18.3.43

MOST SECRET. AZ/304.

54

18th March, 1943.

To: BAILY.

From: TRAVIS.

Hellschreiber.

Further to my CXG.711 of 16th March 1943 replying to your CXG.601, the following additional information has been compiled by Kenworthy:-

1. A lower speed of auto has been used for military point to point communication and dropped to approx. 25 w.p.m. Normally the military use is confined to 15 to 18 w.p.m. very poorly operated i.e. letters badly timed and therefore received copy is very disjointed.

The foregoing facts decided the F.O. Research Section to develop a suitable machine to cover all ranges of speed. The magnet unit, and printing head were copied from original type commercial German machine with only minor modification. The original German machine had a complicated governing device on a universal type D.C. motor and relay contacts were mounted on the printing mechanism to make a convenient start stop device operated by a short or long signal. This latter was eliminated, as an interfering signal such as a heterodyne or station holding his key down would stop the machine and therefore lose traffic. F.O. used synchronised motor normally used by Creed & Co., for Wheatstone transmitters of their design; variation of speed is arranged for by varying the working points of two friction discs i.e. by altering the relation between driving and drive disc diameters.

2. The majority of transmissions of Hellschreiber use the seven-line technique and although it was originally intended to make a machine especially suitable for twelve-line it was found that a fairly good record could be made of the twelve-line type although the copy was upside down.

The seven and twelve-line technique scan the letters in opposite directions and therefore to correct this the printing spiral has to be reversed in pitch.

3. The method of arriving at equivalent dot element speeds of working as compared with morse is as follows:-

Twelve-line Hellschreiber.

Grid 9 x 5 + spacing of 3 between letters and 2 horizontal
i.e.12 x 7 - number of elements per letter = 84

50 w.p.m. = 250 letters = 250 x 84 bauds
= 21000 bauds per min.
= 10500 cycles " "
= 175 cycles per second.

40 c.p.s. = 100 w.p.m. morse

∴ equivalent morse speed = $\frac{175}{40}$ = 440 approx.

40 w.p.m. = 200 letters.

$\frac{4}{5}$ of above speed $\frac{1760}{5}$ = 350 approx.

Seven-line.

7 x 7 = 49 elements per letter.
5 x 5 + spacing of 2 between letters and 2 horizontal.

50 w.p.m. = equivalent morse speed 250 w.p.m.
40 w.p.m. = " " " 200 w.p.m.

The above are usually automatic transmissions.

4. Re para. B of your 601. This apparently refers to Tone T/P circuits which are used for point to point services. The technique is partly based on land-line voice frequency practice but as difficulties were encountered in the early stages of the work the Germans went from two tone operation, i.e. one mark one space to using 5 tones - normally 3 space and 2 mark. It is possible for them to reverse the tones. Frequencies are used out of the range 300 to 2340 cycles plus or minus 20 to 40 cycles. Their practice at the present moment is to separate any adjacent channel by 360 cycles, e.g. you may have 540 space 900 mark 1260 space 1620 mark 1980 space. From this it is seen that they have spread their tones over the band which minimises the effect of selective fading.

As a general rule only one transmission takes place on each circuit but one pair of stations have been testing for some considerable time using pairs of tones only and using several channels on the same transmitter.

We shall be glad to answer any further points which may not be fully dealt with above.

D.D.(S)

Copy to Mr. Kenwalley
" " Col: Tillman

GNVB/WH

for Major G.S.

Copies to: Lieut.Col. Lithgow
Asst.Comdt. No. 6 School.

Lieut.Col. Pritchard,
Asst.Comdt. No. 1 School
(For Major Brown, German T/L Section).

Lieut.Colonel H.B.Sayer,
R.F.