

German Field Line Communication equipment of WW 2



Funksammler Publications

20 line switchboard

Development and Description

To bridge the gap between the smaller 10-line and larger 60+ line switchboards, in 1940 the “*Klappenschrank zu 20 Leitungen*” or 20-line switchboard was introduced. Weighing in at about 40 Kg, the switchboard is a heavy sturdily built unit. The unit is fully encased, offering excellent protection during transport with even the interconnection cables being protected within the casing. Like the small 10-line switchboard, the unit could be set up and connected quickly. The unit also contains its own alarm bell, alarm bell generator, buzzer and handset connection, so no external *FF 33* field telephone is required for operation.



Figure 143: Klappenschrank zu 20 Leitungen

An enlargement unit could be placed on top of the “*Klappenschrank zu 20 Leitungen*”, containing additional line connections and two public network connection fields, complete with dialling disks.

The “*Klappenschrank zu 20 Leitungen*”, like the *OB 17*, uses a two-cord interconnection system. Ten interconnection cord pairs are provided. When not in use, the interconnection cords automatically roll into the interconnection cable enclosure which forms the bottom section of the unit, preventing snagging and damage. Ten Kellogg switches are connected to the interconnection cords, this means that the operator can only speak to a incoming line once one of the interconnection cords is plugged into the relevant field (in the previously discussed switchboards, each incoming field had its own dedicated Kellogg switch or interconnection button).

On the left and side of the front panel are three 5-pin connection sockets for handsets, or headsets with breast microphones when hands-free operation is required. On the top left of the panel is a provision to hang the handset

German Field Line Communication Equipment of WW2©

On the right of the front panel is an enclosed battery compartment, which houses the local battery (“*OrtsBatterie*”) and the alarm bell battery (“*WeckerBatterie*”). A switch on the front panel allows the alarm bell to be switched off for silent operation.

The front panel contains four centre sections. The top section houses the conference parallel sockets, which allows several lines to be connected to the same call. The two middle sections contain the 20 incoming line fields, each with a signal flap and an interconnection cable socket. The bottom section contains the ten interconnection cable flaps, one for each cable pair.

If the internal buzzer could not be operated, a alarm bell generator was provided, the crank handle can be found on the right bottom side of the interconnection cable enclosure.



Figure 144: Enlargement unit placed on top of the exchange

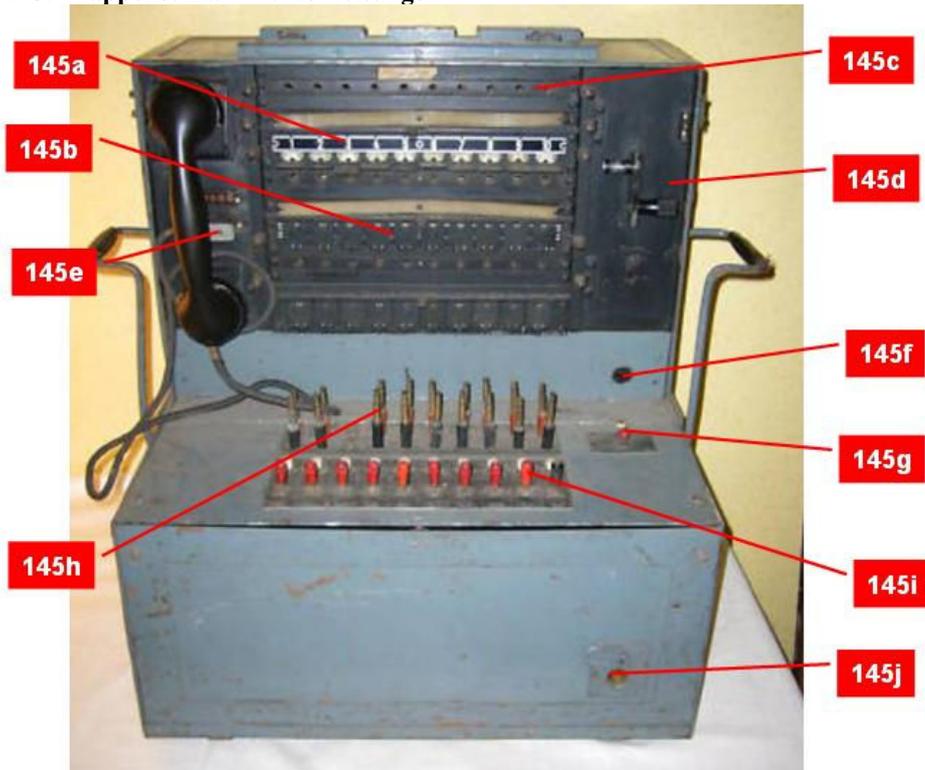
The enlargement unit sits on top of the switchboard. On the left and right side it contains two fields for interconnection to public networks. Each field has a writing tab, dialling disk, signal flap with Kellogg switch and interconnection cable socket, similar to the “*Amtszusatz fuer den Kleinen Klappenschrank zu 10 Leitungen*”. The centre section contains the incoming line fields, either an additional 30 lines, or 10 additional fields and a 9 by 10 “Scribner²” parallel connection field, which allows four complete 20-line units plus enlargement units to be coupled as a single, 120 line switchboard.

Due to the weight and size, it is likely that it was designed to be a vehicle mounted mobile switchboard.

² C.E. Scribner was a Western Electric Manufacturing Company engineer credited with many patents and inventions, amongst others the telephone “jack”. Building large telephone switchboards posed specific challenges, at some point the length of the interconnection cables limits the number of lines it can reach. This problem was solved by connecting each subscriber to multiple sockets along the switchboard. The original solution was patented by Firman and later refined by Scribner. In this solution, each “workstation” of the switchboard has a parallel socket matrix, allowing an operator of a particular workstation to place outgoing calls to the lines of all other workstations.

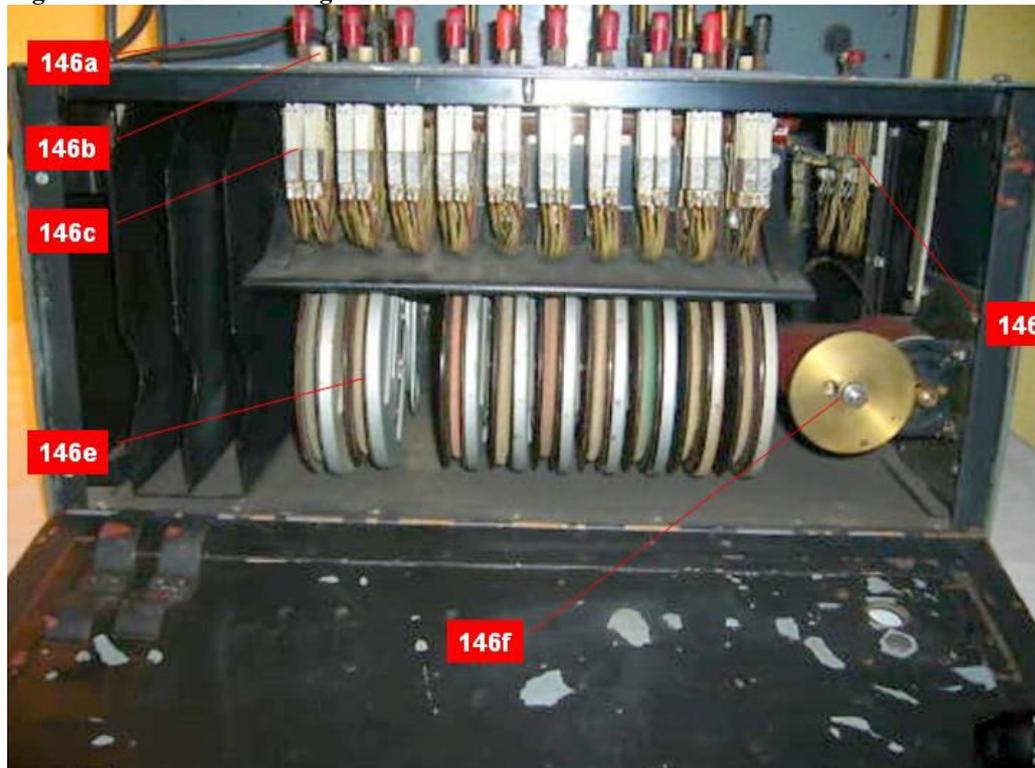
Construction

Figure 145: Klappenschrank zu 20 Leitungen



- | | | |
|------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------|
| 145a Upper 10 lines with signal flaps and interconnection plug sockets | 145d Alarm bell battery compartment | 145h Interconnection cable jacks |
| 145b Lower 10 lines with signal flaps and interconnection plug sockets | 145e Handset | 145i Kellogg switches and call-back buttons |
| 145c Conference call sockets | 145f Signal indicator | 145j Generator crank |
| | 145g Switches for ring tone generation and parallel operation | |

Figure 146: 20 Line exchange internals



- | | | |
|--------------------------------|-------------------------------------------------------|----------------|
| 146a Kellogg switch | 146d Parallel operation and ring tone switch contacts | 146f Generator |
| 146b Call back button | 146e Spring loaded cable reels | |
| 146c Call back button contacts | | |

Figure 147: 20 Line exchange back connection panel



147a 30 pole sockets for remote connection of lines

147b 30 pole sockets for parallel operation

147c Direct line connection terminals

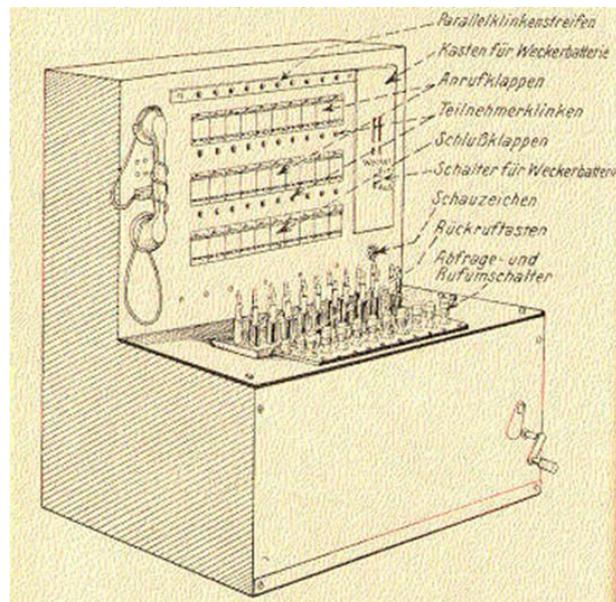


Figure 148: Handbook illustration

Operation

- Place the “*Klappenschrank zu 20 Leitungen*” on a suitable surface.
- Remove the front panel. Remove the back cover and connect the incoming field telephone lines.
- Unlock the signal flap locking bar and lock in the up position. Close any signal flaps that have dropped during this operation.
- Open the battery panel and connect the battery.
- If the enlargement panel is used, place this on top of the switchboard and connect the incoming lines to the connection terminals on the back.
- Set the alarm bell switch to the desired operation (“*Aus*” for silent operation). You are now ready to operate the switchboard.

When an incoming call is received, the signal flap of the incoming line will drop. At the same time, the alarm bell will ring (if switched on) or the alarm indicator with flash. Place the first red interconnection cable into the socket of the incoming line and place the Kellogg switch in the “*Abfr.*” position. Take the handset from the hook; you can now speak to the incoming caller (while depressing the microphone switch on the handset as usual). When the caller has given the outgoing line he wishes to speak to, place the first black interconnection cable into the socket of the outgoing line. Hold the Kellogg switch in the “*Rufen*” position and crank the generator handle. When the outgoing line answers, place the Kellogg switch in the neutral position and close the signal flap of the incoming line. The connection is now established and the switchboard is ready to take the next call. Up to 10 calls can be connected like this at the same time.



Figure 149: Klappenschrank zu 20 Leitungen in action

To end the call, one of the participants has to crank the generator handle, this will cause the signal flap of the relevant cable pair (bottom row of signal flaps) to fall. At the same time the alarm bell will ring or the alarm indicator will flash. Disconnect the interconnection cables from both the incoming and outgoing line and let them retract into the bottom panel. The interconnection is now ready for re-use.

The key difference with the switchboards described earlier in the chapter is that not every individual line has its own Kellogg switch or interconnection button. Before the operator can speak to an incoming line, one of the interconnection cables has to be plugged into the required socket. If all ten interconnection cable pairs are in use, it will not be possible to respond to an incoming call.

When the enlargement unit is placed on top, calls can be made to more lines and to external lines. The operation of the external line fields is identical to that of the “*Ambstzusatz*” described before.

Grosse Feldklappenschrank (1937)

Development and Description



Figure 150: Grosse Feldklappenschrank

The main modules of the “*Grosse Feldklappenschrank*” are:

- a) Collapsible metal table frame
- b) Base unit a (“*Untersatz a*”), containing the interconnection cable pairs and switches
- c) Base unit b (“*Untersatz b*”), forming a writing surface
- d) Line connection unit for 10 lines, containing 10 signal flaps and interconnection cable sockets
- e) Line connection unit for 50 lines, containing 50 signal flaps and interconnection cable sockets
- f) “Scribner” parallel connection unit for 40, 100 or 150 lines.
- g) Public network connection unit (“*Ambstszusatz*”), containing three public line connection field complete with dialling disks
- h) Conference call connection strips with 10 interconnection cable sockets

The units were interconnected with 30-pole plugs and cables. The outgoing telephone lines were not connected to the units directly, but a remote terminal block was used connected by a 30-pole cable interconnection cable.

The development of the large field switchboard goes back to 1916, when the imperial army introduced the “*Grosse Feldklappenschrank 16*”. Conceived as a modular system, the large field switchboard was not designed for a particular number of lines, but could be configured as required. The design was slightly updated in 1937, after which it was simply known as “*Grosse Feldklappenschrank*”. Units from the 1916 and 1937 versions remained interchangeable.



Figure 151: From top to bottom: Conference call unit, Amstszusatz, 2 x 10-line connection units, Base unit a

German Field Line Communication Equipment of WW2©



Figure 152: Doppelpolwechselschalter

A number of accessories could also be used such as an external alarm bell and the ring tone generator, usually containing two buzzer circuits (*Doppelpolwechselschalter*).

The modular construction of the large switchboard meant that it was easily transportable and highly flexible. A typical set up would consist of both base units placed side by side on the table frame. Three 10 line connection units and a conference call unit would be stacked on top of base unit a and

two 10 line connection units and the Public network connection unit would be stacked on top of base unit b. This would give the switchboard a total of 50 field telephone lines and 3 public network connections. If more field telephone lines were required, the three line connection units could be replaced with a single 50-line unit, in this way 70 field telephone lines could be serviced.

For larger switchboards, several switchboards could be placed next to each other and interconnected by using “Scribner” parallel connection units. For example, the units on the base unit b could be replaced with a 150 line parallel connection unit. In this way, a total of six complete 30 line switchboards could be linked together for a total of 180 lines. By sharing the “Scribner” connection units both left and right of each operating station and using 50 line connection units, a total of 7 complete 50 line switchboards could be linked into a single 350 line switchboard.

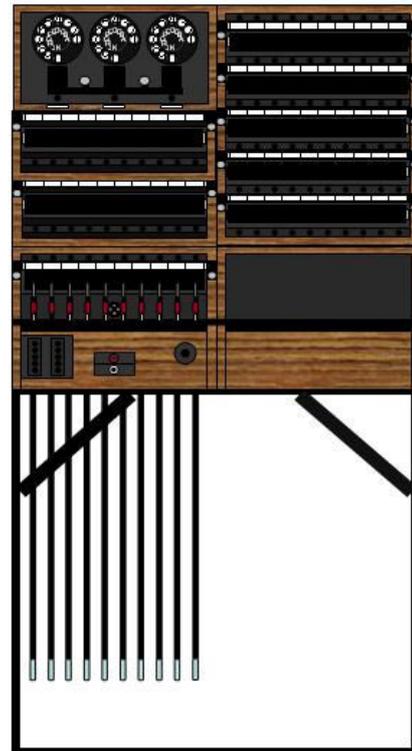


Figure 153: Configuration with 70 lines + 3 public network connections



Figure 154: Large exchange (200 lines + 12 public connections) using 50-line units and 150-line Scribner units

German Field Line Communication Equipment of WW2©

For larger switchboards, an “*Überwachungsschrank*” or monitoring panel could be added, allowing a supervisor to monitor the operation and perform fault finding.

The metal frame has a height of 72.5 cm, the height of the base units are 11.5 cm to the line panel and 23.5 cm total height. The “working surface” is therefore a comfortable 84 cm off the ground.

The module standard width and depth are 32 x 18 cm while the standard line connection unit for 10 lines is 11 cm high. The *Ambstzusatz* unit is 17 cm high while the conference call connection unit is only 6 cm high. The height of the 50-line unit and the 100-line “Scribner” unit is 39 cm. By combining the units, stacks of the same height can be constructed. For example 3 x 10-line units plus a conference call unit or 2 x 10-line unit plus the *Amtszusatz*. The total height of the switchboard including the frame is typically 135 cm.



Figure 155: (r) Supervisor base unit and measuring unit on top

Most units have an alignment ridge on the bottom and a corresponding slot on the top of the unit. Each stack of units could be fixed together with a locking pin running top to bottom through all units. The conference call unit is clearly designed to be the top unit, as the top lid has to be opened to gain access to the locking pin holes.

The “*Grosse Feldklappenschrank*” uses a two-cord interconnection system. A total of ten interconnection cord pairs are provided in base unit a. When not in use, the interconnection cords are suspended under the base unit, weighed down by cable weights. Ten Kellogg switches are connected to the interconnection cords; this means that the operator can only speak to an incoming line once one of the interconnection cords is plugged into the relevant field. To avoid confusion, the cable pairs are alternatively coloured white, green and red.



Figure 156: Base unit a connection panel (see table for explanation)

The lid of the bottom section of the base units can be lifted, giving access to various connection strips. Accessories like external batteries, alarm bells, buzzer unit are connected to these strips in the base unit.

WU	Wecker Untersatz	Connects to the stacking pin contacts in both base units and to the external alarm bell.
W	Wecker	
WB+	Wecker Batterie +	Connects the alarm bell battery
WB-	Wecker Batterie -	
KB+	Kontroll Batterie +	Connects control battery
KB-	Kontroll Batterie -	
MB+	Mikrofon Batterie +	Connects the microphone battery
MB-	Mikrofon Batterie -	
PB1+ PB2+	Polwechselschalter Batterie 1&2 +	Connects the ringtone generator batteries
PB1- B1	Polwechsel Batterie 1 – Batterie 1	
PB2- B2	Polwechsel Batterie 2 – Batterie 2	
RT	Ruf Taste	Connects to the activation contact of the ringtone generator
S1	Signal 1	Ringtone signals for the ringtone generator
S2	Signal 2	
Ü a	Überwachung a	Connects to the monitoring panel.
Ü b	Überwachung b	
ÜS a	Überwachungs Schrank a	
ÜS b	Überwachungs Schrank b	
ÜS c	Überwachungs Schrank c	
E	Erde	

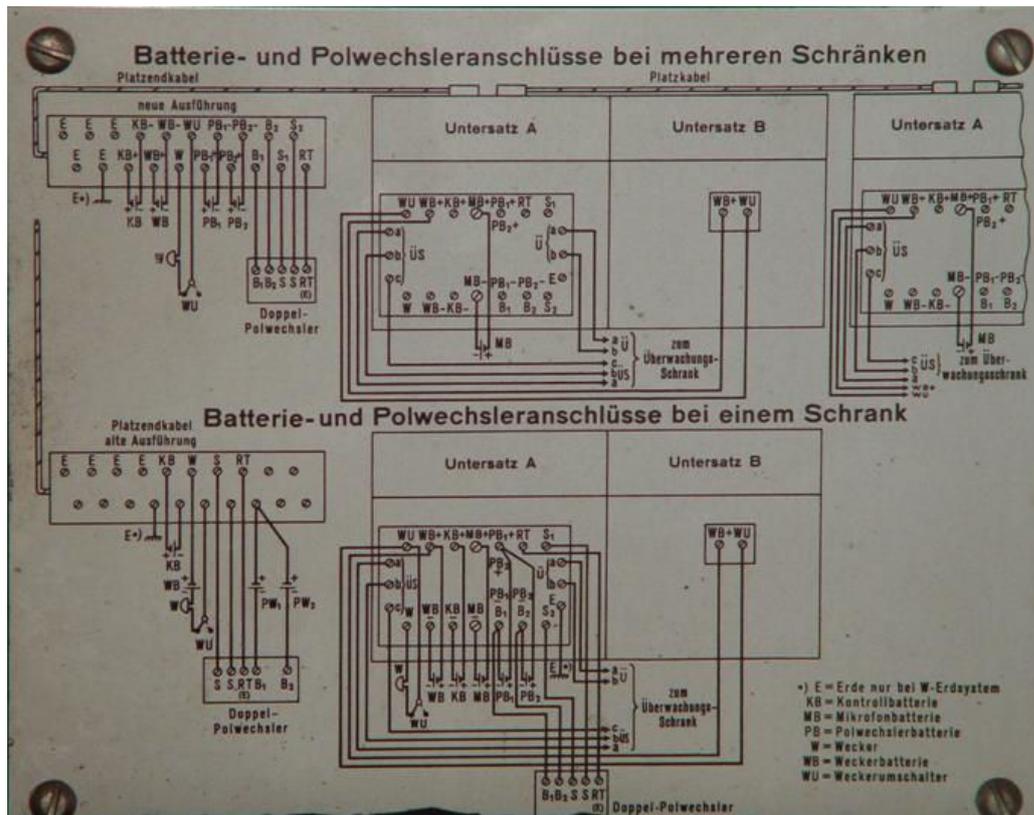
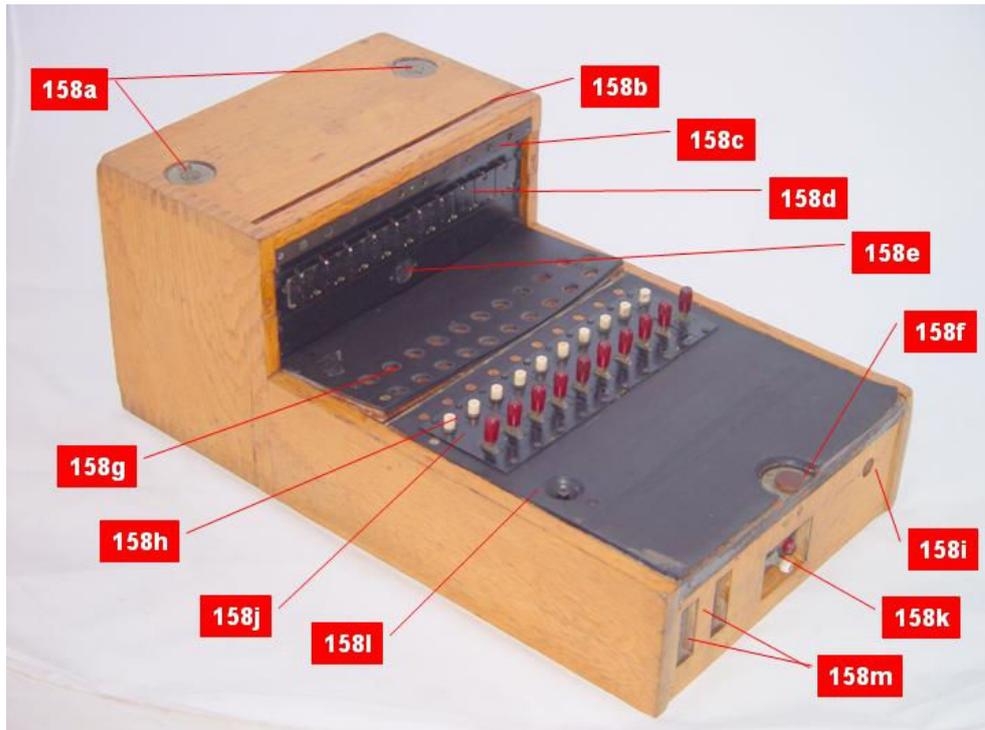


Figure 157: Connections for single or multiple switchboards.

Two five-pin plugs on the front of base unit a allow connection of handset and/or headset. Typically a busy switchboard would require the use of a headset and breast microphone, keeping the hands of the operator free. The base unit b surface could be used as a writing surface to keep logs.

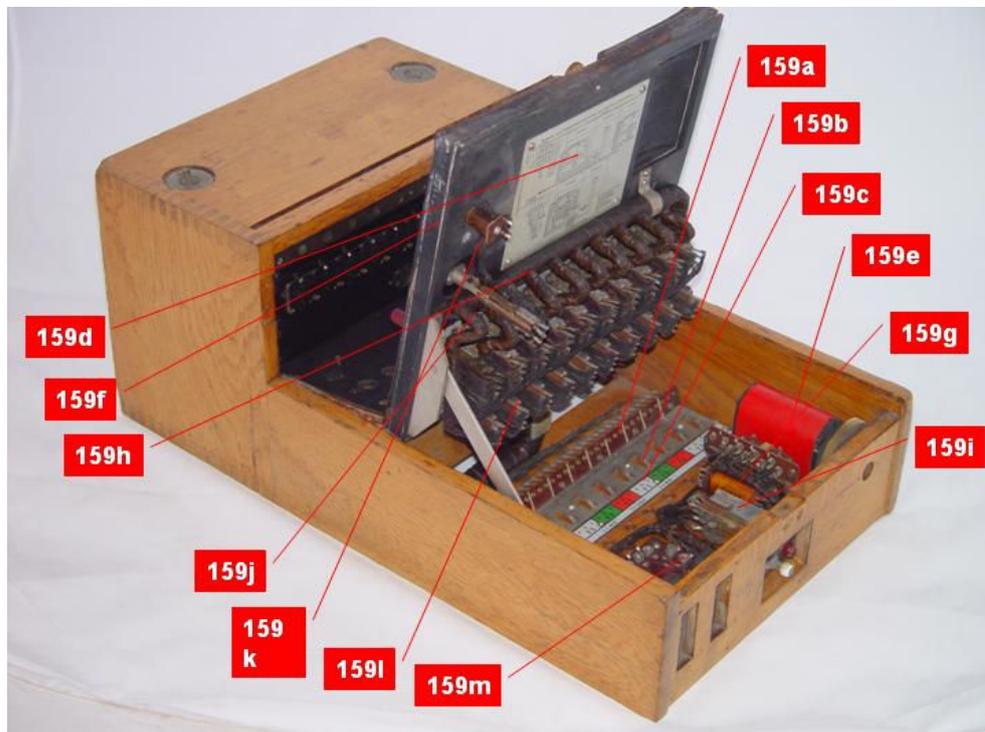
Construction

Figure 158: Base unit a overview



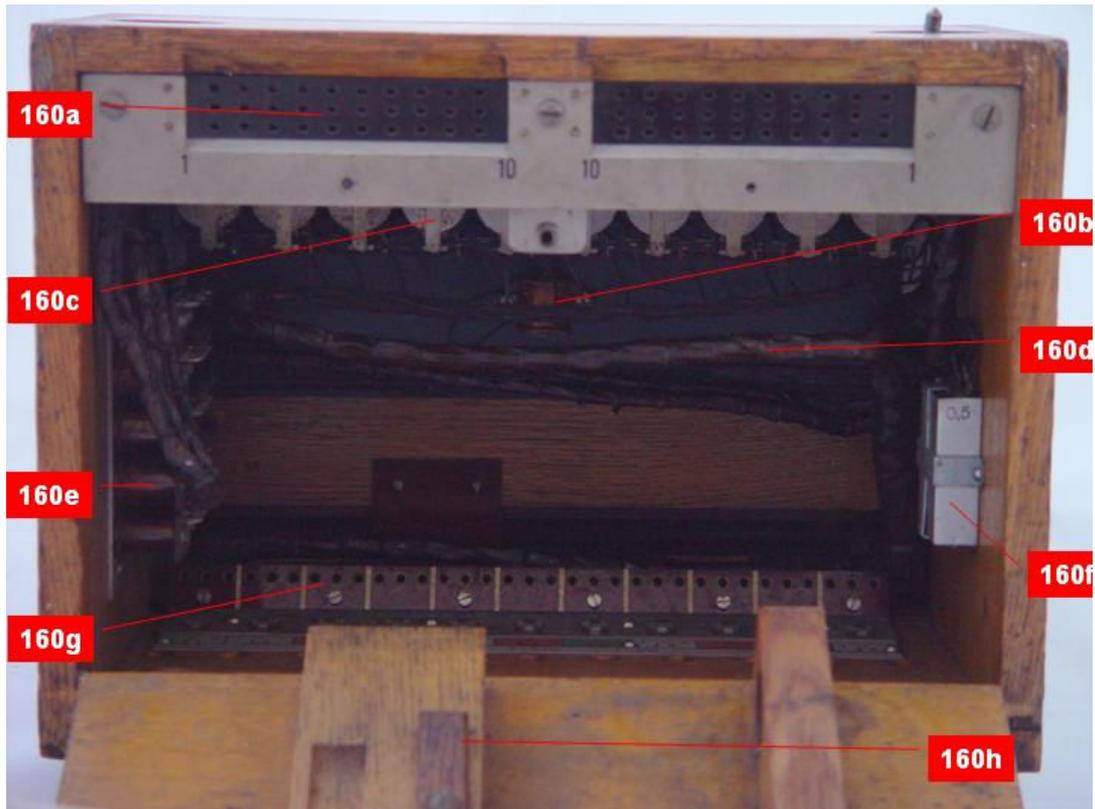
- | | | |
|-----------------------------------|------------------------------------------|-----------------------------------------------------------|
| 158a Stacking pin sockets | 158g Passages for interconnection cables | 158k External alarm bell and parallel connection switches |
| 158b Alignment groove | 158h Callback buttons | 158l End pulse button |
| 158c Monitoring plug sockets | 158i Generator crank hole | 158m Sockets for hand- or headsets |
| 158d Signal flaps for cable pairs | 158j Kellogg switches | |
| 158e Alarm indicator | | |
| 158f Locking screw | | |

Figure 159: Base unit a front compartment



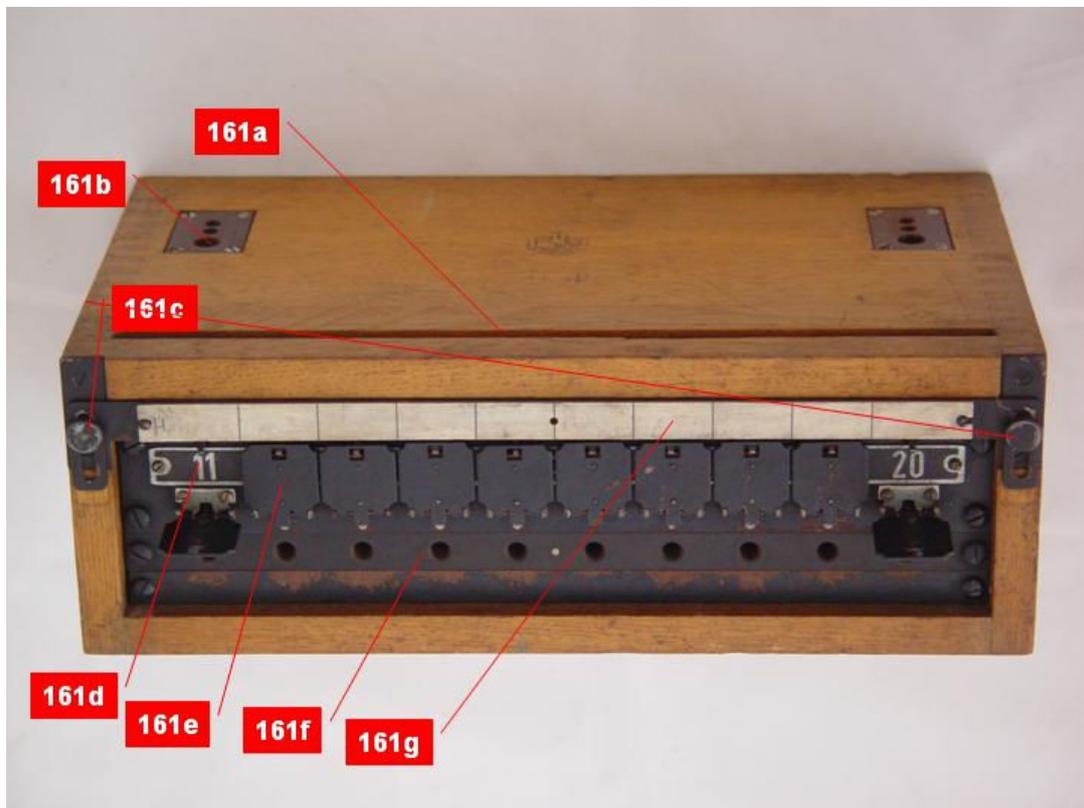
- | | | |
|---------------------------------------------------|--------------------------------|-------------------------------|
| 159a Front interconnection cable connection strip | 159d Schematic | 159i Front switch contacts |
| 159b Hooks for interconnection cables | 159e Ringtone generator | 159j Wiring loom |
| 159c Connection instructions | 159f End pulse coil | 159k Kellogg switch contacts |
| | 159g Microphone coil | 159l Callback button contacts |
| | 159h End pulse switch contacts | 159m Connection panel |

Figure 160: Base unit a back compartment



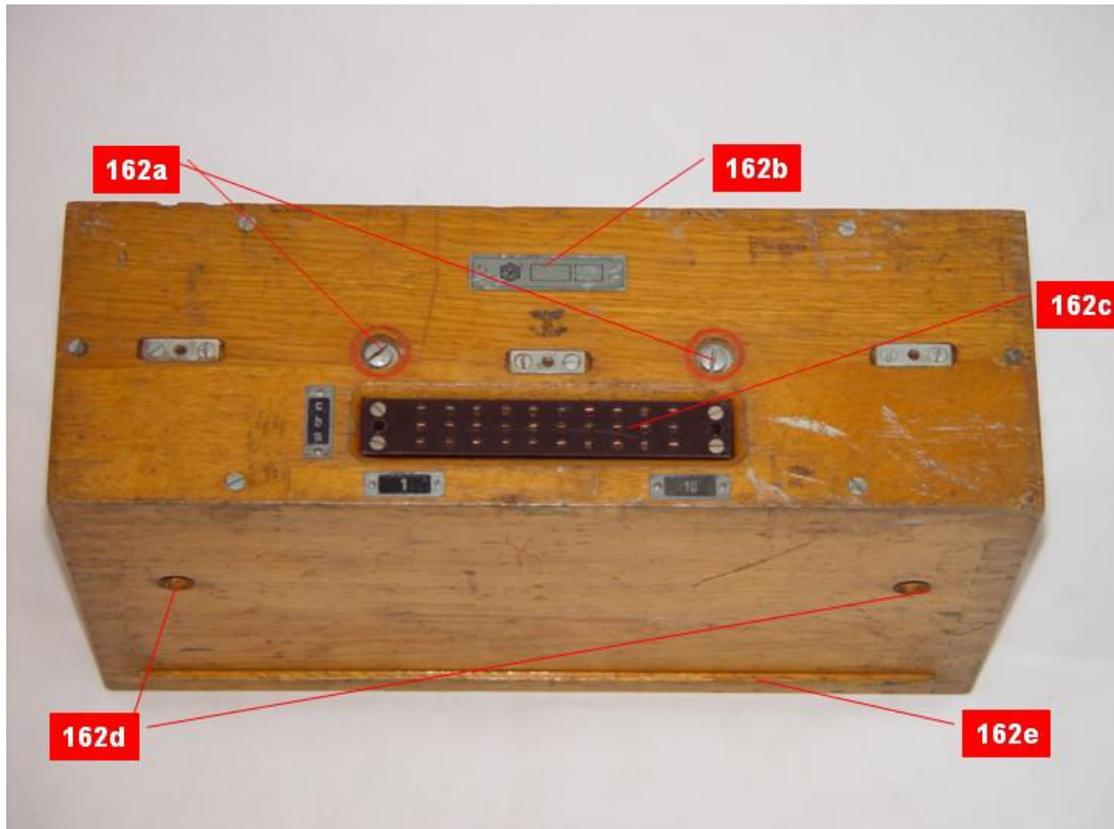
- | | | |
|-------------------------------------|------------------------------------|--------------------------------------------------|
| 160a 30-pole interconnection socket | 160c Signal relays for cable pairs | 160f Capacitor block |
| 160b Alarm indicator coil | 160d Wiring loom | 160g Rear interconnection cable connection strip |
| | 160e Coils | 160h Tool storage |

Figure 161: 10 line connection unit front view



- | | | |
|-----------------------------------------|-----------------------------------|-----------------------------------|
| 161a Alignment groove | 161d Line Number strip | 161g Locking bar with writing tab |
| 161b Holes an contacts for stacking pin | 161e Signal flap | |
| 161c Locking bar screws | 161f Interconnection cable socket | |

Figure 162: 10 line connection unit back view

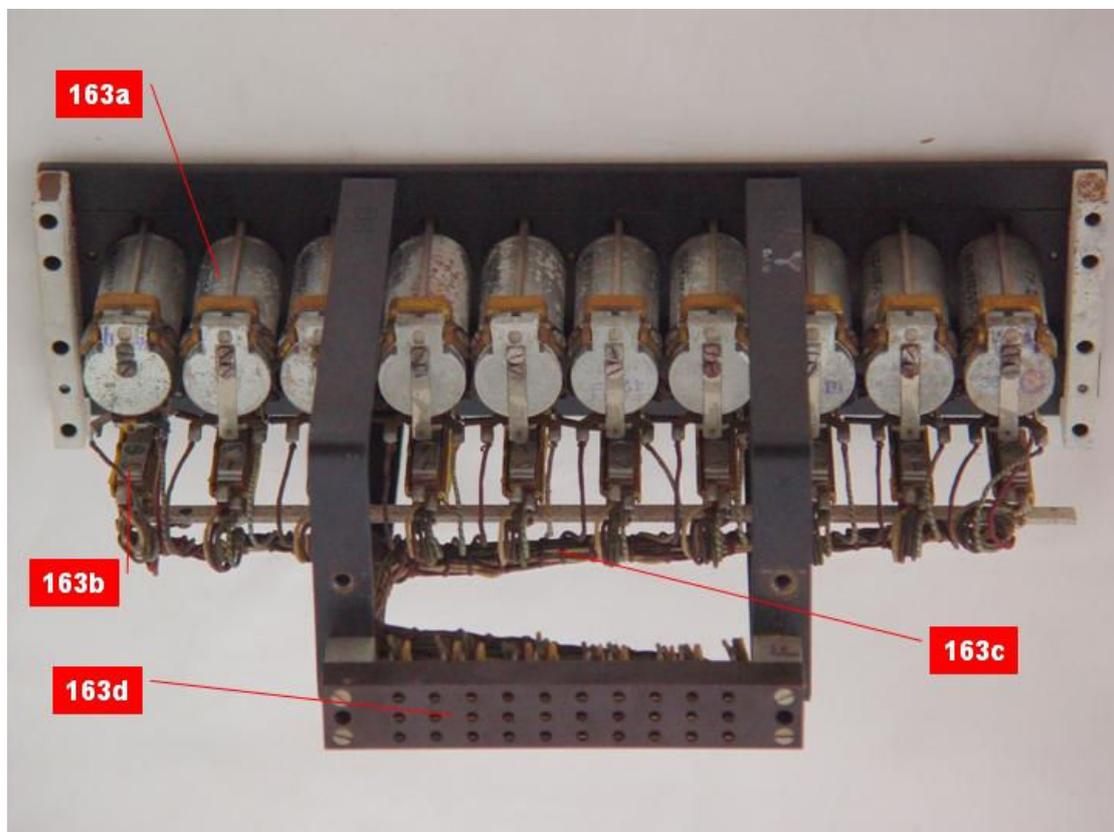


162a Housing locking screws
162b Maker/date tag

162c 30-pole interconnection
socket

162d Holes for stacking pins
162e alignment ridge

Figure 163: 10 line connection unit internal view



163a Signal relay

163b Interconnection cable
socket contacts

163c Wiring loom
163d 30-pole connection socket

Figure 164: Conference call unit front view



164a Top lid locking screws

164b Interconnection cable sockets

Figure 165: Conference call unit internals

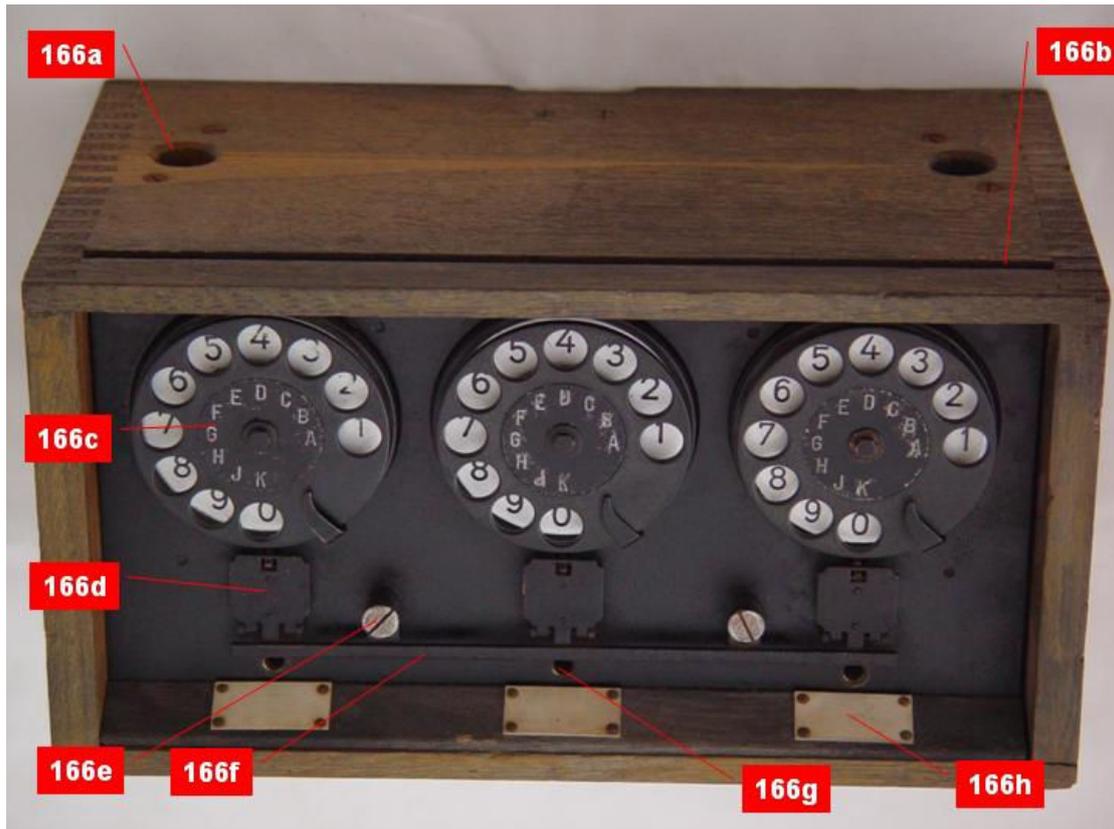


165a Hole for stacking pin

165b Interconnection cable socket contacts

165c Interconnection cable socket

Figure 166: Amtszusatz front view



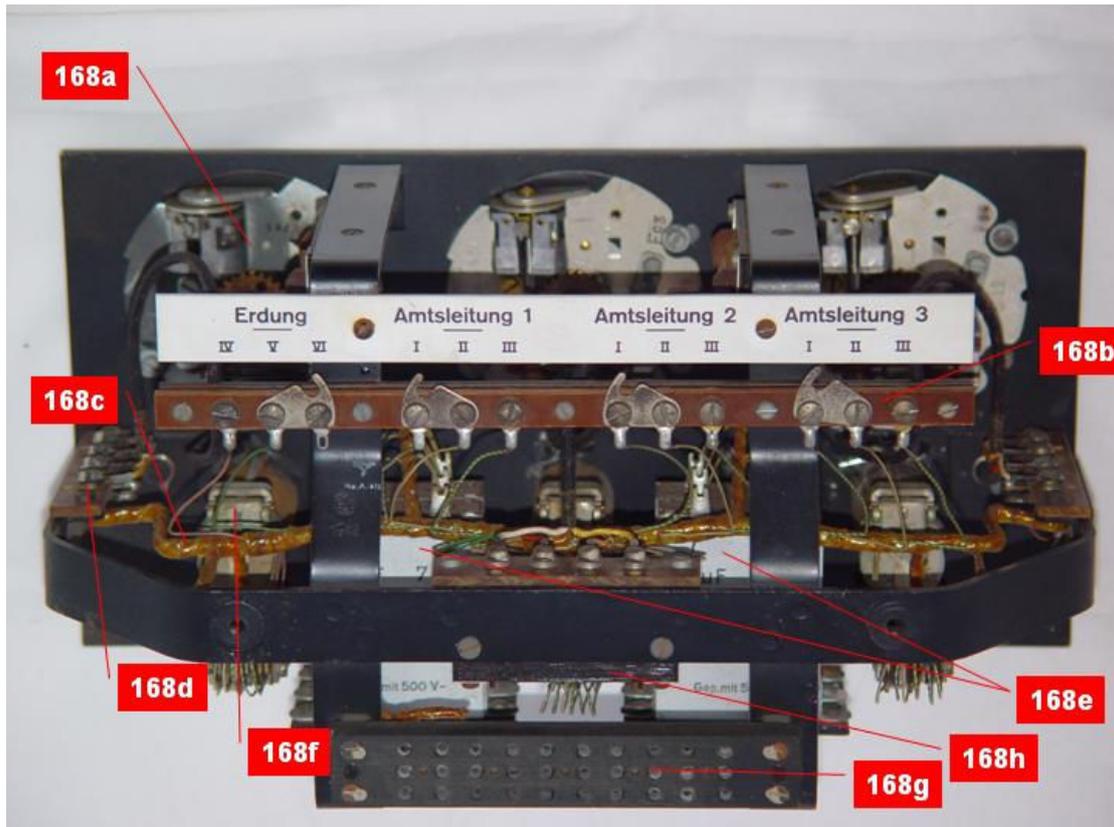
- | | | |
|-------------------------|------------------------|------------------------------|
| 166a Stacking pin holes | 166d Signal flap | 166g Connection cable socket |
| 166b Alignment groove | 166e Locking bar screw | 166h Writing tab |
| 166c Dialling disk | 166f Locking bar | |

Figure 167: Amtszusatz rear view



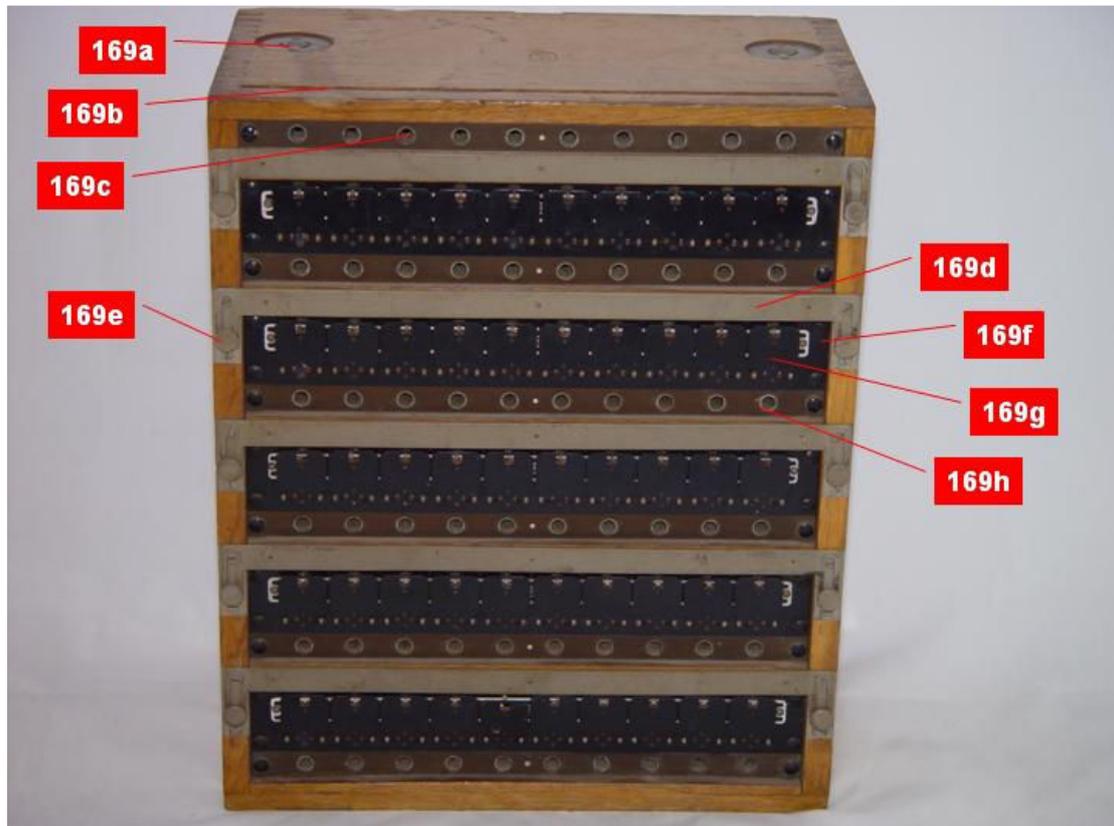
- | | | |
|-----------------------|----------------------------------|--------------------------|
| 167a Earth jumper | 167c Public network type jumper | 167e 30-pole plug socket |
| 167b Jumper numbering | 167d Jumper setting instructions | 167f Schematic |

Figure 168: Amtszusatz internal view



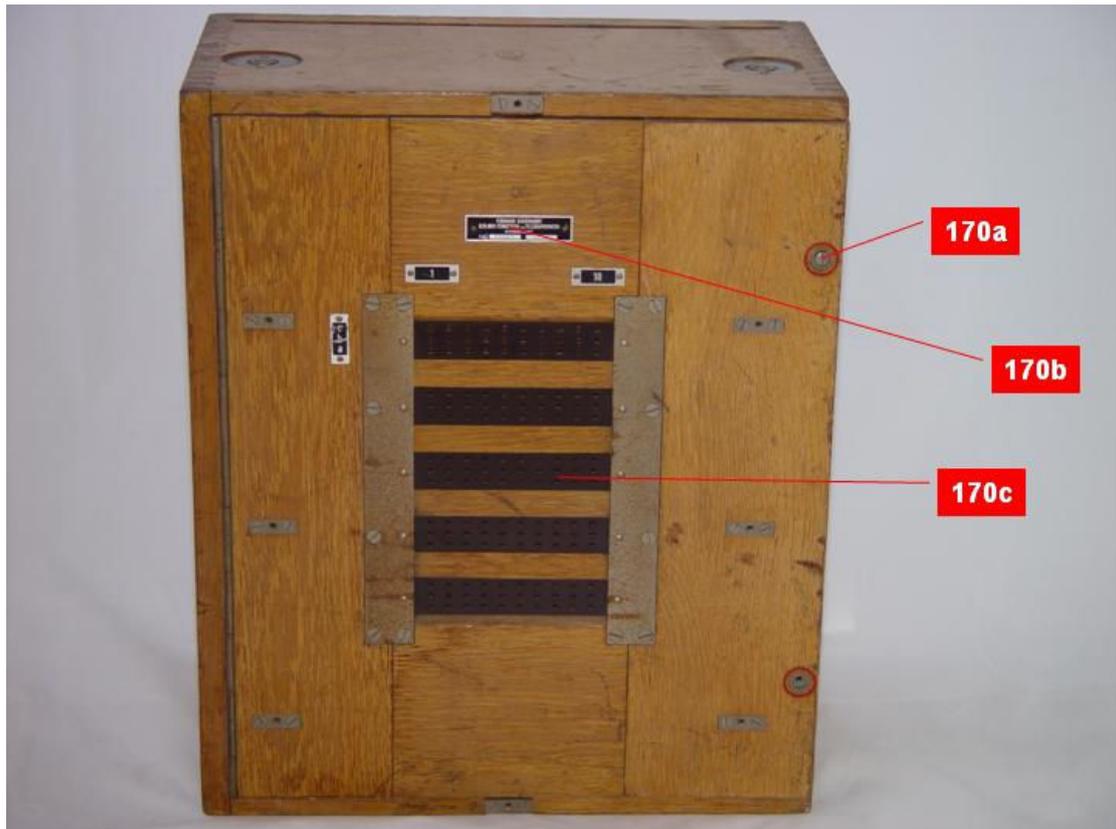
- | | | | | | |
|------|--------------------|------|-------------------------|------|---------------------------|
| 168a | Dialling mechanism | 168d | Dialling disk connector | 168g | 30-pole connection socket |
| 168b | Jumper strip | 168e | Capacitor blocks | 168h | End pulse self induction |
| 168c | Wiring loom | 168f | Signal relay | | |

Figure 169: 50 line interconnection unit front view



- | | | | | | |
|------|-------------------------|------|--------------------|------|------------------------------|
| 169a | Stacking pin connector | 169d | Locking bar | 169g | Signal flap |
| 169b | Alignment groove | 169e | Locking bar screws | 169h | Interconnection cable socket |
| 169c | Conference call sockets | 169f | Numbering strip | | |

Figure 170: 50 line interconnection unit rear view

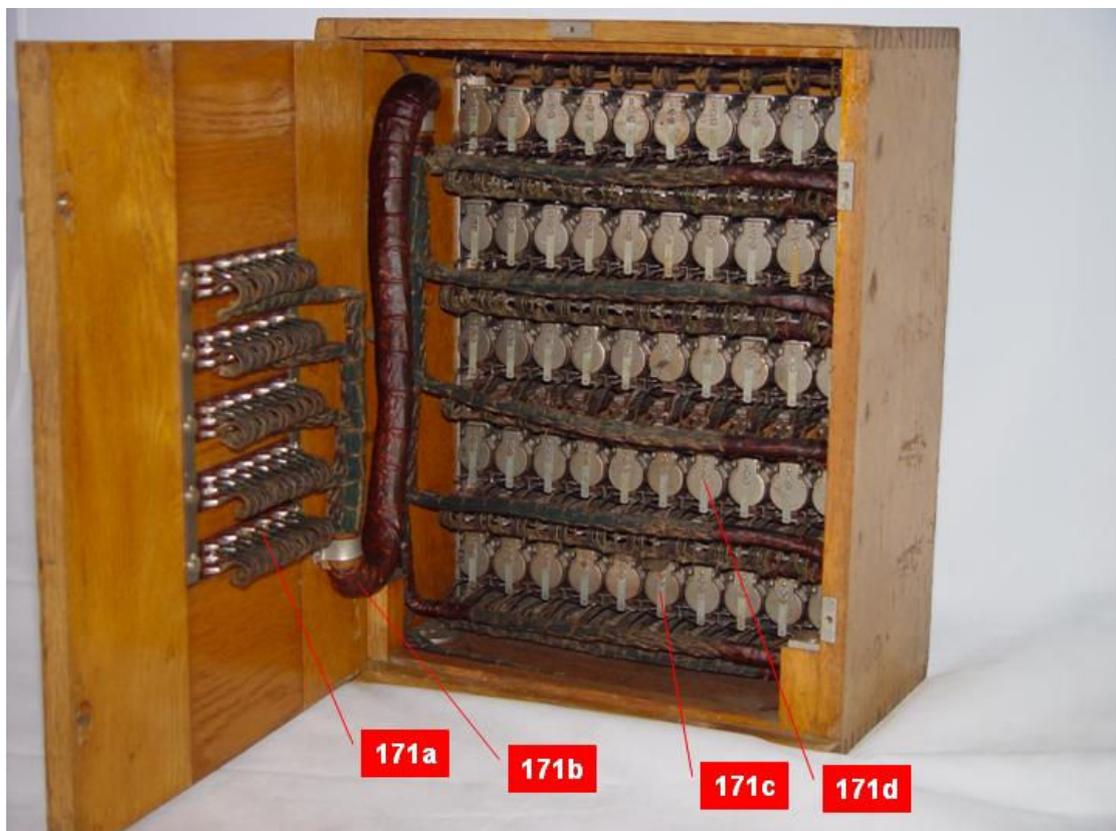


170a Rear panel locking screw

170b Maker/date tag

170c 30-pole socket

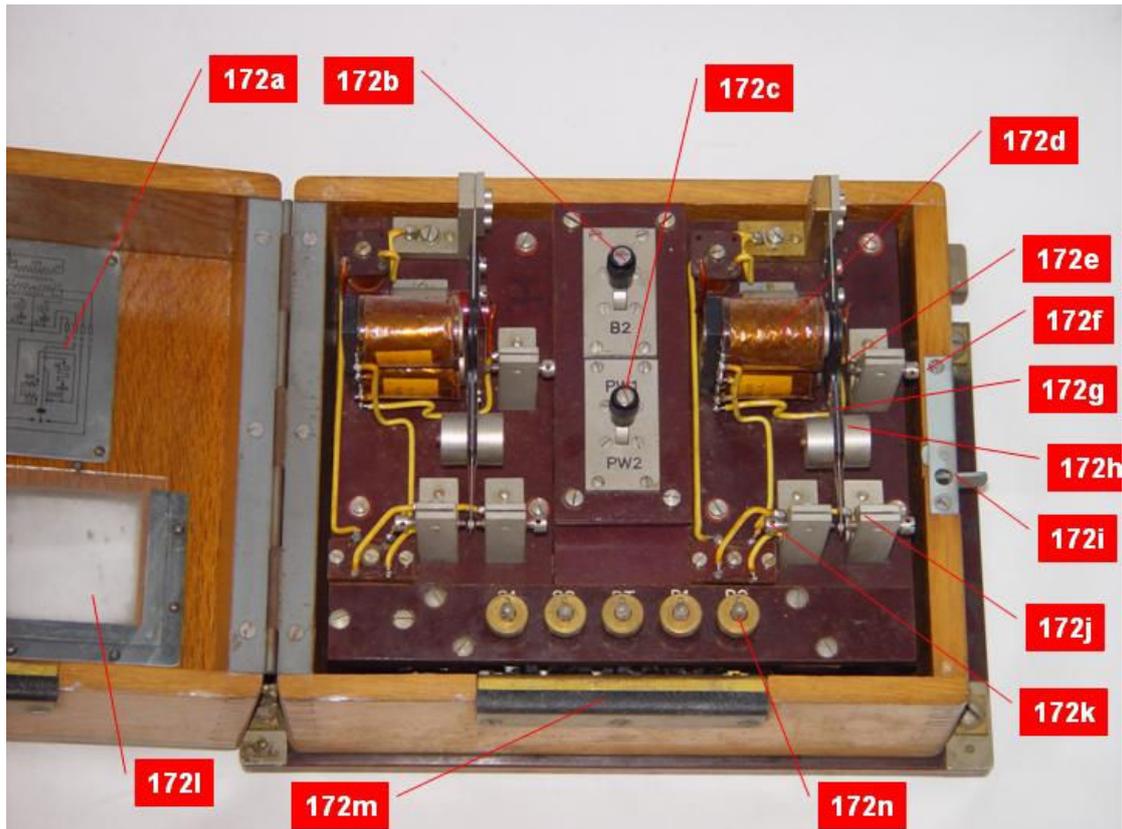
Figure 171: 50 line interconnection unit internal view



171a 30-pole connections
171b Wiring loom
171d Signal relay

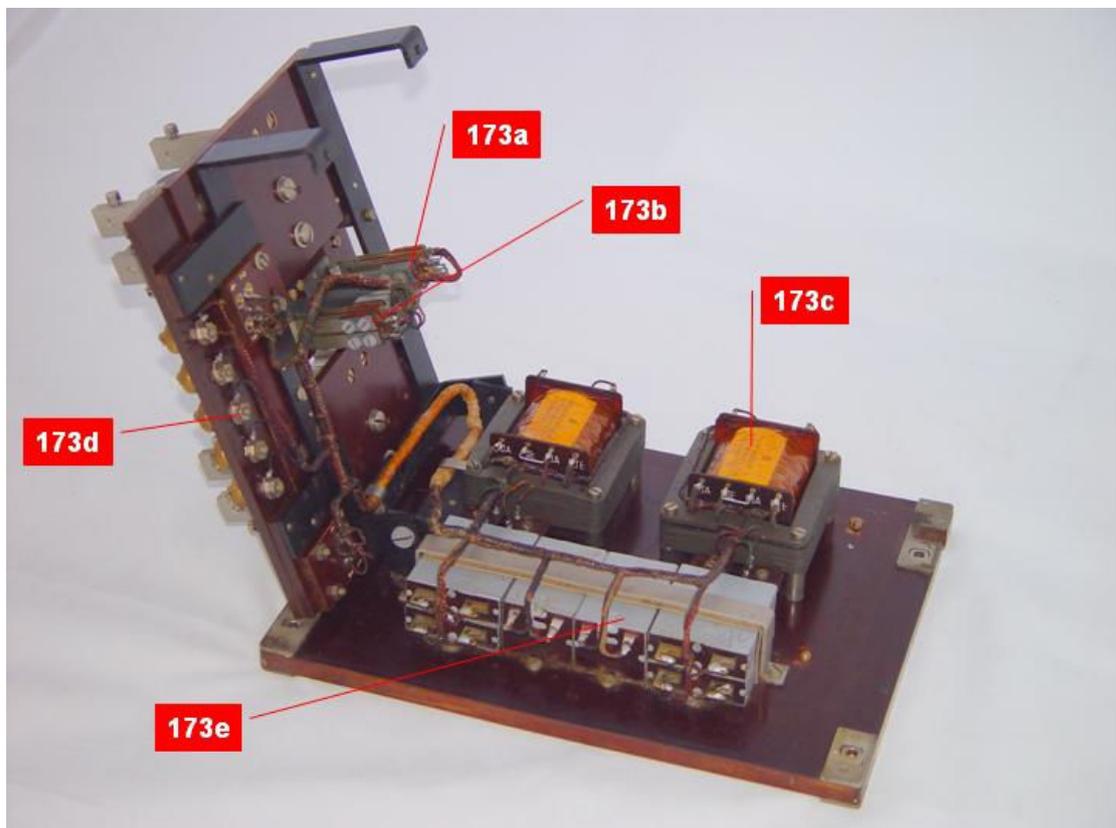
171c Interconnection socket contacts

Figure 172: Doppelpolwechschler top view



- | | | |
|---------------------------------|-----------------------------------|--------------------------------|
| 172a Schematic | 172f Generator contact adjustment | 172j Generator output contact |
| 172b Battery selection switch | 172g Swing arm | 172k Output contact adjustment |
| 172c Generator selection switch | 172h Swing arm weight | 172l Window |
| 172d Generator coil | 172i Casing lock | 172m Rubber cable transit |
| 172e Generator contact | | 172n External connections |

Figure 173 Doppelpolwechschler internal view



- | | | |
|----------------------------------|---------------------------|-----------------------|
| 173a Battery selector contacts | 173c Output transformers | 173e Capacitor blocks |
| 173b Generator selector contacts | 173d External connections | |

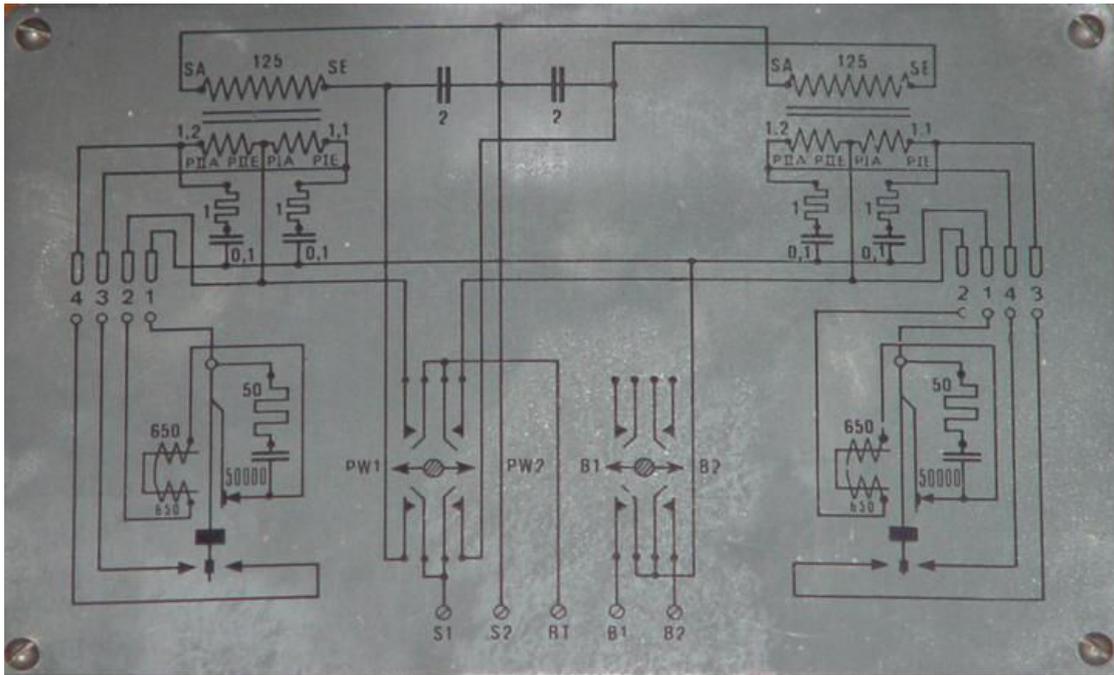


Figure 174: Doppelpolwechselschalter schematic

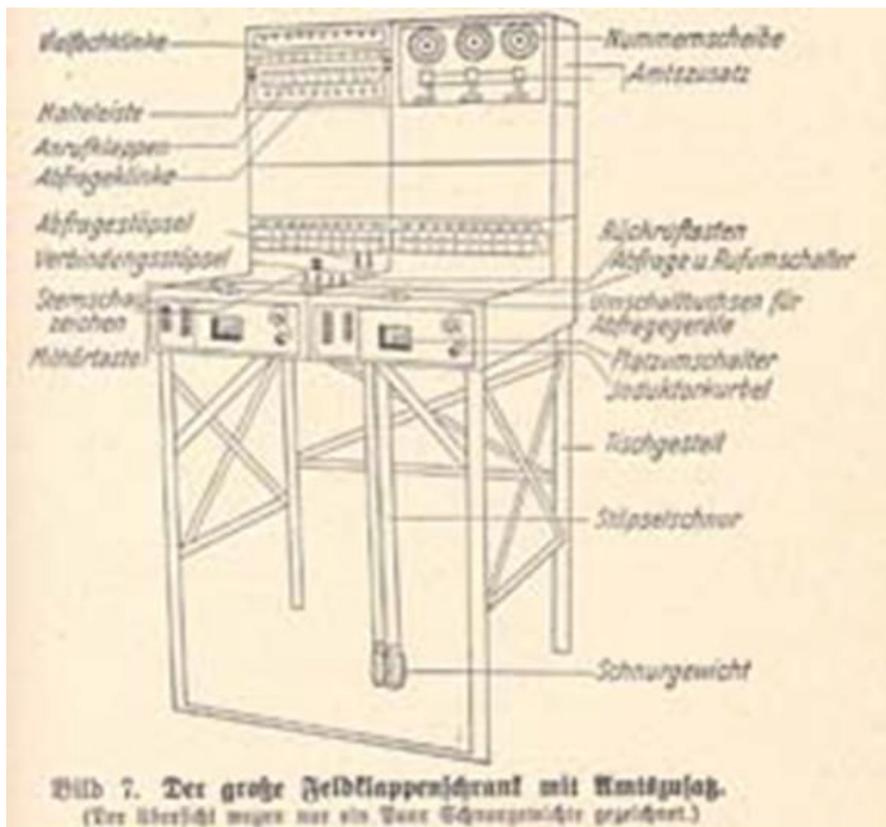


Figure 175: Grosse Feldklappenschrank description from instruction booklet

Operation

The *Grosse Feldklappenschrank* could be used in many configurations; in this section a single 50-line set-up is assumed. This setup consists of:

- a. Table frame
- b. Base unit a
- c. 10 interconnection cable pairs
- d. Cable weights
- e. Base unit b
- f. 10-line unit 1-10
- g. 10-line unit 11-20
- h. 10-line unit 21-30
- i. 10-line unit 31-40
- j. 10-line unit 41-50
- k. Conference call unit
- l. 3-line *Amtszusatz*
- m. *Doppelpolwechselfschalter*
- n. External Alarm Bell
- o. Line connection units
- p. 30-pole interconnection cables
- q. Stacking pins
- r. Battery

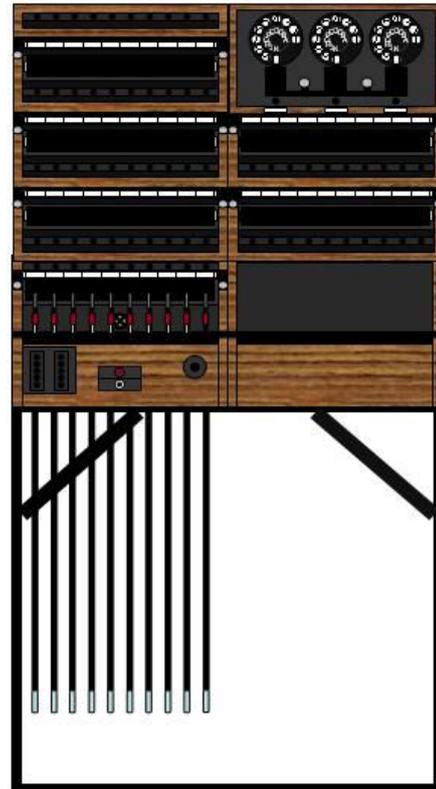


Figure 176: Feldklappenschrank 50 line configuration

To set up the *Grosse Feldklappenschrank*:

- Erect the table frame, ensure all locking screws are tight
- Place base unit a on the left of the table frame
- Place base unit b on the right on the table frame.
- Connect the interconnection cables to base unit a, each cable held taught by a cable weight. Ensure that the cables are not crossed in any way and run freely.
- Connect the Alarm bell contacts in base unit b to the connection panel in base unit a.
- Connect the microphone battery and the battery for the *Polwechselfschalter* to the connection panel in base unit a.
- Connect the *Doppelpolwechselfschalter* and the external alarm bell to the connection panel in base unit a.
- Set both control switches on the front panel to the central position.
- Stack the 10-line units 1-10, 11-20, 21-30 and the conference call unit on top of base unit a.
- Open the lid of the conference call unit and place the stacking pins through the units and screw them tight onto the base unit a.
- Stack the 10-line units 31-40, 41-50 and the 3-line *Amtszusatz* on top of base unit b.
- Place the stacking pins through the units and screw them tight onto base unit b.
- Place the five line connection units at the place where you want to collect the incoming field lines (usually outside the building or shelter where the switchboard is placed).

German Field Line Communication Equipment of WW2©

- Connect the line connection units to their respective line units using the 30-pole cables.
- Connect the incoming field lines to the line connection units.
- Connect up to three public telephone lines to the *Amtszusatz*.
- Plug in the operator headset and connect the generator crank handle to the generator.
- Unlock all the signal flaps by moving the locking bars and mark up line information on the writing strips and tabs. Close any flaps that fall during this operation. You are now ready to operate the *Grosse Feldklappenschrank*.

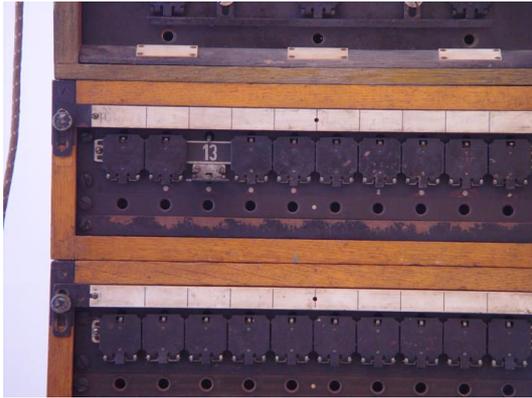


Figure 178: Signal flap indicating incoming call

Move the Kellogg switch backwards in the “*Abfragen*” position. Now the operator can speak to the incoming line. When the caller has indicated which outgoing line is required, place the first front interconnection cable into the outgoing field and move the Kellogg switch forward to the “*Rufen*” position.

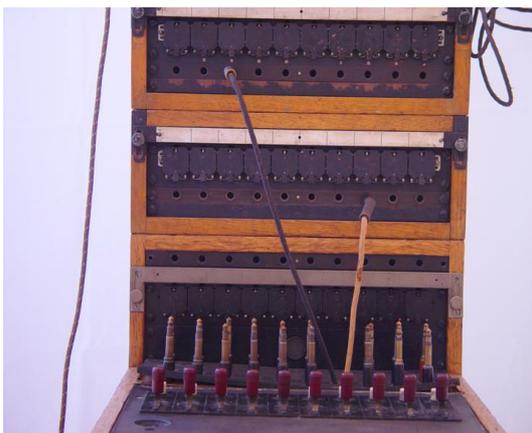


Figure 179: Incoming and outgoing lines connected

When an incoming call is received, the signal flap of the relevant line will drop. At the same time the alarm indicator on the front panel will flash and the external alarm bell will ring. Place the first rear interconnection cable into the incoming field; this will automatically reset the signal flap to the closed position.

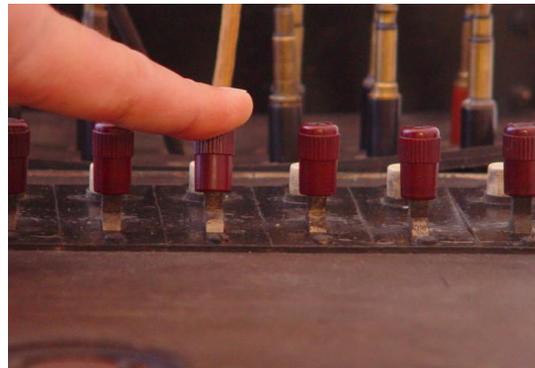


Figure 177: Operating the Kellogg switch to speak to the incoming caller and to ring the requested line

This will activate the “*Doppelpolwechschalter*” and will cause the alarm bell to ring at the outgoing line. When the outgoing line answers, place the Kellogg switch in the middle position, the incoming and outgoing lines are now connected.

If the incoming line has to be called back, this can be done by pushing the white button behind the Kellogg switch. This will activate the *Doppelpolwechschalter* and the alarm bell will ring of the phone of the incoming line.

German Field Line Communication Equipment of WW2©

Up to ten connections can be made simultaneously this way. If several callers have to connect to the same call, one of two conference socket strips can be used, one in the base unit a and one at the top of the left stack. In this way two separate conference calls can be made simultaneously.

If a connection to a public line has to be made, call the required number on one of the three dialling disks and place the interconnection cable into the corresponding socket of the *Amtsanschluss*. The end-pulse is automatically generated when the interconnection plug is pulled from the socket.



Figure 180: Calling an outside line

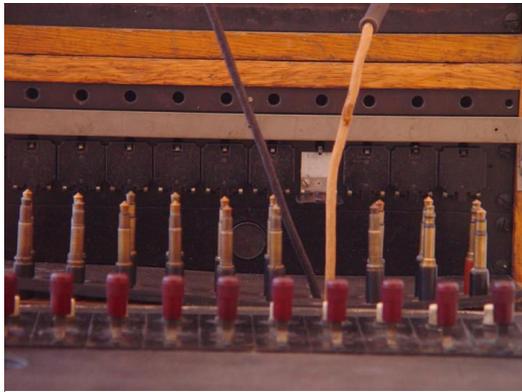


Figure 181: Connection indicator flap indicates that the call has ended and that the cable pair can be removed

At the end of the call, one of the participants has to crank the generator of his field telephone. This will cause the signal flap of the occupied interconnection cable pair to drop (the field behind the signal flap as well as the corresponding cable pair are coloured white, green or red for easy identification). At the same time the alarm indicator will flash and the external alarm bell will ring. Remove the interconnection cables and reset the signal flaps. The cable pair is now available for the next connection.

After prolonged use, the battery polarity of the “*Polwechschalter*” should be reversed (this will undo some of the wear on the contacts). This can be done by changing the switch in the “*Doppelpolwechschalter*” from “B1” to “B2” or vice versa. If the generator is starting to falter, change over to the second “*Polwechschalter*” in the unit by moving the switch from “PW1” to “PW2” or vice versa. Adjust the contacts of the failing generator if required. If both generator circuits fail, the generator can be used for manually generating the alarm signal. The red control switch on the front of base unit a has to be flicked to the right to operate the generator. The Kellogg switch has to be pushed forward while cranking the generator