



## The German spy set SE88/5 in a box.

A research-story after eight decades.

By Thomas Höppe, DJ5RE.

Editorial revision by Giselle Jakobs.

Spy radios from the „Abwehr“, the German military secret service in WW2, are numbered by the following system: a transmitter is marked with an „S“ (Sender), while a receiver is marked with an „E“ (Empfänger). The abbreviation „SE“ indicates the presence of both a transmitter and a receiver. The first number is a sequential or serial number which simply indicates the period during which the set was developed in the Abwehr workshops. The older the set, the smaller the number. The early sets (1939 and earlier) begin in the 70's series and the later wartime sets used the 100's series. The last number, after the „/“, represents the power of the transmitter, but should not be taken too seriously. For some transmitters the number reflects the RF output power, while for others, the number reflects the DC input power on the anode, as they could rarely reach the indicated value.

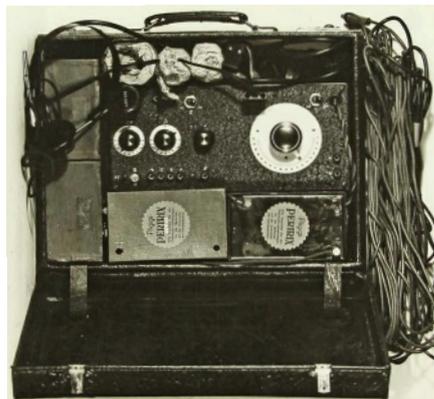
During World War II, Germany made plans to invade Great Britain. The codename for this plan was „Operation Sea Lion“. In preparation for a possible invasion, the Abwehr tried to establish spies in Britain. This attempt was anything but successful and has been a frequent topic of discussion in various historical analyses resulting in somewhat strange explanations for its failure. We will not discuss that here. The first missions in 1940 and 1941 were codenamed „Lena“, the landings in southern England codenamed „Lobster South“ and the landings in Scotland codenamed „Lobster North“. All of the agents were poorly trained in espionage and were caught almost immediately. We will not go into the details of those missions. We will instead take a look at the radio sets that the spies brought with them, all of which were powered by dry batteries, working independently from the mains supply.

**S 88/5:** A small transmitter, crystal controlled with KL2 tube. No receiver, the agents were sending their messages „blind“ with no ability to receive a response.



Transmitter S 88/5 with accessories.

**SE 92/3:** A transmitter/receiver housed in one box. The transmitter used the same schematic (with KL2 tube) as the S 88/5. The receiver was a regenerative design with tuned preamp, tuned detector stage followed by an AF amplifier stage (German: 1-V-1 audion), each stage using a KF4 battery pentode.



Complete SE 92/3 in a suitcase.

To save space, the coils in the input filter of the RF amp and in the detector stage were wound on Siemens powdered iron cores with cross-shaped shields and an adjustable core.

**SE 88/5:** A transmitter and receiver housed in separate boxes. The transmitter is the S 88/5 described above, combined with the receiver „E 88“. This receiver was built using the box and mechanical layout of the German standard receiver „E 75“. This receiver was named E 85 in the set SE 85/14 and E 90 in set SE 90/40. The design again used three tubes in total for preamp, detector and AF-amplifier (1-V-1), usually with 3x CF7 tubes if usage with a mains power supply was planned. The E 88 was the only known „E 75“ type receiver version modified for use with 3x KF4 battery tubes. It was pretty much the same design as that used in the SE 92/3, except with coils on 35mm ceramic form and the possibility of a volume control via potentiometer at the grid of the AF stage, a detail we do not find in the SE 92/3 (Photo of this set on top of this page).

## Abwehr set SE 88/5

There are several publications which supposedly show the SE 88/5 set housed in an unusual transport box. Most radio sets that included a receiver (not just a transmitter) were housed in small suitcases made of leather or resin reinforced cardboard. The transport „box“ with hinged lid, the „mouse key“ TKP and the „Steeg & Reuter“ crystal will help us to identify this very rare SE 88/5 set. All wartime pictures of the SE 88/5 seem to be taken of the same set.

In the mid-1970s, the theme of issue 11 of „After the Battle“ (ATB) magazine was „German spies in Great Britain“, including

spies from both WW1 and WW2. Within the pages of the magazine, we find a picture of our research-target, the SE 88/5 in a transport box: ATB noted that this set belonged to the „Lobster North“ team of Drücke and Schalburg. This team had arrived from Norway, having crossed the North Sea in a Heinkel HE111. The seaplane found calm seas near Banffshire in North Scotland and the team reached the coast via an inflatable dinghy. Drücke and Schalburg came ashore together with another agent named Werner Wälti. After arriving on the coast, the two groups separated. Drücke and Schalburg went to the railway station in Portgordon, where their wet clothes and strange accent aroused the suspicions of the stationmaster and the pair were quickly arrested. They told the police about Wälti who had caught a train to Edinburgh from the village of Buckie. The Edinburgh police were alerted to Wälti's presence and, after enquiring at the left luggage office at the railway station, found a suspicious suitcase with salt marks (from seawater) on it. When Wälti returned to retrieve his suitcase, he was arrested by William Merrilees, a police officer camouflaged as a railway porter. ATB magazine reports that Wälti's radio set was an SE 92/3, while Drücke and Schalburg were equipped with an SE 88/5 in a transport box.

After the war, it appears that various museums were able to acquire former spy radios from MI5. For example, some papers in the National Archives (Kew) document the transfer of various spy artifacts to the Imperial War Museum. The Edinburgh police officer, William Merrilees, a very famous person, also seems to have acquired some spy artifacts after the war, including one of the spy radios. Some of these items were later transferred to the police museum in Edinburgh, possibly after Merrilees passed away.

When the radio(s?) arrived at the police museum in the 1980s, the boxes were opened by Harry Matthews, a well-known individual and respected specialist in old radio equipment who had formerly been employed by the 'Museum of Communication', located in Burntisland, just north of Edinburgh. Matthews drew excellent schematics of the transmitter and receiver received from Merrilees. The Cryptomuseum in the Netherlands has some papers from the estate of Dr. Lissok, a Belgian who was an avid and early collector of WW2 spy sets. Lissok had collected information about the German spy sets used in England, and Matthews' schematics were luckily found among Lissok's papers.

## Ceramic coil form

Today, I can confirm that Matthews provided us with the only correctly drawn schematic of the receiver. The replica of this receiver by the author was immediately successful, proving that Matthews did an excellent job. There are more schematics of the E 88 available, but after taking a closer look at these,

one can easily recognize that they actually show the receiver of the SE 92/3 not the SE 88/5. Let's take a closer look at the details of the schematics at page 4.

The design of E 88 and E 92 are virtually identical. Both are regenerative receivers with tuned preamp, detector stage followed by one audio stage. The German designation would be '1-V-1 Audion'. Both receivers use the German KF4 battery tubes. So where do the differences lie? The E 88 has standard 35mm ceramic coil forms, widely known as 'Hirschmann Spulenkörper', although they were produced by several companies. They were available with 4 or 5 prong sockets and were intended to be used to realize changeable plug-in band coils.

The E 88 used only the ceramic body without connector pins. The antenna coil and the resonance coil of the input stage were wound on a common coil form, while the coupling coil from the front end, the resonance coil of the detector and the tickler coil shared the second 35mm coil form. These ceramic coil forms were rather large, wound with single



**Hirschmann ceramic coil (left)  
Siemens powdered iron core coil (right).**

layer close wound windings, an arrangement that created a large induction field: They needed space around the coils and were housed in different 'chambers' of the 'E 75' box design to prevent interstage coupling.

The E 92, on the other hand, used much smaller coils. They were wound on Siemens iron dust cores with cross-shaped head flanges and clip-on plastic form halves providing four chambers for the windings. These coil forms, 'Haspelkorpel' in German, had a mounting screw at the bottom and a ferrite screw to adjust the inductance on the top. The symbol for an adjustable coil in a schematic is an arrow through the coil symbol. The Siemens powdered iron core coils used in the E 92 were quite tiny when compared with the ceramic cylinders used in the E 75/E 88. The shield-plates on both sides of the coil reduced the inter stage cou-

pling, allowing a very compact arrangement of the components in the E 92 receiver.

## Volume control.

Another difference between the two receivers (E 88 and E 92) was the option for adjustable output volume. The E 88 had three knobs: the large one for frequency control, another for regeneration control (left hand-knob), and a third for volume control (right hand knob) which also included the on/off control. The E 92, on the other hand, had no volume control. The on/off control was a separate switch and the volume control potentiometer was missing.

All of the other schematics, besides those of Harry Matthews, show no potentiometer at the grid of the final tube. Even the schematics made by the RSS (Radio Security Service) for MI5 during the war, and which are of the E 88, show no adjustable volume control. It would appear that, since the RSS already had the E 92 schematic available to them, that they simply used that schematic instead of drawing a new one for the E 88. This drawing was simply copied again and again...until Matthews came along and revealed the truth! Veritas vincit! Thank you Harry Matthews... good job!

But let us return to the question: which agent brought the SE 88/5 in the transport box to England?



A few years ago I got two very interesting pictures from Paul Reuvers from the Cryptomuseum. The picture show a showcase from a museum in Edinburgh and the description.

Let's take a look at the photograph of the museum display in more detail. Take a look at the passport. The passport photograph is that of the spy Werner Wälti. The spring knife also appears in issue 11 of ATB where it is said to have belonged to Wälti. Drücke had a similar knife, but the handle was made of horn. Each 'Lobster North' team had a small pistol similar to those in the display. If you recall, ATB stated that Drücke and Schalburg had the SE 88/5 set while Wälti was given the SE 92/3 set. But the set in the museum display is not of an SE 92/3 but rather of an SE 88/5! It would appear that the museum display includes artifacts from both teams. Are you confused? It gets even worse.

Let's examine the following photograph which shows the caption accompanying the museum display.

We are on a rocky path, aren't we? The SE 88/5 is on display next to Wälti's passport and knife! The caption does not claim that the display set is that of Wälti but one could come to that conclusion. Who is correct? „After the Battle“ or the museum in Edinburgh? Did Merrilees possess the equipment of both „Lobster North“ teams, and the museum simply got some artifices that do not

necessarily accompany one another? We have to dig deeper....

After examining some of the spy files from the National Archives at Kew, we have several hints which support the conclusion that both of the the „Lobster North“ teams, Drücke/Schalburg and Wälti had exactly the same radio equipment, the SE 92/3.

**Radio set, false passport, and other items, taken from a German spy arrested in Edinburgh in 1940 after landing by dinghy on the remote Banffshire coast. His mission was to report on the strength of Royal Air Force units in eastern England.**

Robert Petter, posing as a Swiss national Werner Wälti, was arrested by police at Waverley Station, Edinburgh. Two other spies were arrested by police at Portgordon, close to where the three had landed. Petter and his accomplice Karl Drügge were executed in 1941.

Pistol, knife and radio set deposited by Lothian and Borders Police. M.11999.3.1-4  
Other items purchased. M.1991.73

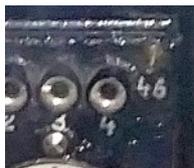
File KV 2-114

Let's take a look at an excerpt from the Security Service file KV 2-114 from agent Jan Willem Ter Braak::

His set is number 24. It is a combined receiver and transmitter in a metal case similar to that brought over by SUMMER, VERA, WALTI and M and G. As an accessory it had a small Pifco dual range meter

Here we learn that SUMMER (Gösta Caroli), Vera (Schalburg), Wälti, M (John Moe) and G (Tor Glad) had the same set as that of Ter Braak. The unfortunate Ter Braak had committed suicide and his file contains photographs of his set which is definitely an SE 92/3, a combined transmitter/receiver which matches the information in his file! The Kew files are first-hand sources, so it would seem that neither Drücke/Schalburg, nor Wälti actually brought the SE 88/5 to England. Now it get's really exciting...!

Let's look at the Edinburgh museum display photograph in more detail: Here we can see a small white number painted on the receiver's box, a barely legible So24



Close attention is required since, as noted above, Ter Braak had an SE 92/3 that was numbered „24“. But what we see in the photograph above is „So24“, not „24“. We will return to this bit of information in a moment. Now let's look at the transmitter as seen in the museum display photograph. It has a perfectly legible „46“ written on the corner of the box.

Details available regarding the Wireless Sets supplied to Enemy Agents sent across to England.

NAME	DATE OF LANDING	SET NO.	FREQUENCY	CODE NO.
PONS } TIEBOM }	3.9.40	9	4307	Grid
	3.9.40		5939	
WALLBERG } MEIER }	3.9.40	8	4314	Grid
	3.9.40		5986	
	5.9.40	35	6100	Circular No.1
			4108	
	20.9.40	transmitter 46	6195	Circular No.2
		receiver S.C.24	4603	
DE DEKTER } ERICHSEN }	30.9.40	6	62193	Circular No.6
	30.9.40		43984	
WALTI	30.9.40	21	6592 4365	Circular No.7
	3/4.10.40	40	6403	Grid
TER BRAAK (Suicide)	3.11.40(?)	24	5453.3 4508.5	Not known
JACOBS	31.1.41	26	5299 6280	Circular No.2
MGE } GLAD }	7.4.41	38	5294	Crossword
	7.4.41		4275	
RICHTER	12.5.41			

THIS IS A COPY  
OF THE ORIGINAL DOCUMENT  
RETAINED IN THE  
PUBLIC RECORDS SECTION  
OF THE  
HOME OFFICE  
AOT 1968.

u.(d)  
5.41.  
/WA.

*Handwritten signature/initials*

Next, we have a list of all of the captured spies and their radio equipment (National Archives, KV 2/114, Jan Willem Ter Braak file).

As noted above, Ter Braak's receiver was „24“ and this is not the same as the receiver marked „S.O.24“ on the list above. The museum display in Edinburgh does not contain any of Ter Braak's equipment! Ter Braak's set „24“ was an SE 92/3 and is confirmed by the photographs in his file!  
The „So24“ receiver and the „46“ transmitter, which are featured in the museum display,

play, are shown in the list above, but the name of the spy who brought the set with him has been redacted from the file. The set was given to a spy who arrived on 20 September 1940 with circular code disk „2“. But who was he, or she?  
The above list was pulled together in May 1941 and our SE 88/5 seems to be the only spy set used in England that had a separate

receiver and transmitter. All of the other agents had either a transmitter S 88 or a combined transmitter/receiver (SE 92/3) housed in a suitcase. One agent, Karel Richter, had no crystal frequency listed as he had a free oscillating adapter transmitter with an adjustable variable frequency oscillator (VFO).

National Archives file KV 2/62



The file KV 2/62 from the National Archives provides the answer to our mystery. Wulf (Hans) Schmidt's file contains excellent pictures of his radio set. The transmitter clearly shows the number 46 and has crystal frequency 6195 kHz, the same as on the list of page 3 from May 1941. It all fits together!

Double-agent Schmidt (codenamed TATE by the British and LEONHARDT by the Germans) with the E 88 in the transport box! (left)

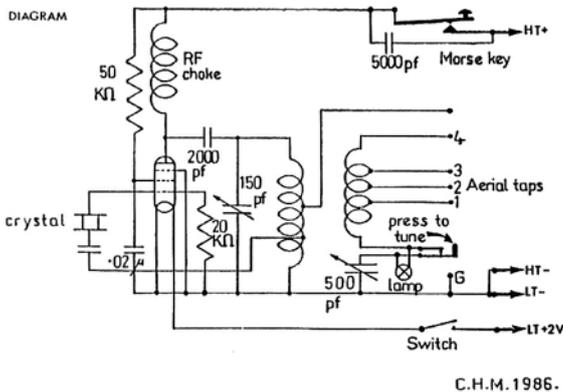
The number on the receiver is also visible clearly: So24



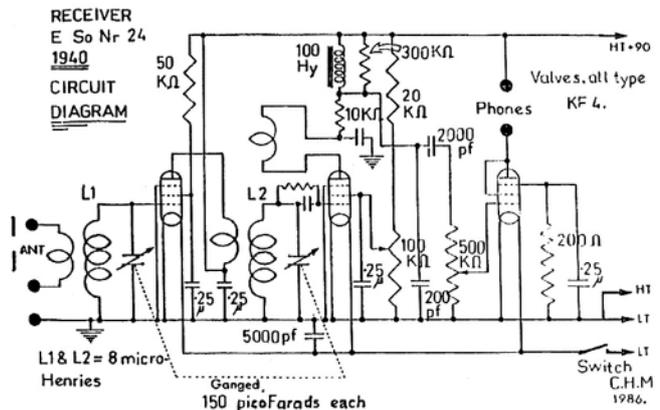
Transmitter unit of the SE 88/5 (S 88/5) with serial number 46 in enlarged cutout.



E 88 receiver, part of an SE 88/5. Serial number in enlarged cutout was So 24.



S 88/5 circuit diagram drawn by Harry Matthews.



Circuit diagram of the E 88 drawn by Harry Matthews.

## Wulf Schmidt

The KV 2/62 file has a treasure trove of valuable information. Wulf (according another file, Hans) was caught by the British and changed sides, working for them as a double agent. This explains why his name was redacted from the 1941 list of spy radio equipment. He was part of the Double-Cross System and only a very small group of individuals knew about it. The secret was kept until the end of the war and for decades afterwards. Schmidt was the longest-serving double agent during the entire Second World War.

It is interesting to note that MI5 insisted on using the German SE 88/5, later supported by a more selective HRO superhet receiver. They did not want to replace the tiny transmitter since they were afraid that the change in the typical keying-note would be recognized by the German radio operators. The British accurately documented their problems with the transmitter which only provided 2W output. They noticed the very rough tone and that there were some problems with interruptions in oscillation depending on the antenna configuration.

The MI5 notes match the author's experience when testing the replica. The transmitter has a lot of „character“. The reason can be found in the schematic. It is a „Hartley“ design. A Hartley makes a tap on the output coil, and a part of the RF on the output is fed back to the control grid. This RF feedback creates oscillation, and the frequency of the oscillation normally depends only on the setting of the parallel resonance circuit. In this transmitter however, the RF is fed back in series with a crystal. This very uncommon design creates quite a bit of stress for the crystal, as it has to withstand a lot of RF current passing through it. But there is also an explanation for this little detail. Should the crystal fail, it was

possible to create a shortcut over the crystal sockets and use the transmitter as a free oscillating Hartley VFO. The KV 2/62 file does not tell us if this option was tested during the Double-Cross operation.

## “Volunteer Interceptors“

Various radio interception stations were asked to listen to the transmissions of Schmidt. The results were alarming! The ground wave of the weak transmission was only heard within a few miles, while the sky wave was only heard at receiving points a few hundred kilometres away (e.g. Gilnahirk in Northern Ireland). Most of Great Britain was within the so-called dead zone of the radio transmission. The difficulties in detecting clandestine transmissions around the 60m band became obvious. The British decided to install a tight network of receiving stations across England. This network gave them a better chance of intercepting and identifying clandestine transmissions by having a receiving station in the small area where the ground wave could be detected. The radio network was established by recruiting hundreds of so-called „VI's“ .... “Volunteer Interceptors“ from the pool of amateur radio enthusiasts. The HAMS (as they were called) were not allowed to transmit in wartime Great Britain, so they were quite excited to help with the war effort. Volunteer interceptors who had good results were given better receivers, like the National HRO, a device that your average amateur could hardly afford. The HAMS did their very best to become good interceptors so that they could be rewarded with the „crown“. It was an impressive case of recruiting radio amateurs at the secret front. A second aspect affecting the role of radio amateurs is included in KV 2/62: As all traffic was made using morse code, MI5 analysed the use of HAM

expressions and abbreviations during the contacts.

I wish to thank Harry Matthews (deceased) and Marion McLean from Edinburgh, Giselle Jakobs (author of „The Spy in the Tower“), Rudi Staritz, Arthur Bauer ([www.cdvandt.com](http://www.cdvandt.com)), Paul Reuvers ([www.cryptomuseum.com](http://www.cryptomuseum.com)) and Manfred Bauriedel for the very fruitful exchange of information. The correspondence with them helped to put together a puzzle after almost 80 years.

## Conclusion

When the picture became clear, we learned that all of the published information about the SE 88/5 was more or less wrong. MI5 had disguised the origin of the set, both during and after the war. Even when they handed Schmidt's set to a museum, they did not tell the truth. Schmidt (TATE) remained in England after the war and MI5 provided him with a new identity, Harry Williamson, a name that he kept until he passed away in 1992. There was no chance to solve this puzzle until the British government declassified Schmidt's file KV 2/62.

The police museum in Edinburgh has been informed about these research results so that they can tell the truth about the SE 88/5 spy set in their possession, a remarkable story about espionage and counterespionage. This radio set has written history! One example: TATE reported a field of mines in the sea on the coast. As a result of this false information the German U-boats avoided that area, and England had a safe retreat for their ships.

November 2020, Thomas Höppe, DJ5RE



**SE 88/5 replica from the collection of DJ5RE, often used for radio contacts in the 40m amateur radio band.**

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DOUBLE-CROSS AGENTS DURING WWII IN THE UNITED KINGDOM											
Agents' Code Name	Date of Starting Work	Method of Contact	Main Tasks	Reason for Conclusion of Case	Remarks	Agents' Code Name	Date of Starting Work	Method of Contact	Main Tasks	Reason for Conclusion of Case	Remarks
BALLOON	May 41	Nov. 43	s/w	General, especially arms and armament.	Germans considered that other TRICYCLE was BALLOON unnecessary.	MUTT	Apr. 41	Feb. 44	w/t	Sabotage and general, especially military information.	Doubts about German belief in the case.
BRONX	Oct. 42	May 45	s/w	Industrial and political information.	Still working at conclusion of hostilities.	PEPPERMINT	Dec. 41	April 43	s/w sent in diplomatic bag	General information, especially morale, military factories, and aircraft production.	Breakdown of communications.
BRUTUS	Oct. 42	Jan. 45	w/t	To create Polish fifth column in England and report military matters.	Fear of disclosure in trials of French separatists of BRUTUS.	PUPPET	Apr. 43	May 44	s/w	General, especially economic.	Doubts about communications.
CARELESS	July 41	Jan. 43	s/w	R. A. F. information, especially delivery of American aircraft. Also production of A. A. defences.	Refused to assist in work. (Polish arms, shot down by Germans in 1939).	RAINBOW	Feb. 40	June 43	s/w	Aviation, air defence, industrial, and economic.	Weakening of German interest.
CARROT	June 42	Dec. 42	—	Reports to Vichy Government.	Lack of interest on part of enemy.	ROVER	May 44	May 45	s/w and w/t	Details of aircraft factory. Air raid damage.	Conclusion of hostilities. Rover was returned to Polish army.
CELEERY	Jan. 41	Aug. 41	p/c	Air Force matters.	Misfit. SNOVW sub-agent.	SHEPHERD	Mar. 44	—	s/w (no method of reception)	Suppliers and manufacturers, attitude of miners and railway employees, coastal inf.	Sept. 44—wireless contact was maintained using XX Committee operators.
DRAGONFLY	Mar. 41	Jan. 44	w/t	Aerodromes and troop movements. Daily weather reports; military and general information.	German failure to pay agent.	SNARK, THE	July 41	Mar. 43	s/w	Food prices and living conditions.	Lack of German interest.
FATHER	June 41	June 43	s/w and reception w/t	To steal a plane and return to Germany. All information, including technical.	Germans. Questions became embarrassing to agent was posted overseas.	SNIPER	Nov. 43	May 45	s/w and w/t	Aircraft and scientific apparatus, and methods used in antisubmarine warfare.	End of hostilities.
FIDO	July 43	Feb. 44	s/w (no method of reception)	To steal a plane and concentration of troops, aviation, and technical.	Suspicious, and bad communications.	SNOW	Sep. 39	Mar. 41	w/t and p/c	General, especially Air Force matters.	Suspected of having been exposed by Germans after visit to Lisbon. Imprisoned.
FREAK	Dec. 43	May 44	w/t	General information and wireless messages on behalf of TRICYCLE	Breakdown of the TRICYCLE network.	SUMMER	Sep. 40	Jan. 41	w/t	General on area round Birmingham.	Agent's attempt to escape. Recaptured by Briton employed at Spanish embassy.
GANDER	Oct. 40	Nov. 40	w/t transmission only	Road obstacles and defences in northwest England and morale.	Imperfect means of communication.	SWEET WILLIAM	Aug. 41	Aug. 42	Spanish diplomatic bag	Morale, food situation, etc.	Communication unsatisfactory owing to lack of control.
GARBO	Apr. 42	May 45	s/w and courier	General information, especially military. Developed team of imaginary agents.	End of hostilities. Awarded M.B.E. by British and Iron Cross 2nd Class by Germans.	TATE	Sep. 40	May 45	w/t	Chosen by Germans as postmaster. Operated for four and a half years.	Arrival betrayed by 3088 MGR. Captured by Huns Schmidt. Real name: Huns Schmidt.
GELATINE	May 41	May 45	s/w	Political information.	Tricycle sub-agent. Conclusion of hostilities.	TEAPOT	Jan. 43	1945	w/t and p/c	General.	Triplecross who provided inf. for the Admiralty.
GIRAFFE	Sep. 40	—	s/w	Air Force matters.	Insufficient traffic	TREASURE	Aug. 43	Dec. 44	s/w and w/t	Military information and news about projected invasion.	No further use.
G. W.	Oct. 39	Feb. 42	p/c and Spanish dip. bag	Sabotage. General information.	Arrest of his Spanish contact.	TRICYCLE	Dec. 40	May 44	p/c, s/w, and w/t	General, military, and economic information.	No further use.
JEFF	Apr. 41	Feb. 44	w/t courier	Sabotage. General information.	Doubts about German belief in the case. Imprisoned from Aug. 41 onwards.	WASHOUT	June 42	Dec. 42	s/w	Troop dispositions and aircraft production.	Arrest of ARTIST made and unsatisfactory suspect.
JOSEF	Aug. 42	Dec. 44	p/c and courier	Shipping and comvoys.	Failure to extract sufficient advantage from it.	WEASEL	May 42	Dec. 42	s/w	General and naval.	German lack of interest and character of the agent.
LIPSTICK	Nov. 42	Mar. 44	s/w	Troop disposition and technical information.	Complications due to his writing to the Japanese with the separatist movement.	WORM, THE	July 43	Jan. 44	s/w	Military, naval, and Air Force information.	German lack of interest probably due to length of time spent in reaching England.
METEOR	Apr. 43	May 44	s/w	General information, especially naval.	Breakdown of the TRICYCLE network.	ZIGZAG	Dec. 42	Nov. 44	w/t	Sabotage. Movements of U.S. troops. Anti-U.S. activities. Night fighter, radio location devices.	Yugoslav. Real name: Jean —
MULLETT	Dec. 41	May 44	s/w and p/c	General information production and industrial.	Doubts about communications.						Dropped twice by parachute in England in 1944. Real name: Eddie Chapman. German code name FRITZCHEN.

List of double agents during WW2 in the UK. Agent Tate's real name was Hans Schmidt according to this list.