

ORGANISATION OF BOMBE SECTION

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1. The section operates from Hut 11 B.P. Extension 85, and Wavenden M/C Room, Extension 149. Hut 11 having a direct line to Hut 6 Testing Room.

Wavenden is controlled by Hut 11 for distribution of work etc.

In operation at Hut 11 are four machines, at Wavenden there is one machine.

Hut 11.	"Agnus"	30 enigmas.
	"Ming"	36 enigmas
	"Bonzo"	36 enigmas
	"Jumbo"	36 enigmas with extra refinements.

In complete charge of each watch in Hut 11 is a Mechanic.

In charge of operations will be a Wren, if available and competent.

All errors etc., should be referred direct to I/C Watch.

All new menus and jobs referred direct to I/C operations, including all work for Wavenden.

At Wavenden one man only is on duty on each watch, combining Mechanic and Operator duties.

I/C Watches at B.P. will be any three of the following men :-

Marah.
Fordham.
Noble.
Banfield.
Jones. C.

OPERATION OF BOMBE SECTION.

The time taken to put on a new job varies considerably, but all men in charge of watches know from experience the quickest and most efficient course to adopt.

Plugging up varies from 5 to 35 minutes, depending on the menu and machine. The easiest machines to set up being "Agnus" and Wavenden. Due to the layout of the other machines careful consideration is required when preparing a menu for plugging up, bearing in mind the following points :-

1. Keep the number of commons to a minimum ; the less the number of connections the higher the conductive efficiency.
2. Prepare set up so that the operators can set all their banks the same, provided the job is on three times.
This necessitates cross plugging where 10 OUT and 11 IN on chain 1 and 2, and 8 OUT and 9 IN on chain 3, are not adjacent. This must be allowed for in the set up to overcome contact trouble. Choice of input varies with the menu involved on each machine.

Time taken in drum changing varies on each machine. Agnus and Ming being the easiest. Jumbo takes longer due to having to reset on account of German Ringstellung. The screw on operation of Bonzo is very slow and laborious.

Operators try to arrange wheel orders to avoid changing of fast drums, preferring the slow drums, with centre drum as second choice. The reasons are :-

1. Once the fast drums are set they cannot get out of position. Therefore unless changed do not need checking.
Being all of various settings they are most awkward to check and change due to their position on the machines.
2. The lower drums are usually set the same; so can be quickly checked, they are the easiest to change.
3. The centre drums are the easiest to get out of time, so must be checked each run.

Anyone who operates a hand machine will appreciate that changing at least 30 drums every 16 minutes is heavy, yet delicate and skilful work. Unlike the hand machines not a single brush in any drum can afford to be damaged. Each drum is inspected as it leaves the machine and before replacement in the rack; should a drum be found damaged after a run it is pointed out to the I/C Watch, a mechanic, who can tell whether that bank needs re-running.

With this system it is known that all drums in the rack are serviceable and ready for immediate use without further inspection.

The procedure on receipt of a job is as follows :-

The new menu is handed to the I/C Operations who gives the job, if a new one, a number, if it is an old one he checks up to see that the menu number is correct. Having ascertained on which machine the job is to run, it is marked out accordingly. If it is to be plugged up on more than one machine a duplicate menu is made, and drum settings and wheel orders copied on to a separate sheet of paper.

If the menu is received during a previous job, the above mentioned can be prepared in advance and no time is lost. Directly the last check results are corrected the machines are unplugged. While one person plugs up a new menu, the machine operator changes and sets up the drums. Until all the staff can plug up faultlessly and quickly the above

procedure is not possible on all machines in use. Therefore, it is an advantage to stagger the Job Completion on each machine.

Check results are 'phoned over during or at the end of the first run, this, again, depends on the menu. No wheels are changed until it is known that the results of the first wheel orders are correct. This is a preliminary check on the menu, the plugging and drums.

The drum settings are checked at the end of each run. This system again is adopted to save time. Should the operator find an error in the setting of a drum, she corrects and re-runs that particular bank, having changed the drums on the other banks.

If the checking is done at the beginning of a run there would be no check on the previous run, (unless by a wrong stop) therefore, the correct stop might be missed or a re-run involving a double change of drums be unavoidable.

Checks are not waited for after the first run, but from the above it is obvious that the sooner an error is known the more chance the mechanic has to rectify it.

It is arranged that check stops are taken on every wheel order, if an ordinary stop does not occur.

It is quicker to plug and run 22 wheel orders on two machines than it is on three machines, besides avoiding unnecessary wear and tear to the machine contacts and plugs.

No re-run is ever avoided if there is the slightest chance of a stop having been missed. This is not appreciated by all personnel operating in conjunction with Hut 11. Many unnecessary runs have been done with a considerable loss of time, due to an open circuit or no brush pressure.

I/C Watch knows the efficiency of each of his operators, and there is no danger of wrong set ups being passed with this knowledge.

If it was appreciated how important the permanent staff Hut 11 consider this work and how efficient they want to be, little doubt would exist as to anything having been carelessly done.

THE MAINTENANCE OF MACHINES

As all are aware the machine must be kept 100% serviceable. What this entails might be appreciated from the following points :-

The most efficient electrical statistic machines made are only guaranteed to operate 8 hours per day, with one day per month for inspection. The Bombes are expected to, and do, work 24 hours a day with no day for inspection.

AGNUS, the first machine to be commissioned, has been in continuous use for 9 months. In this period it has been out of action unavoidably for 42 hours, including time taken to fit up the machine for a Banbury Job, for double input job and changing the main drive shaft.

Each drum contains 108 brushes, all of which must be timed correctly to make and break their contacts at the same instant, remembering they must make perfect contact, yet no two strands of any two brushes must short.

In a ten enigma menu, ten of these drums (in the fast position) must make and break together at the speed the machine runs, the contacts are made for a maximum of 20 milli seconds.

When all the brushes are on their respective segments the searching circuit is brought into operation, but it must be cut off before the first brush leaves the segment. About 8/12 milli seconds is allowed for this. During this time the machine must decide whether or not there is an open circuit throughout the spider. If there is, then again, during the 8/12 milli seconds the searching circuit must inform the stopping circuit, and the stop indication circuit. They in turn, must stop the machine at the correct and exact position.

It can be appreciated from the screed on Banbury Jobs, what the relays have to accomplish on this type of menu. Should any of these operations fail, then, there is no second chance and the stop is missed.

A short between any two of the 30,000 odd connections might, also, cause a stop to be missed. These connections in most cases are only 1/32 inches apart, and therefore even a speck of metal solder or a brush strand can cause a short.

Due to continuous plugging and unplugging wear and tear of plaited leads is unavoidable. Broken leads cause open circuits, i.e. false stops. Damaged separators or bent contacts cause shorts, i.e. missed stops. Therefore, all leads have to be inspected when plugging up.

All drums as mentioned previously, are inspected on leaving the machine, and they are further tested periodically for shorts or open circuits on the drum tester. Replacing brushes is a highly skilled operation as will be appreciated from remarks on brush timing.

There are 350 oiling points to be attended to on each machine, besides the changing of commutators caused by continuous wear. The tightening up of all connections is also necessary periodically due to shrinkage of bakelite.

Machines are tested for shorts and open circuits at least once per week, and always before a Banbury Job.

The 460 relay points on AGNUS to the 1,450 on JUMBO have to be kept clean and perfectly adjusted for continuous use.

The precision required may be gauged by the fact that some sets of relays must have their four contacts operating in correct sequence. As they only take a maximum of 5 milli seconds to move from their OFF to ON position, this hardly leaves time for a round of golf.

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