Köln (Koeln) E52 xxx restoration project

Why do we need to restore Köln receivers?

We can distinguish between two major circumstances:

1. Aging defects and/or general re-adjustment

2. Often more serious, are “amateur-like modifications” or carelessness, which has to be reversed, as to bring the Köln E 52* receiver back to its original fashion. Sometimes, however, destruction of essential parts occurred, like burning-out of the power transformer, owing to the usage of a solid metal piece instead of a 1000 mA fuse! This actually occurred in a Köln owned by a Dutch collector, which he obtained from Russia some years ago! *The inconsistency of using E52 and E 52 might make it easier for web-search-machines to trace subjects on our website

For this occasion we consider our Köln E52a2 receiver, serial-number 2871.
The serial-number is not a straight succession (production) number, but was provided in so-called “lots”. These numbers are generally painted on the microfilm glass-disc and/or rubber stamped on the left-hand side of the projection housing (regard photo 0). See for Köln details also our **E 52 main page** and my paper on: **Aspects of German electronic engineering in the 1930s (Synopsis), Luftboden-Programm**

Photo 0

Number 2871 is clearly visible on the left-hand side of the projection housing. Inside we still see the genuine “Luftwaffe colour”. The valve socket belongs to the second RF pre-amplifier (RV12P2000); the white triangle indicates, that it is indeed a P2000. Whereas a blue triangle would have indicated a RV12P2001. However, Köln receiver does not utilise variable µ valves like P2001. The empty valve socket-holes fit to the BFO/Detector -LF pre-amplifier module (consider photos 47 – 51 of **Part III**)

On the statistics behind these numbers, consider: Hans-Ulrich Widdel's survey report.

Our Köln E 52a2 might have been produced in late 1944 or early 1945. One never will find, in contrast to common German practice, a hint on a date of production in it. Only the date stamped on the valves might give a clue(hint), when most valve-base would carry similar date (only valid, when valves had not been changed since). German valves were stamped like: 45/43, which indicate that the valve was accepted (Abgenommen) week 45 of 1943.

It was obtained in Holland (1993), though, the previous owner told me, that he got it when he was to be sent home late 1945, after his engagement with the US Occupying Forces in Germany. Where he had worked as a translator (interpreter). He was asked, what he would like to bring home? He was then accompanied to a very large store, packed fully with German electronic gear. Cable rolls with fine (Vacha) coaxial cables (far too heavy!). He choose two receivers, one being a Köln E52a2 and an Ulm E53b VHF receiver (how he managed to transport (convey) 80 kg is an open question). Anyway, in those days priceless devices, which represented the best that was made in Germany (maybe elsewhere too). The E52 may have been the best military shortwave receiver of its time.
Until late 1940s it was "not done" in Holland, to mention a fine (high quality) German receiver, what was then stated was, for instance, "a 10 valve shortwave receiver" without further explanation (as did late PA 0 UM during an Electron interview, whereas the actual receiver was visible in the background). One reason might also have been, that the actual owner was not allowed(supposed) to possess such a device! After say early 1950s, no one dared these facts (circumstances) any longer.

I have been engaged for more than 40 years with Köln receivers.
In the early years between 1945 until say late 1960s, "Köln" (receiver) meant a magic word, and only very fortunate(lucky) people could afford one. I still remember vividly an intriguing advertisement of about 1961/62, in which a German company offered a Köln receiver for 1500 DM! Which kept it for most people an un-affordable dream (surely for me, as I was then a poor student, AOB). It was, however, not even in a genuine shape, as it had been "adapted" by Rohde & Schwarz in the late 1940s (for checking time-keeping signals).
But we then weren't aware of "originality", as collecting electronics was not yet "en vogue". Collecting historical electronics started, world-wide, say in the second half of the 1980s. Since then, many devices have even become less affordable, owing to big money spenders (inflation?) and, since recently, due to the e-Bay's aberrations (madness or is it lunacy?).
However, as long as real collectors dominated the scene (say until early 1980s), many collector items were regularly employed (utilized) too, as nothing else comparable was affordable.

Our Köln serial number 2871, was inflicted by aging defects and by amateur-like modification, as it had been re-painted outside. More serious is, that the original text at the aluminium* front-cover(plate) had been made invisible (it is not yet clear whether it was filled-up or that it had been rubbed-off). *Hereafter sometimes abbreviated Al.

Generally, however, one of the most serious problems is, that the ganged tuning capacitor (six fold) is of very unconventional, though sophisticated, design. Each capacitor section is fully separated (independent) from each other and its position (actual capacitance vs rotation-angle) to one another was adjusted(kept) by means of spring loaded ceramic shafts. These shafts-adjustment-screws are conveniently accessible. It relied, however, on spring loading. What does occurs in time is, that the ceramic shaft is, due to metal oxide, being hampered in its free movement. When, for whatever reason, the shaft is being forced a bit towards its spring tension, then its spring-force might be not sufficient enough to restore its starting position

(insufficient shaft pressure). The down-side is now, that the tuning capacitor section can rotate(move) a few degrees around a free position, which is intolerable.
Getting access to the spring section (hole) is only possible by means of complete dismantling of the Köln receiver!
Never believe anyone, who claims to have overhauled his entire Köln receiver, without having dismantled it totally! As, 99 out of 100 Kölns suffer from this tricky down-side in some respect..
After having done this many times, dismantling can be accomplished within say 45 to 60 minutes (vice verse). We will closely show all steps necessary. Although not essential, also taking a closer look on various plug-in modules.

I have made some special tools, by which means disassembling or assembling becomes very simple. For receiver adjustment, I have also adopted the original Köln antenna-cable, be it adapted with a “BNC” connector as to fit it onto the signal generator (or wobbler).

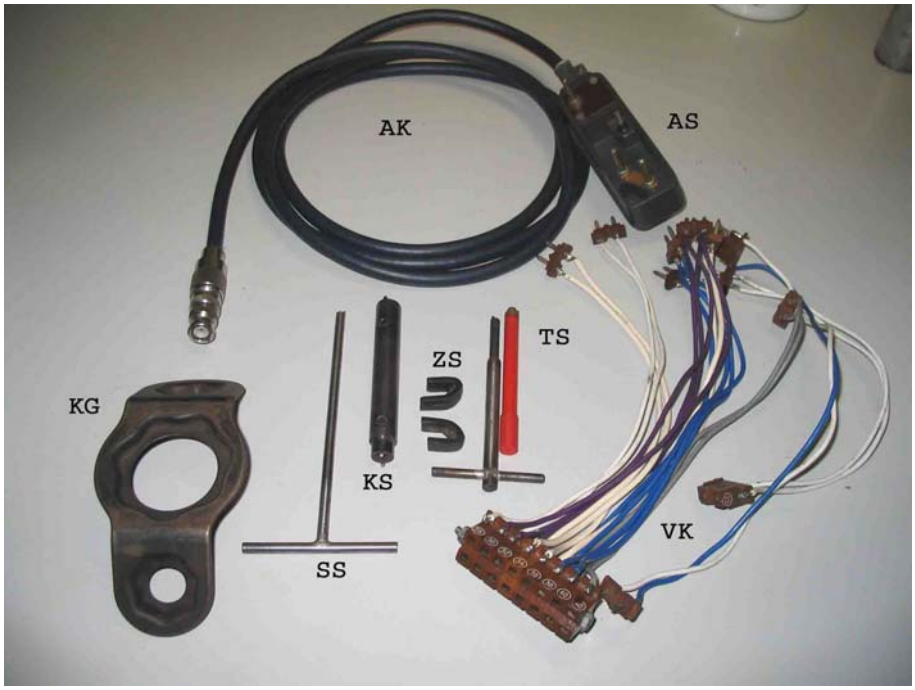

Photo 1

AK = Antenna cable (genuine blue Vacha, with ceramic spacers); AS = Antenna connector; KG = Original Köln tool for fixing the knobs (Bedienungsknöpfe); KS = a Köln tool by which means the knob-screws can be handled; SS = especially made tool as to lock or un-lock small contact screws (bolds); TS = especially made insulated trimmer adjustment tool; VK = is a set of extension cables, by which means the replaceable(exchangeable) receiver modules such as: power supply - IF - BFO/detector - or the LF module, can be remotely tested; ZS = self made, it has to keep the spring loaded (two)gears in special fixed (calibrated) position.

To understand the Köln E 52 a principle concept better, we start with its schematic diagram. As this may enhance your understanding. Basically, all Köln derivates such as type E 52b …. and: a, a1 and a2, rely on the same concept. Simplifications, had mostly to restrict the use of some scare materials, though, also had to reverse principle concept errors. Especially, problems with the accuracy of frequency scale readings. It proved, that it was inevitable to change the way in which the oscillator “L and C” had to be re-adjusted. Also the design of oscillator the tuning capacitor was transformed.

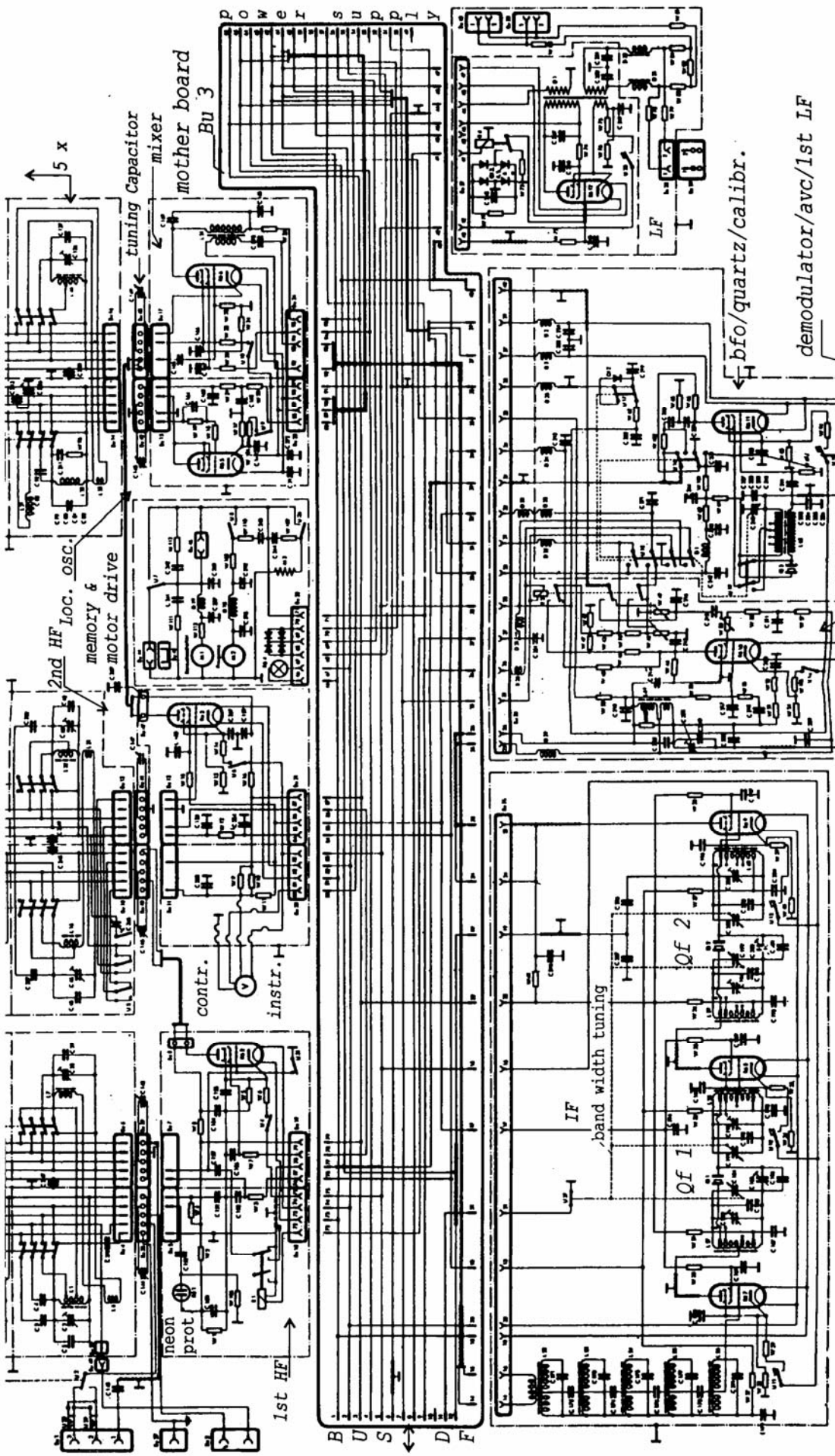

Fig.4 E 52a receiver, (1,5–25 MHz) central the mother board Bu 3

Photo 2

The purpose of the tools (Photo 1): KG and KS may herewith be explained

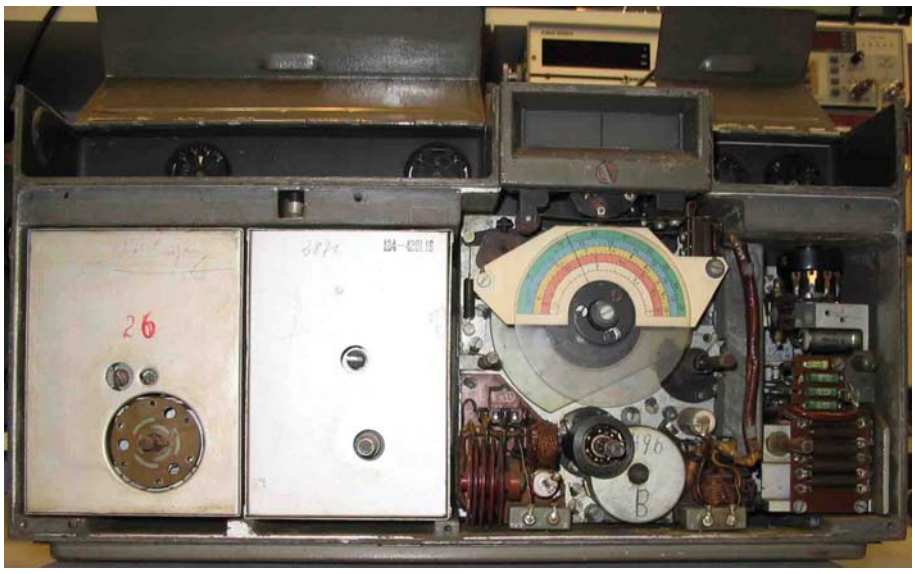

Photo 3

Step two: remove the aluminium front cover. From left to right we see: IF - BFO/detector - motor-tuning module and on the far right (without RF screening) the - LF module.

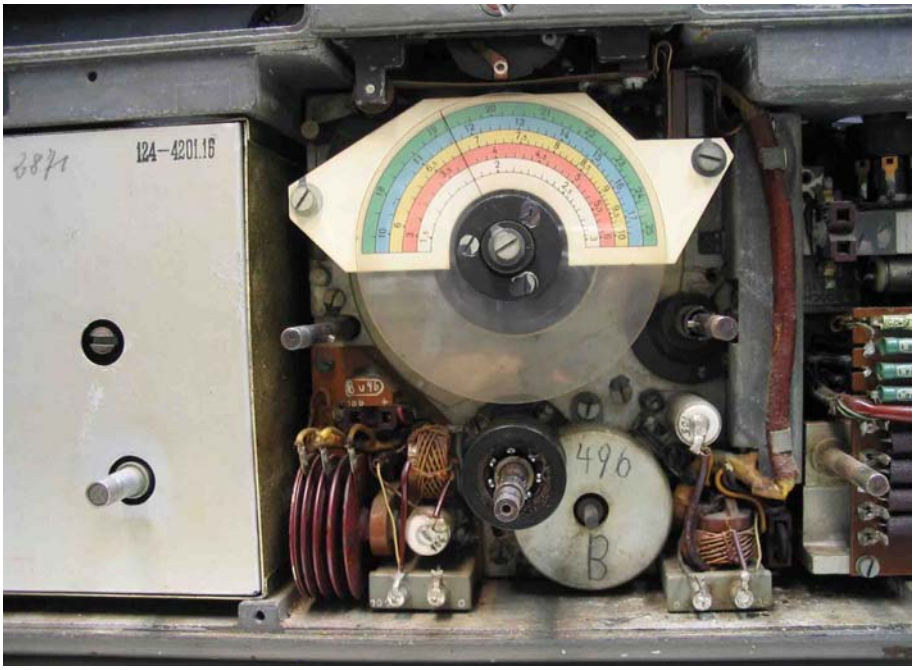

Photo 4

Shown here is the motor-controlled tuning module of our E52a2. We may consider, however, that there exist no major difference between the versions of 1942/43 (Köln E52a) and the types a1 and a2. The difference lays in mechanical and/or electrical simplifications. Be it, that some modifications nullified serious concept (design) errors of 1941-1942!

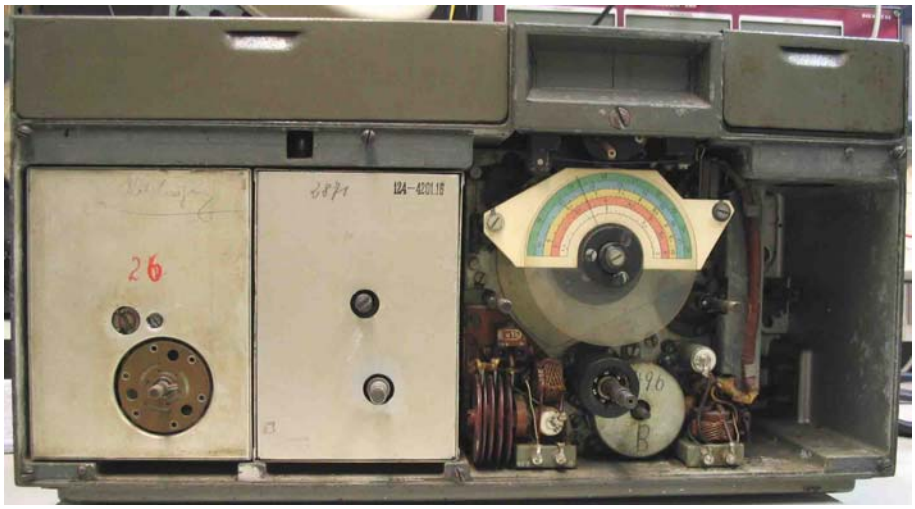

Photo 5

Next step: the LF-module being removed (pulled-out)

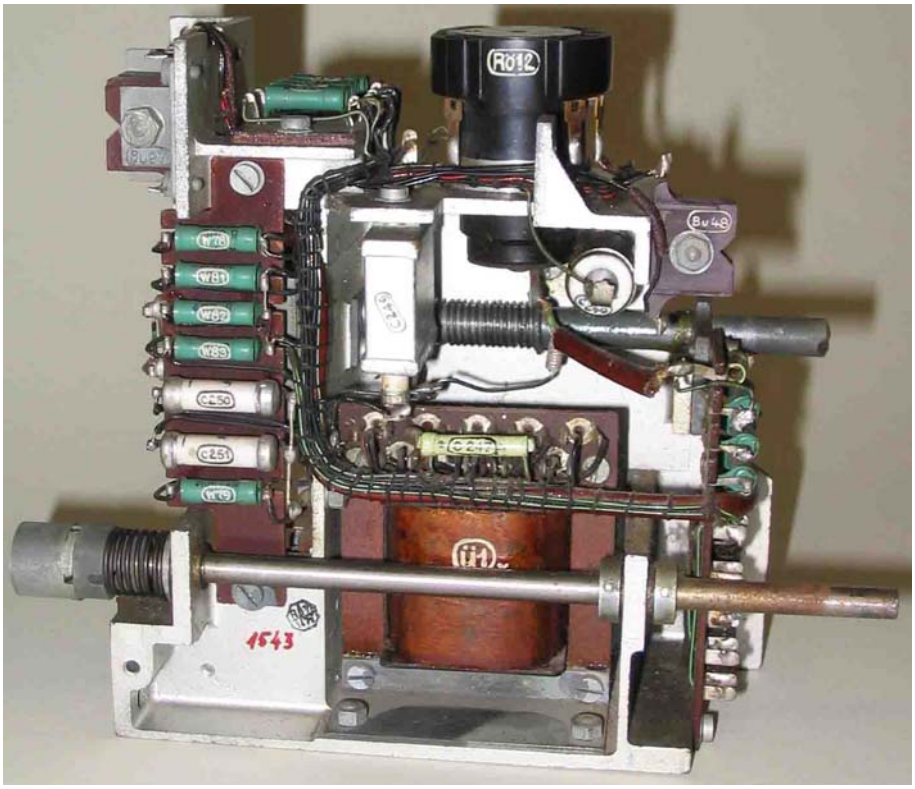

Photo 6

Side view of the LF-module. Ü1 is the LF-output (headphone)transformer. A fault sometimes occurring is, that the sound level is too low. But, what is not always recognized is, that although there is no positive anode voltage owing to the broken primary transformer windings: that there exists a separate feed-back winding fed by the cathode circuit. The audio valve (RV12P2000) acts now as a cathode-follower, and that the valve is utilized as triode, instead of a pentode.

Photo 7

Front view of the audio (LF) module. The shaft reaching through the module, links the function control onto the appropriate switch united inside the power supply module

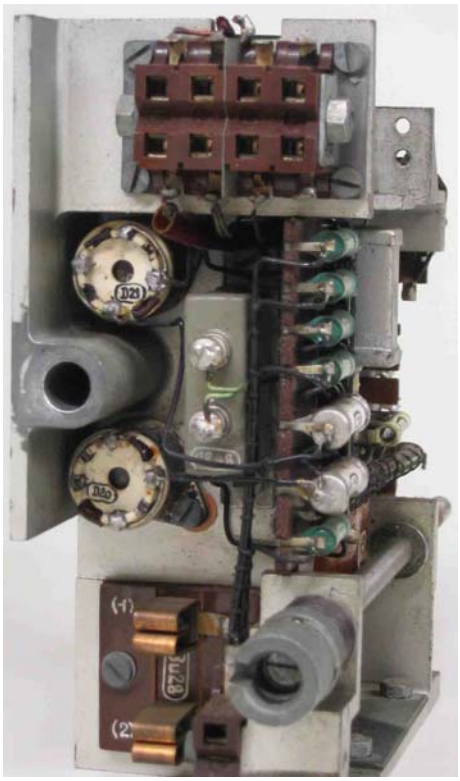

Photo 8

In front on the right, we see the clutch (Kopplung) onto the mode switch (A 1 – A 3 with or without AGC*), in the power supply module. Bü28 is the headphone output. D20/21 are (dust-core) low-pass filters, the tiny ceramic housings are screened by means of deposited silver (owing to oxidation now looking black) * also known as AVC

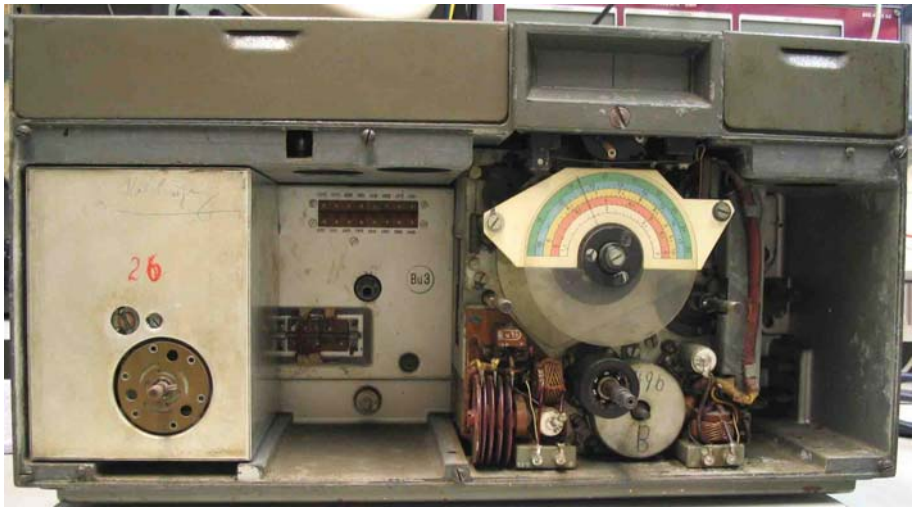

Photo 9

Next, BFO/Detector/LF pre-amplifier being removed. Bu3 is the “mother-board” it represents the entire interconnecting wiring of a Köln receiver! Every separate module is linked through it (leaving apart the inter-connections onto the RF coils). Consider the schematic receiver concept at page 4

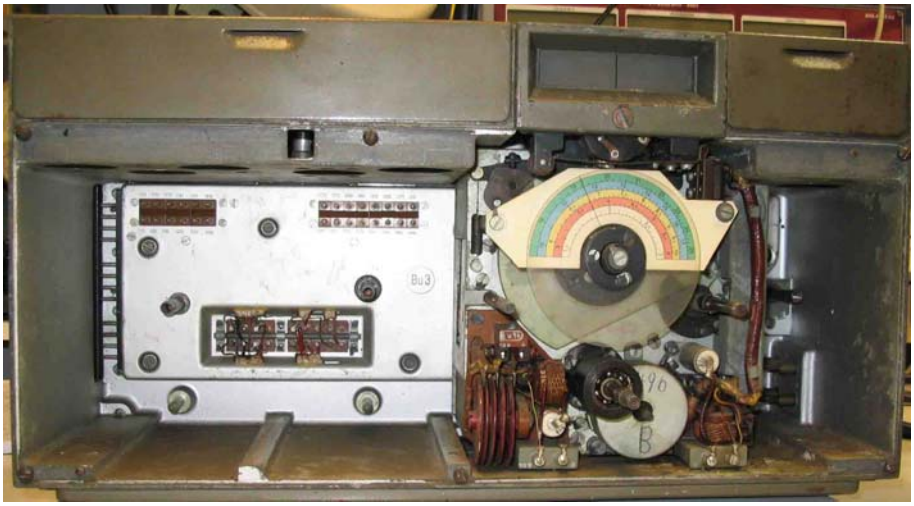

Photo 10

Next, the IF module is removed too. The rectangular contact-arrangement in the (lower)centre, is to link the power supply onto the (Köln) receiver. The two upper connectors is to connect both IF and BFO/Detector/LF pre-amp onto the mother board wiring

Photo 11

The (Luftwaffe)blue/gray module is the power supply unit. The aluminium cylinder is the power vibrator (Zerhacker) type MZ 6001. It is to supply the Köln receiver straight from a 12 volts battery source. Its design is very versatile, as, for instance, when a mains connector is not directly available (may be broken or is not fitting) the wire-cores can be fixed(fit) with screws, as is also facilitated for battery operation(when no battery connector(Stecker) is at hand)(black Bakelite (horizontal)blocks above the connector-sockets). The Al. cover on the left covers the mixer and oscillator L and Cs. On the far right, we see the front-end selection section (module). The two RF stages (two pre-amps) are all inductively coupled tuned band-filters. The central tuned section is the band-filter coupling between the first and second RF stage. Some of you will wonder why it does not have an Al. cover? This may be owing to: shortage of materials (rationalisation). In fact it may be omitted, as coupling between previous or follower stage (= mixer) is unlikely anyway. (see photo 12)

Photo 11a

This basic trimmer type originate from Hescho, and was only adopted in Britain just at the end of the 1930s. What wasn't, was the integrated centre hole, which allowed adjustment of C as well as inductance (thus L and C) tuning. I haven't found Telefunken's original patent claim yet, though, we may be sure that this facility was intellectually owned by Telefunken. The Köln tool TS (at photo 1) fits exactly inside the centre hole and assured that the "trimmer tool" could not slip away, which might cause a high tension fault.

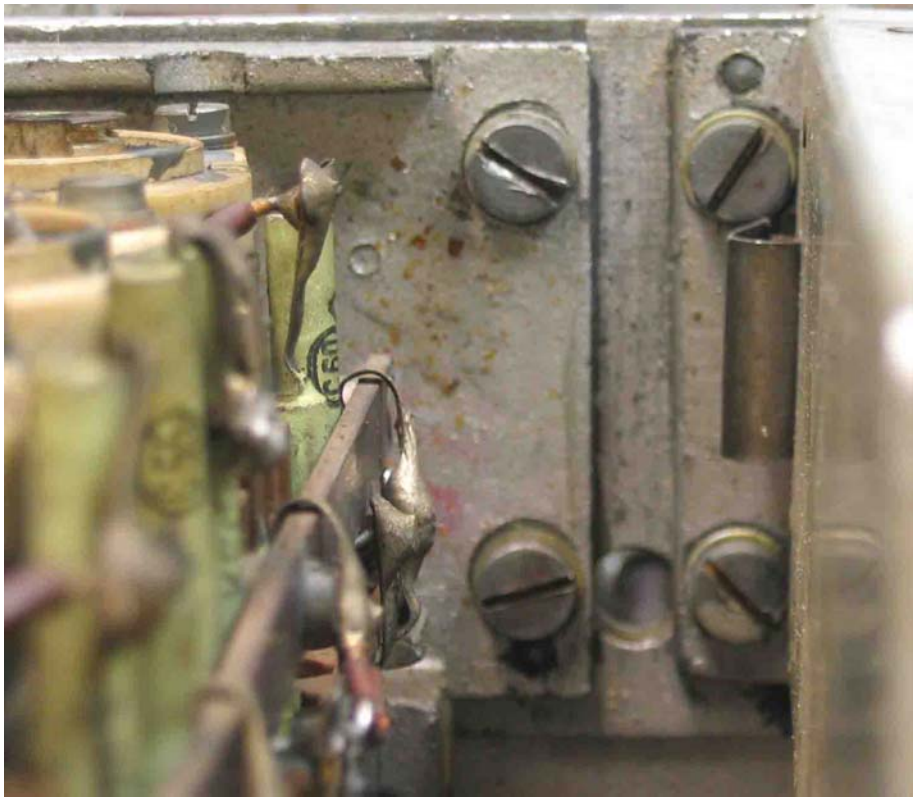

Photo 12

This illustration is to prove that no provisions were taken as to facilitate spring-loaded grounding of an Al. cover box. On the right we see how the Al. cover is originally being fixed

Photo 13

The Al. shielding plate to the valve module, containing the oscillator and mixer stage. The right valve socket belongs to the mixer and at the left to the oscillator valve

Photo 14

Shielding being removed. Rö 5 is the oscillator valve socket. The coil-box (N/R 88) loaded with the brown capacitor, is the first of originally six band-filter (1 out of 6) between mixer and first IF stage. Bandwidth at grid 1 of the first IF valve already limited to > 15 kHz! (regard circuit diagram at page 4)

Photo 15

Next step is, to detach the two locking bolds and pulling the module upwards. “Nacheichen” is the central trimmer, as to compensate capacitance deviations of the oscillator valve Rö 5

Photo 16

By means of special tool SS (see photo 1) we can detach the contact bolds. It is clear, that these special contact-bolds incorporate two functions: one is to secure steady contact as well as to provide RF connections onto the de-mountable modules (Steckmodule)

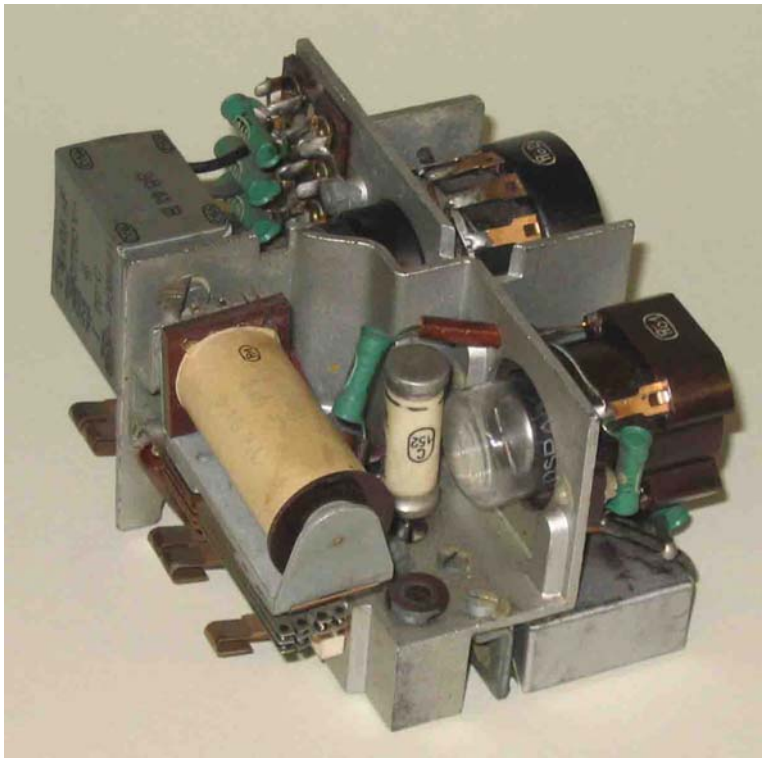

Photo 17

Shown is, the front-end (RF) module. Valve (Rö 1) is type TE 20 (Osram)*. This is a special low capacitance neon signal limiter. Special is, that it is pre-loaded with a dc voltage, as to lower its actual ignition point. The relay is to connect (link) the (frequency) calibration signal onto the first RF stage. An interesting feature is, that G_1 of the first RF valve (RV12P2000) can be connected straight onto ground. This should instantly reduce the overall noise level of the receiver, as the front-end circuit noise could no longer contribute(add). This could only work, as long as all (band)filters were tuned appropriately! Isn't this a clever solution, when we consider that the (generated) RF-EMF is ≥ 1 µV? *often(successively) being omitted

Photo 18

We see the bottom side of the receiver. The power supply being pulled backwards a bit. The 5 ganged RF tuning capacitors shown in-line. The oscillator C148 (tuning C number 6) is being covered. The top section of this photo shows the motor-tuning of Köln type a - a1 or a2. Just

left of the two-pin connector on the right we see the mechanical connection onto Köln's central mode (function) selector switch

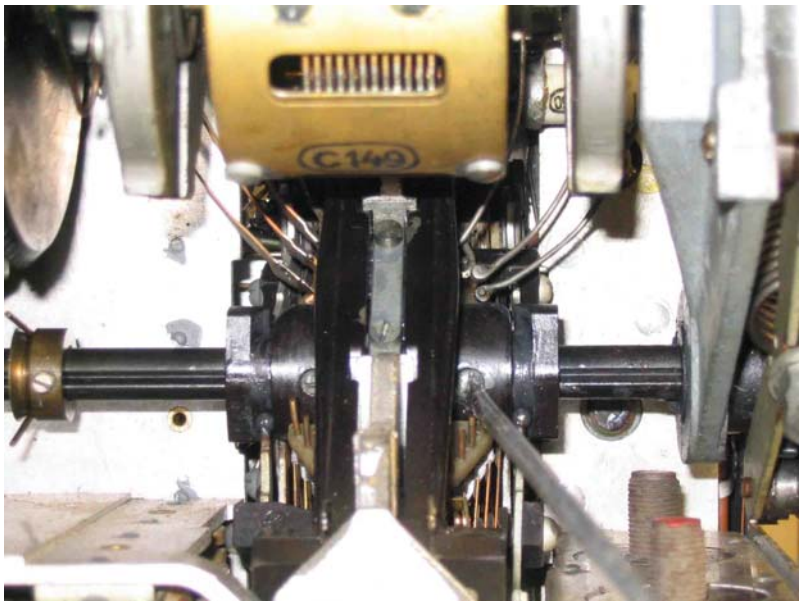

Photo 19

The next step is to remove the central band-switch-shaft. The spring-sliders on the left is to ensure that the central shaft cannot carry RF signals (keeping it RF neutral).

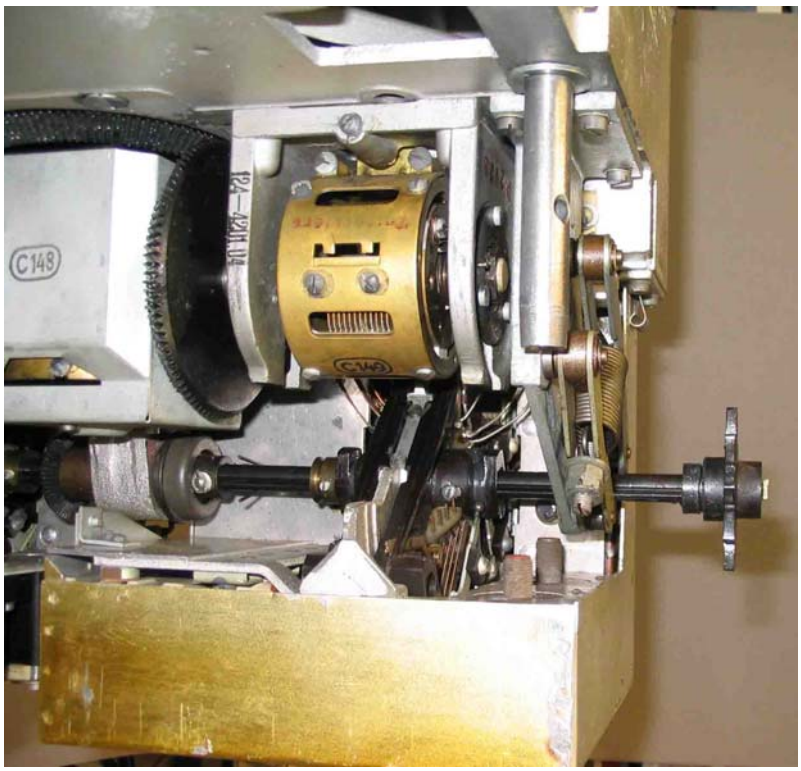

Photo 20

Followed by pulling the switching-shaft outwards. The sprocket-wheel on the right, fixes(provides stable, spring loaded) band-switch-setting (locking) (1 out of 5)

Photo 21

The individual tuned RF modules can now be removed (detached). Interesting is, that this module carries serial number 2884. When we remember that our Köln has serial number 2871, then we may conclude: that, presumably, this module was originally meant for Köln number 2884. This is not too strange, as we may regard, that pre-alignment of Köln modules were maintained in a special laboratory set-up. The stamped numbers 9405 and 9368 may originate from bench (and/or test) numbers.

Photo 22

We have stripped-off the previously shown module. We can see, that Köln tuning capacitors are mounted on a (central)ceramic shaft only. Visible is only its stator section, which has to be kept in a certain position accurately (regard explanation at **Part IV**). This now is one of the concerns why we have to dismantle Köln receivers generally. Regular tuning capacitors join generally common ground, which may be a simple solution, though, it certainly is not the best way around! If we look carefully, we can see that in the centre above the tuning C, there is a semi-cylinder facing upwards. Inside it is the spring-loaded ceramic shaft. It is evident, that there is no way around, then that the entire capacitor mounting (module) has to be removed. Though, how?

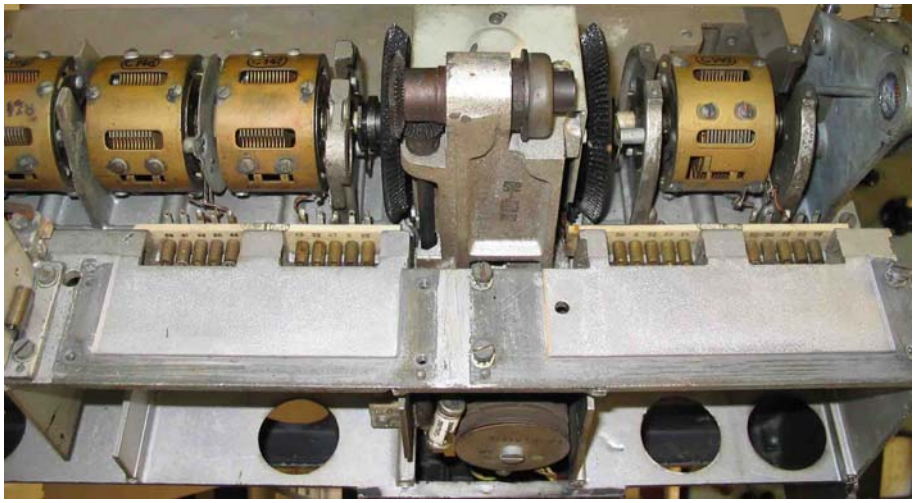

Photo 23

For better vision, this photo is printed upside down. RF module two and three have already been detached

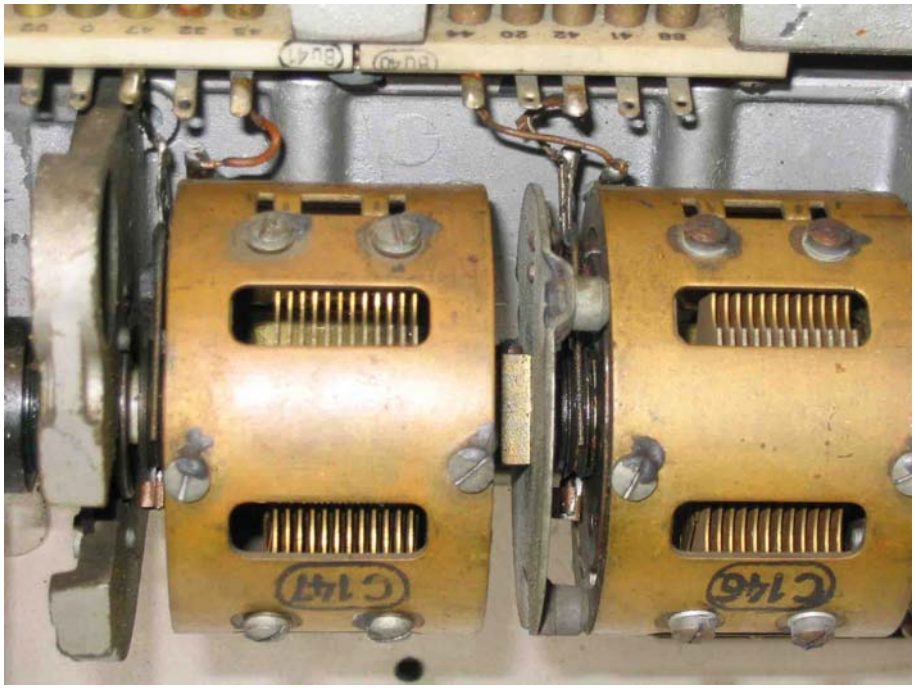

Photo 24

The slider-springs on the right of tuning capacitor C146 and 147 is to connect the RF circuit (signal) onto the rotor of the tuning capacitor. Regard again, the semi-cylindrical shape of the spring loaded housing. It is, herewith, clear that to access it, we have to dismantle the Köln receiver entirely! C146 and C147 both belong to the tuned band-filter between RF stages 1 and 2. (C146 = anode circuit, and C147 = band-filter output, driving grid 1 of the second RV12P2000). When we look carefully inside C 146/C147, we just can see partially a rotor-blade