

## II

HIGH SPEED BOMBES FOR THREE WHEEL JOBS

- 1) It may well happen in the future that a large number of high speed bombes will be regularly needed for four wheel problems, but this is not the case at present, and in the meantime we must make the best use of high speed bombes for three wheel problems. Also, now that Letchworth has gone over to high speed production, it seems that the future expansion of bombe power for Hut 6 problems should be in the form of high speed machines. The suggestions in this note are tentative ones, intended to be shot at, and calculations of running times are needed before the best policy can be decided.
- 2) It appears at first sight that high speed machines should do a three wheel job in little over half the time taken by the same number of standard three wheel bombes, but this wants checking. Most of the time will be spent in changing drums, and the very short running time between changes may introduce difficulties for the W.R.N.S.

The multi-drums which Keen hopes to introduce will considerably improve the performance. To avoid having to take check stops in every w/o, a locking device is contemplated, which will ensure that settings cannot be altered when drums are changed.

Plugging up time is not serious when it is small in comparison with the total running time on a job, but when the running time is cut down by multi-drums the plugging time may be a serious factor. For this reason automatic plugging is again being considered. It is most important to estimate how much advantage would be gained before embarking on what will undoubtedly be a major problem in design and construction.

In considering the advantages of automatic plugging, and of other developments, it must be remembered that a saving in W.R.N.S. or a saving in space is important.

- 3) For convenience I will refer to types of machines under their M or Mark numbers. Thus:-
 

M1	=	Standard Three Wheel bombe.
M2	=	Three wheel Jumbo.
M3	=	M1 + Mawdsley Cobra + Dollis Hill sensing equipment
M4	=	Letchworth four wheel bombe.

On the M4 machines the high speed drums have fixed settings, and were intended to be  $\beta$  wheels. Thus for three wheel jobs at high speed the umkehrwaltz would have to be changed and the high speed drums would

represent left hand wheels of the enigmas, straights being put on the slow running shafts.

It is proposed that, after about ten M4 machines have been produced all future Letchworth machines shall have  $\beta$  wheels in the slow position and variable settings for the high speed drums, which will represent right hand wheels of the enigmas. After this change the Letchworth machines might well be called M5. Thus: -

M4	=	Letchworth four wheel bombe with high speed $\beta$ wheel.
M5	=	Letchworth four wheel bombe with slow $\beta$ wheel and variable settings for high speed drums.

The advantages of M5 are that it can be used for three wheel jobs without any change and that it will deal with Willi Willi and short signal menus even if they become four wheel problems. Incidentally: -

M6	=	Twinn bombe.
M7	=	Universal drive three wheel bombe.

- 4) It is possible to change the high speed commutators on M3, but it will probably take about a day to do so, and for the sake of the machine it should very seldom be done. Provision has been made for changing the umkehrwaltz so M3 machines can do 3 wheel jobs at high speed provided they are fitted with suitably wired high speed commutators. But each bank of each M3 must be tied down to w/o's with a definite left hand wheel. Further the settings of all left hand wheels must be Z, which rules out Willi Willi, short signal and ci menus, but admits crib and R/E menus.

On the whole I should prefer to tie down both banks of a machine to the same left hand wheel. Thus a machine tied down to wheel II might be denoted by M3(2), and a batch of five machines with high speed commutators for wheels I to V might be denoted by M3(1-5)

- 5) High speed drums can be changed quite easily on M4, but to avoid damage to brushes it would be best to tie each machine down to a definite left hand wheel until multi-drums can be introduced on the high speed shafts.

Pluggable umkehrwaltzen are to be fitted on machine No. 7, and earlier machines can probably be altered later, so that all M4 machines will eventually be able to do three wheel jobs at high speed. But again left hand wheels must all be set at Z.

- 6) On M5 machines it will be the right hand wheel that will have to be tied down, and this will be more convenient for Hut 8 jobs, since the menu depends on whether the right hand wheel is I to V or VI to VIII. These machines will deal with 3 wheel Willi Willi menus at high speed, even if the  $\beta$  wheel settings are varied.

- 7) One of the most urgent questions is whether we should immediately ask Mawdsleys to wire commutators on future cobra units to wheels I to V instead

of to  $\beta$  wheels. This depends on how a batch M3(1-5) would perform on the available three wheel problems, and calculations are needed. This means going into some detail.

First of all it must be remembered that the main object of introducing Mawdsley cobras and D.H. valve sensing equipments was to do a full four wheel run in the shortest possible time. The standard M1, which form part of the M3 machines, will not be able to run at its full speed because if it did so, the period of clean contact would not be long enough to allow the high speed commutators to pass through more than 26 positions. In fact the speed of the fast wheels of the M1 is limited, and as far as I remember this upper limit could be attained if the carry of the M1 was modified to 30 pt. Instead of 39. This would of course lower the time of a run, I believe to about 14 minutes, but the calculations must be done again. This modification must therefore be borne in mind.

Now it seems that there are four possible policies with regard to M3 machines: -

- a) Keep the Mawdsley cobras and D.H. equipments in store until four wheel machines are really needed. I don't like this at all.
  - b) Assemble the whole machine but retain the sensing apparatus of the standard M1 and introduce plugs so that the machine can be used either as a two bank M3 for four wheel problems or as a standard three bank M1 for three wheel problems.
  - c) Assemble the whole machine and use it at high speed for any four wheel problems that may come along. When it is not wanted for four wheel problems lock the cobra in the Z position and run the M1 part as fast as possible with D.H. sensing.
  - d) Fit the Mawdsley cobras with commutators wired to wheels I to V and use the M3 machines at high speed for three wheel problems only until four wheel machines are regularly needed.
- 8) On the whole I prefer alternatives c) and d) but the choice between them depends partly on the estimated performance of a two bank batch of M3(1-5). (When the cobra is used, the machine is limited to two banks.)

Scheme c) has the big advantage that, whenever an occasional four wheel job turns up, all M3 machines as well as all M4 and M5 can be switched on to it at once. On the other hand scheme d) offers some advantage of speed in the running of three wheel jobs. But it is quite probable that, until multi-drums come in, this advantage would be reversed by introducing a third bank of valve sensing apparatus, so that for three wheel jobs the machine would work as a 3-bank Mammoth at slow speed. Actually the D.H. sensing unit has two bank apparatus for double input as well as for Mammoth and for a pseudo Clarke test; it is conceivable that the valves for one of the subsidiary inputs might provide sensing for the third single input. This

modification of scheme c) should be considered, and I am inclined to guess that it provides the best alternative, though it may be ruled out by the time required for Mammoth plugging.

The policy in regard to M4 and M5 machines is not so difficult. It seems clear that, as soon as umkehrwalzen are pluggable, each machine should be supplied with a set of straights and one set of high speed drums wired to a particular wheel, in addition to a set of  $\beta$  wheel drums.

Since the long three wheel jobs suitable for M4 are mainly Hut 6 jobs, it seems reasonable to have ten M4 machines in two batches of M4(1-5). This means asking Mr. Keen to arrange that the first M5 machine shall be No. 11 in the series, instead of No. 12 as is at present intended.

The working of M4 and M5 machines in batches should be considered. The main uses will presumably be 60 w/o Hut 6 jobs on R/E's and cribs, and Hut 8 Dolphin flaps. It may well be that a pair of analysers could be profitably used to deal with the testing for a batch, or for two batches in the case of long Hut 8 jobs. It seems that in the future we must attempt to group bombs so that long jobs may be run on the most suitable machines grouped in the same place. If this is done it may be that some of the reasons for the small use that has been made of analysers in the past may disappear. At any rate the matter urgently needs consideration as policy in regard to the two analysers that are under construction must be settled soon.

The various main types of job requiring a lot of bombs must be considered separately. Thus Hut 8 jobs are either 60 w/o's or legal w/o's, and they may be roughly classified as: -

- a) R/E's giving two strong menus.
- b) Long cribs giving two strong menus.
- c) Medium cribs giving two, three or four menus of varying strength.
- d) Short cribs giving single menus, often very weak.
- e) Stagger jobs.

Before the necessary investigations have been carried out it is premature to make any definite suggestions and the following plans are only intended to be shot at.

### M3 MACHINES

- a) Assemble the machines as the Mawdsley cobras arrive, all cobras being wired for  $\beta$  wheel.
- b) Ask Mr. Flowers to supply a third bank of sensing apparatus for each of the 12 machines already ordered instead of producing further two bank sensing units.
- c) Use the machines as slow speed three bank Mammoths for three wheel problems, with cobra at Z position. Use them also for any long four wheel jobs that may turn up.

- d) Make plans for reducing the time of a four wheel run by changing the gearing of the M1 components. Do not carry out these plans (which would result in a slower speed for three wheel jobs) until four wheel jobs become a regular task.

#### M4 MACHINES

- a) The number of these to be limited to ten, made up of two batches M4(1-5)
- b) Use them for Hut 6 jobs except when they are needed for four wheel jobs. \* *Provided they have pluggable U.W.*

#### M5 MACHINES

- a) All standard Letchworth machines after number 10 to be of this type.
- b) Use them in batches at high speed for Willi Willis and Dolphin flaps as well as for Hut 6 problems, except when they are needed for four wheel jobs.

#### For Consideration by:

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\* *Do we need pluggable U.W. on M5 or just provision for getting it later?*