position for each position that the middle enigma wheels move on.

then for a bombe stop xyz the output of the β enigma will be plugged into precisely H - y.

So in order to make full use of our precious ringstellung we have to have 39 plugging wheels, 13 running with the fast enigma-wheels, 13 with the middle wheels, and 13 with the slow wheels. The effect on stops is very roughly the same as that of adding three random constations on to the crib, but, of course, depends on how many of the letters of the 2nd indicator are on the basic menu; with the reasonable case of one letter on the menu and two off it would be possible to run an 11 chain on Jumbo giving 100 stops and 1(stecker. If all three letters were on the menu a

10-chain could be run giving 40 stops and 1 stecker.

If it is not a question of knowing the ringstellung dead, a number of ringstellungen can be run successively, merely by moving the plugging wheels to new positions after each run. Of course a different end-wheel ringstellung means a different turnover set-up as for plain hoppity.

I shall have to do some more sums before I can be sure how useful this method would be; but I imagine that BETRIEBSSPRUQxy, for example, would be runnable about 3 times out of 4 compared with once in 5 times as a plain hoppity. Will anyone who reads this screed point out any obvious fallacies or mistakes, in order to save me the trouble of doing unnecessary arithmetic?

N.S.F.

P.S. The two new things required for the above device are a set of 3 fixed enigmas which do not move with the ordinary enigma wheels, and a set of 39 plugging wheels which do. The fixed enigmas need not be part of the bombe, and in fact they would probably be better as a separate unit, a set of hand enigmas would do, or a bit of another bombe. But such a unit may be useful, without any plugging wheels at all, if any fixed constations are known at fixed positions of the machine. Use could be made of a Banbury, for example, or a cilli which is no good for dottery (owing to shortness, or spottiness, or being a doubtful nearness), the links are set up at their known fixed positions and remain there throughout the run. Moreover the Banburies or cillies need not be in the same period as the crib, nor even on the same key so long as the key they are on has the same stecker, and a know w.o. and r.s. For example, at the moment of writing Cockroach 6/9 and Foxglove 6/10 have known w.o's and r.s's, and the same stecker, so that by merely attaching 3 hand enigmas to a bombe we can make use of the WSX on the Foxglove to eke out a Betriebsprung on the Cockroach.