Collins Classics

KWM-2, 30L-1 and 51S-1
History, Engineering, and Restoration

Giovanni Becattini

References

The following references are used in this book:

- [TEO] Tektronix Epic Oscilloscopes – Elektor Books
- [7KS] Tektronix 7000 Series – Elektor Books
- [TREG] Tektronix Oscilloscopes Restoration Guide – Elektor Books
- [TGHP] The Great Hewlett-Packard – Quacktech
- [VRE] Vintage Radio Equipment – Elektor Book
- [MAC] Apple Macintosh – History, Engineering, and Restoration – Elektor Books
- [QT602] The Good Giant – Tektronix DSA 602A Oscilloscope – Quacktech
- [QT11KP] The Last Plug-ins – Tektronix 11000-Series Plug-ins – Quacktech
- [SCLI] Strumentazione Vintage – Edizioni C&C
- [QTCOL] Collins Classics – KWM-2, 30L-1 and 51S-1: History, Engineering, and Restoration – Quacktech Editions
- [QT324] Two Giants and a Shorty – Tektronix 323/324 - Quacktech
- [QTBYOP] Become Your Own Publisher – Quacktech
- [QTHPSS] Hewlett-Packard Signal Sources – Quacktech

Table of Content

Table of Content (cont'd)

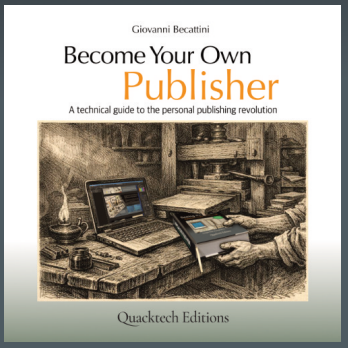
Quacktech Editions
Technical Art Books
www.quackteck.it

Become Your Own Publisher

A technical guide to the personal publishing revolution

History, Technology, and Restoration

Today, a deep transformation is quietly taking place in the publishing world. Print-on-demand services, combined with mature and widely available desktop publishing tools, are driving what can rightly be called a personal publishing revolution.



These technologies make it possible for a single person to become author, designer, and publisher of their own books—even when those books are technically complex, image-heavy, and graphically demanding.

This book tells the story of how I followed this path, leading to the creation of Quacktech Editions, and distills the practical experience gained along the way. It is intended for anyone considering a similar journey, where writing a book also means taking responsibility for its entire path from idea to printed object.

Giovanni Becattini, *Become Your Own Publisher – A technical guide to the personal publishing revolution*, Quacktech Editions (www.quacktech.it), Italy, 2026, paperback, 202 pp. Available in English and Italian.


KWM-2
EXCITER TUNING
P. A. TUNING
MIC GAIN
A. F. GAIN
R. F. GAIN
BAND
EMISSION
PLATE
GRID
PHONES

In the Spirit of Collins

Few companies have influenced the evolution of radio communications as profoundly as the Collins Radio Company and its founder, Arthur A. Collins. It has often been said that, while Guglielmo Marconi is credited with inventing radio, Collins made it truly practical—and commercially viable.

More than an engineer, Collins was a visionary whose work shaped both technology and history. His radios, avionics, and communication systems were never merely products; they embodied a philosophy of engineering excellence that set new standards for reliability, precision, and performance.

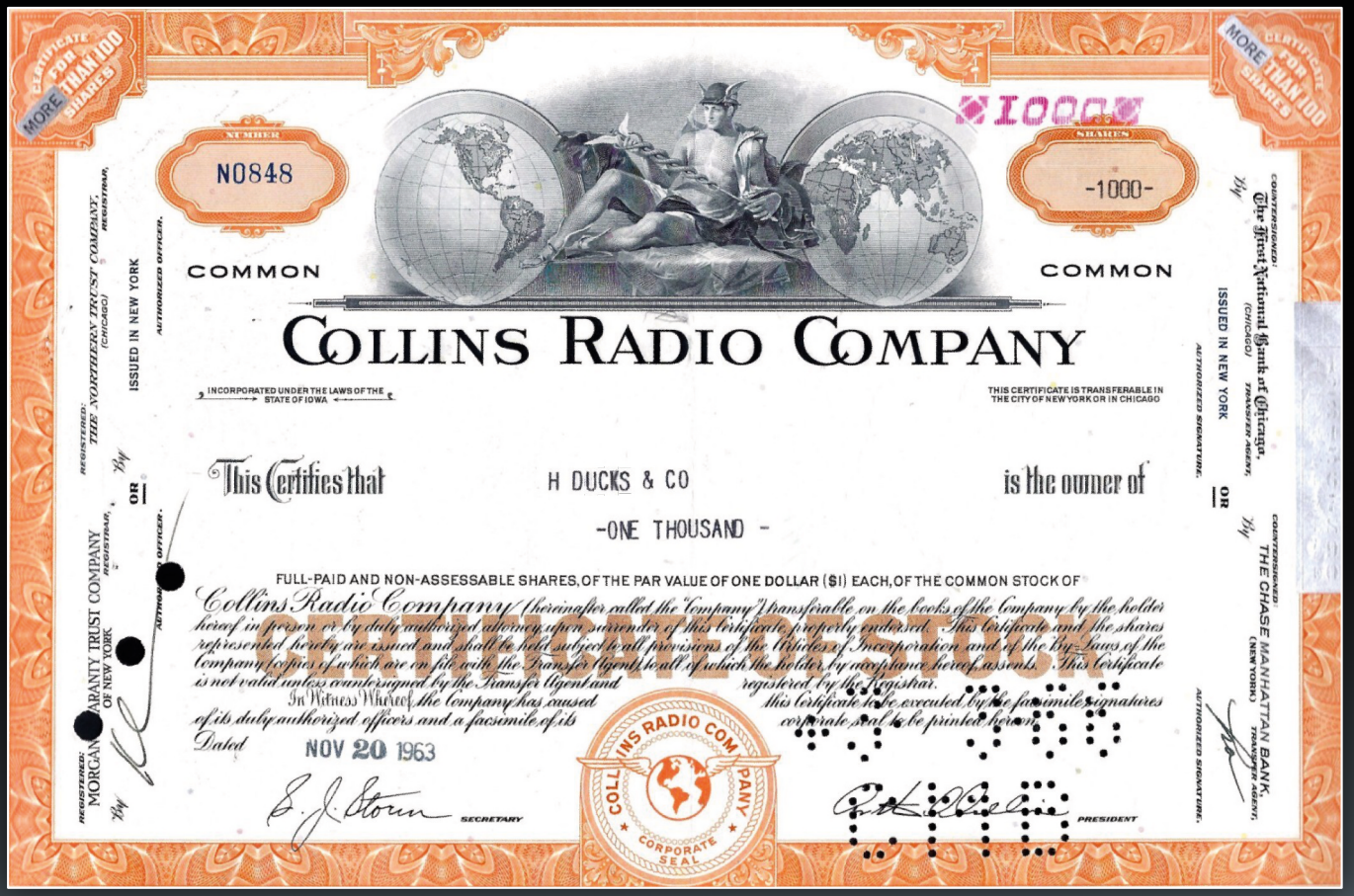
In this book, we offer a concise introduction to Collins and to some of its most emblematic instruments. Rather than attempting a comprehensive historical survey, we explore this legacy through concrete examples: equipment designed at the end of the 1950s that later became legendary among amateurs and collectors, while also playing a significant role in diplomatic, governmental, and military communications. Among these are the KWM-2 transceiver, the 30L-1 linear amplifier, the 51S-1 receiver, and their associated accessories.

This volume also includes a brief summary of the chapters dedicated to Collins and its products from my book Vintage Radio Equipment, a long-standing personal project made possible by Elektor Books International. That publication, with its exceptional print quality, fully embraced the principles of what we like to call "Technical Art Books," an approach that this work seeks to continue.

Giovanni "Gianni" Becattini
giovanni.becattini.books@gmail.com

To my wife
and my family

8



CERTIFICATE FOR MORE THAN 100 SHARES

NUMBER N0848

SHARES -1000-

COMMON

COLLINS RADIO COMPANY

INCORPORATED UNDER THE LAWS OF THE STATE OF IOWA

THIS CERTIFICATE IS TRANSFERABLE IN THE CITY OF NEW YORK OR IN CHICAGO

This Certifies that H DUCKS & CO is the owner of

-ONE THOUSAND -

FULL-PAID AND NON-ASSESSABLE SHARES, OF THE PAR VALUE OF ONE DOLLAR ($1) EACH, OF THE COMMON STOCK OF

Collins Radio Company (hereinafter called the "Company") transferable on the books of the Company by the holder hereof in person or by duly authorized attorney upon surrender of this Certificate properly endorsed. This Certificate and the shares represented hereby are issued and shall be held subject to all provisions of the Articles of Incorporation and of the By-Laws of the Company (copies of which are on file with the Transfer Agent) to all of which the holder, by acceptance hereof, assents. This Certificate is not valid unless countersigned by the Transfer Agent and registered by the Registrar.

In Witness Whereof, the Company has caused this certificate to be executed by the facsimile signatures of its duly authorized officers and a facsimile of its corporate seal to be printed hereon.

Dated NOV 20 1963

SECRETARY

PRESIDENT

COLLINS RADIO COMPANY CORPORATE SEAL

REGISTERED: MORGAN GUARANTY TRUST COMPANY OF NEW YORK REGISTRAR

By

AUTHORIZED OFFICER

OR

REGISTERED: THE NORTHERN TRUST COMPANY (CHICAGO) REGISTRAR

By

AUTHORIZED OFFICER

ISSUED IN NEW YORK

COUNTERSIGNED: The First National Bank of Chicago (CHICAGO) TRANSFER AGENT

By

AUTHORIZED SIGNATURE

OR

ISSUED IN NEW YORK

COUNTERSIGNED: THE CHASE MANHATTAN BANK (NEW YORK) TRANSFER AGENT

By

AUTHORIZED SIGNATURE

Collins Classics

KWM-2, 30L-1 and 51S-1
History, Engineering, and Restoration

Collins Radio Co.

The story of Collins Radio is inseparable from the story of **Arthur A. Collins**—a visionary, a perfectionist, and above all, a man driven by an almost spiritual devotion to precision and excellence. Today Collins is part of **Collins Aerospace**, one of the world's leading aerospace companies, specializing in avionics, onboard systems, communications, and technologies for civil, military, and space aviation.

The Heroes of Our World

Heroes and Heroes

For most people, a hero is someone who has accomplished extraordinary and highly visible feats, most often in war or conquest. Figures such as **Alexander the Great, Julius Caesar, or Napoleon** immediately come to mind: heroes whose achievements are dramatic, tangible, and relatively easy to grasp.

We engineers, on the other hand—perhaps a bit differently normal—tend to recognize a very different kind of hero. Ours are often figures almost completely unknown to the general public, men and women who contributed not to death and destruction, but to progress, knowledge, and the improvement of everyday life. Their tools were not armies, but ideas; not weapons, but imagination, creativity, and rigorous thinking.

Technology and science are sometimes perceived as cold or impersonal, largely because they are more difficult to understand. Yet behind every major technological leap there are individuals of remarkable vision, persistence, and human depth—often far more inventive and daring than "traditional" heroes.

Great Characters

One of the most rewarding aspects of my small but exciting work is studying the lives of such figures: **Charles Howard Vollum** of Tektronix, **Bill Hewlett** and **David Packard** of Hewlett-Packard, **Akio Morita** of Sony, **Steve Jobs** of Apple. These are people our children should study in school, not only as engineers or scientists, but as thinkers and entrepreneurs. In many ways, they are the modern counterparts of the great leaders of the past.

I cannot say how history would have unfolded without Napoleon. But I am absolutely certain that without our heroes—or others like them—the world we live in today would be profoundly different, and vastly poorer. Just consider their impact on medicine, communication, and the general progress of society.

Today, we add another remarkable figure to the main hall of our museum: **Arthur Andrew Collins**.


hp
TEKTRONIX
SONY
Arthur A. Collins


COLLINS

Collins Radio Company

We often have a tendency to oversimplify history, for example when we say that **Steve Jobs** invented the **personal computer**, or that **Guglielmo Marconi** invented radio. In reality, figures of this stature did something far more complex—and far more important: they took the work of many others and shaped it into something coherent, meaningful, and usable, giving direction and purpose to emerging technologies.

The story of **Collins Radio Company** is inseparable from that of its founder, **Arthur Andrew Collins**. It begins in 1933, in Cedar Rapids, Iowa. At just twenty-four years of age, Arthur Collins was already well known in amateur radio circles under the call sign W9CXX. A teenage prodigy, he had designed advanced transmitters and achieved long-distance contacts at a time when many amateurs were still struggling with simple regenerative receivers.

That same year, he founded the **Collins Radio Company** in the basement of his family's home, not to build gadgets, but to solve real problems through rigorous engineering and sound scientific principles. From the outset, Collins approached radio not as a hobbyist's playground nor as a purely commercial opportunity, but as a serious technical discipline demanding precision, understanding, and technology development.

The Radio Wizard

Arthur Collins was not a businessman in the conventional sense. Like **Howard Vollum** of Tektronix, or **Bill Hewlett** and **David Packard** of Hewlett-Packard, he belonged to a generation of American technologists who placed engineering rigor above short-term commercial expediency. Business success, when it came, was viewed less as a goal in itself than as a natural consequence of doing things properly.

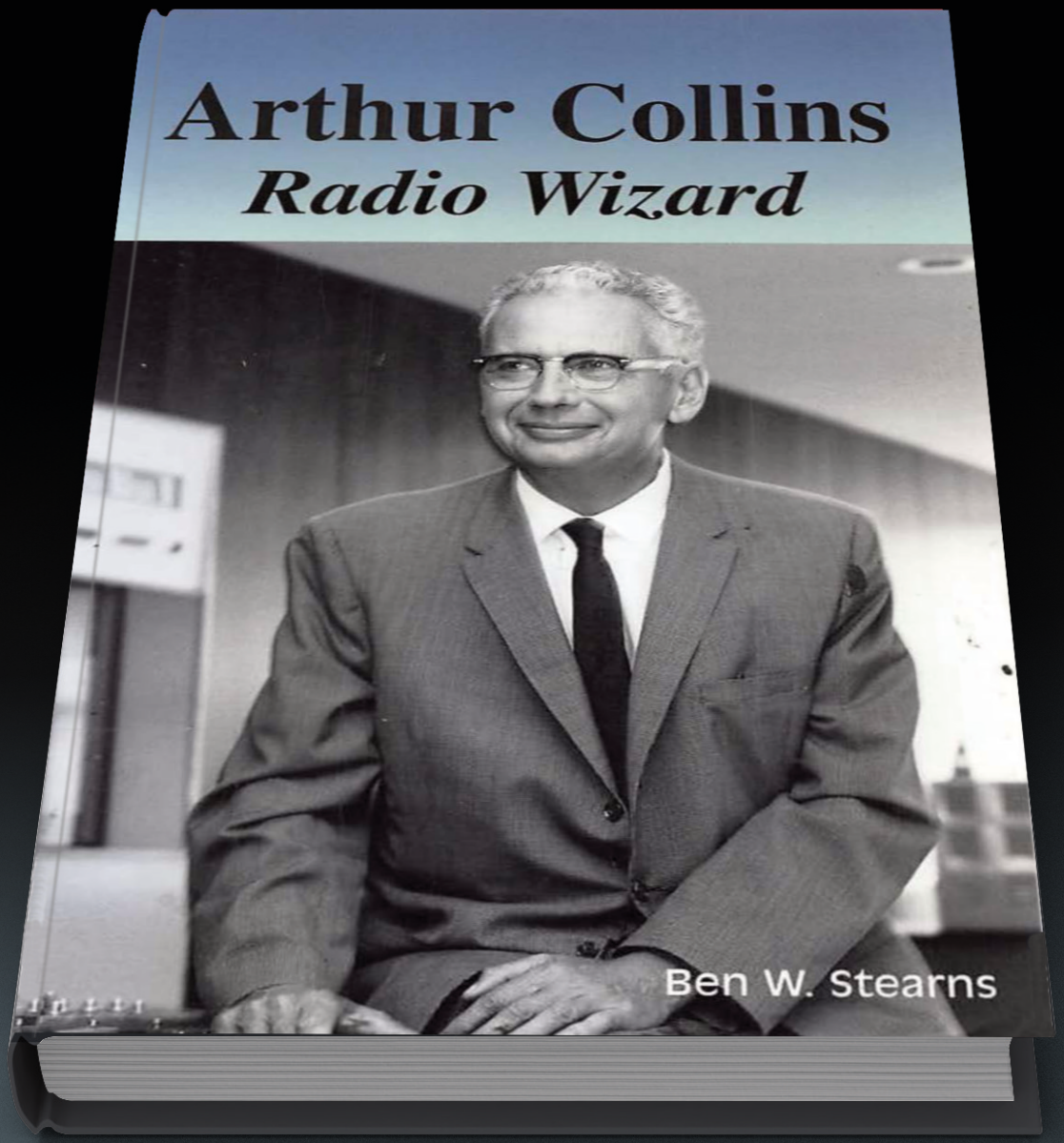
Given the scale and consistency of his contributions, it is therefore not surprising that Collins has often been described as a **perfectionist**. The term appears frequently in historical accounts and recollections by those who worked with him. Yet taken at face value, it risks trivializing a far broader and more ambitious mindset.

What truly defined Collins was not an obsession with details for their own sake, but a clear vision of what engineering ought to be. For him, **excellence** was not a decorative layer applied after functionality had been achieved; it was the **foundation** upon which every design decision rested. If a circuit could be improved, it had to be improved—not because it was visible, but because it was intellectually unfinished.

This philosophy is reflected unmistakably in Collins equipment, both civilian and military. Internal assemblies, invisible to the user, were executed with the same care as front panels and controls. Military procurement officers often described Collins products as **"over-engineered,"** yet this very characteristic made them legendary for stability, robustness, and long-term reliability.

In this light, what is often labeled as perfectionism appears instead as a deliberate refusal to accept mediocrity—a commitment to remain, in Collins's own words, **"on the frontier."** He did not merely want to reach the cutting edge of radio technology; he wanted to keep it moving forward.

As with many exceptional figures, simple labels ultimately fall short. Terms like perfectionist may hint at certain traits, but they cannot capture the scope of Arthur Collins's vision. What remains—and what truly defines him—is what he built, and the enduring legacy of an approach to engineering that sought not just to meet requirements, but to elevate the very standards by which excellence is measured.



Much of the reported information was take from the book “Arthur Collins, the Radio Wizard”, Published by Ben W. Stearns, Marion, Iowa U.S.A. (2002) – Copyright © Ben W. Stearns – ISBN 0-9716416-0-9

Collins Radio Company provided crucial communication systems for the Apollo program, including the Unified S-Band. This system enabled astronauts to communicate with Earth, transmitting voice, data, and television signals while allowing continuous global tracking of the spacecraft.

The equipment developed in Cedar Rapids was essential to making history: Neil Armstrong's first words from the Moon reached Earth through a Collins radio.

Collins Collector Association

The S/Line and the 51S-1

Once again addressing the **amateur** market, the late 1950s marked a decisive turning point with the introduction of the Collins **S/Line**. This modular system—comprising units such as the 32S-1, 75S-1, and the KWM-2—featured a clean and rational front-panel layout, PTO tuning, and the unmistakable "Collins audio." Accessories such as the 30L-1 and the 312B-4 turned the S-Line into not just a collection of components, but a complete operating experience.

The exceptional technical characteristics of the KWM-2 allowed it to extend well beyond the amateur market, finding widespread use in commercial, institutional, and even military applications.

In the late 1950s, Collins introduced yet another masterpiece: the 51S-1. Although visually reminiscent of the S-Line, it was a fundamentally different design, developed specifically for professional and commercial use.

These products were not merely technical achievements; they were objects of industrial beauty. Much like the early Tektronix oscilloscopes or Hewlett-Packard's elegant test equipment, they reflected a deep respect for the user and for engineering as a disciplined, thoughtful craft.

Summary of Previous Episodes

The present book is primarily dedicated to two pieces of Collins equipment: the **KWM-2** transceiver and the **30L-1** linear amplifier, together with their associated accessories, such as the **312B** and the **516F-2** and **PM-2** units.

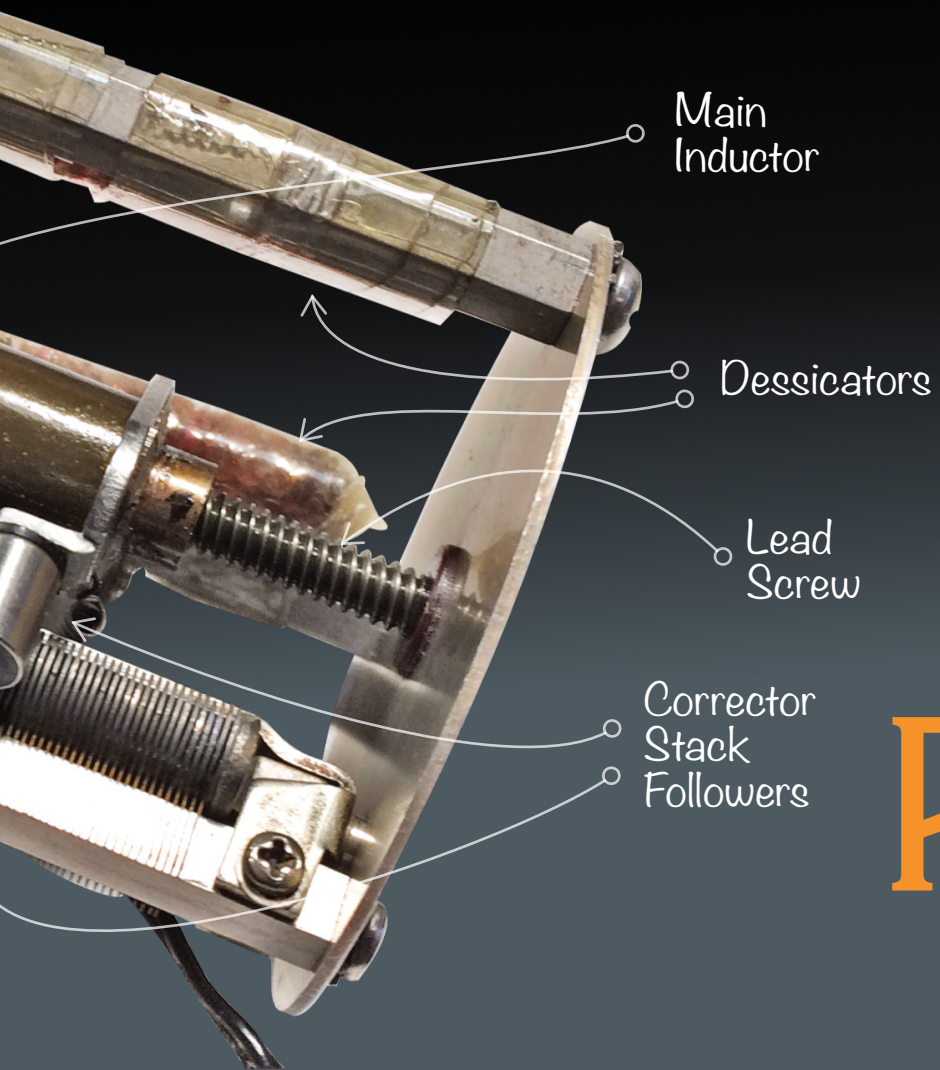
This volume also includes a section of technical notes and observations on the **51S-1** receiver. That model, however, is discussed in far greater depth in my 590-page book **Vintage Radio Equipment** [VRE], published by Elektor Books International. That earlier volume covers a wide range of vintage radio equipment and includes detailed treatments of several classic Collins designs, among them the **51J-4, R-390A, R-392,** and the **T-195**.

Some of the material presented in the following pages can be more fully appreciated when read in conjunction with Vintage Radio Equipment. With the kind permission of the publisher, I therefore include here a concise summary of the sections related specifically to Collins Radio. This chapter is intended both as **a point of continuity** between the two books and as a **practical overview** that may help readers evaluate Vintage Radio Equipment prior to a possible purchase.

Permeability Tuned Oscillators (PTO)

The PTO, introduced by Collins in the ART-13 transmitter, revolutionized variable frequency oscillator design. Unlike traditional VFOs that used a variable capacitor, Collins used a variable inductor: a ferrite core that moved inside a coil to change inductance.

This movement followed a logarithmic mechanical pitch, enabling precise linear tuning over a narrow range (typically 1 MHz over ten full shaft rotations). The result was fine frequency control with remarkable stability.



Though conceptually simple, the PTO's construction was far from trivial. It involved corrector stacks for linearity, anti-backlash mechanisms, endpoint correction coils, sealed enclosures, and high-precision manufacturing. Later versions used subminiature tubes, semiconductors, and temperature-controlled ovens. Despite enhancements, the basic design remained unchanged for 25 years.

Other companies followed suit—Cosmos Inc., Telefunken (with its E863), and more—but these imitations only underscored the originality of Collins' invention. Until digital PLLs became commonplace, the Collins PTO set the standard.

PTOs

very high, the R-390 was not marketed or sold by Collins—and this may explain why it's not highlighted in narratives focused on Arthur Collins's entrepreneurial and technical vision. Additionally, Stearns's *Radio Wizard* emphasizes Collins's corporate vision: personal projects like the 51S-1, the S/Line, avionics systems, and NASA support missions. The R-390, being a government-led, collaborative product, may not have fit the foundation's preferred storyline.

Nonetheless, Collins engineers were unquestionably behind the R-390's architecture. The original engineering specs and system design came from Collins in the early 1950s, and many design details bear the unmistakable Collins design language.

A few internal technical memos, referenced in collector circles, describe Collins' role in meeting the Signal Corps' demanding requirements for stability and serviceability.

Ironically, the R-390 may be one of the most "Collins-like" radios ever built—despite not being treated as such in official literature.

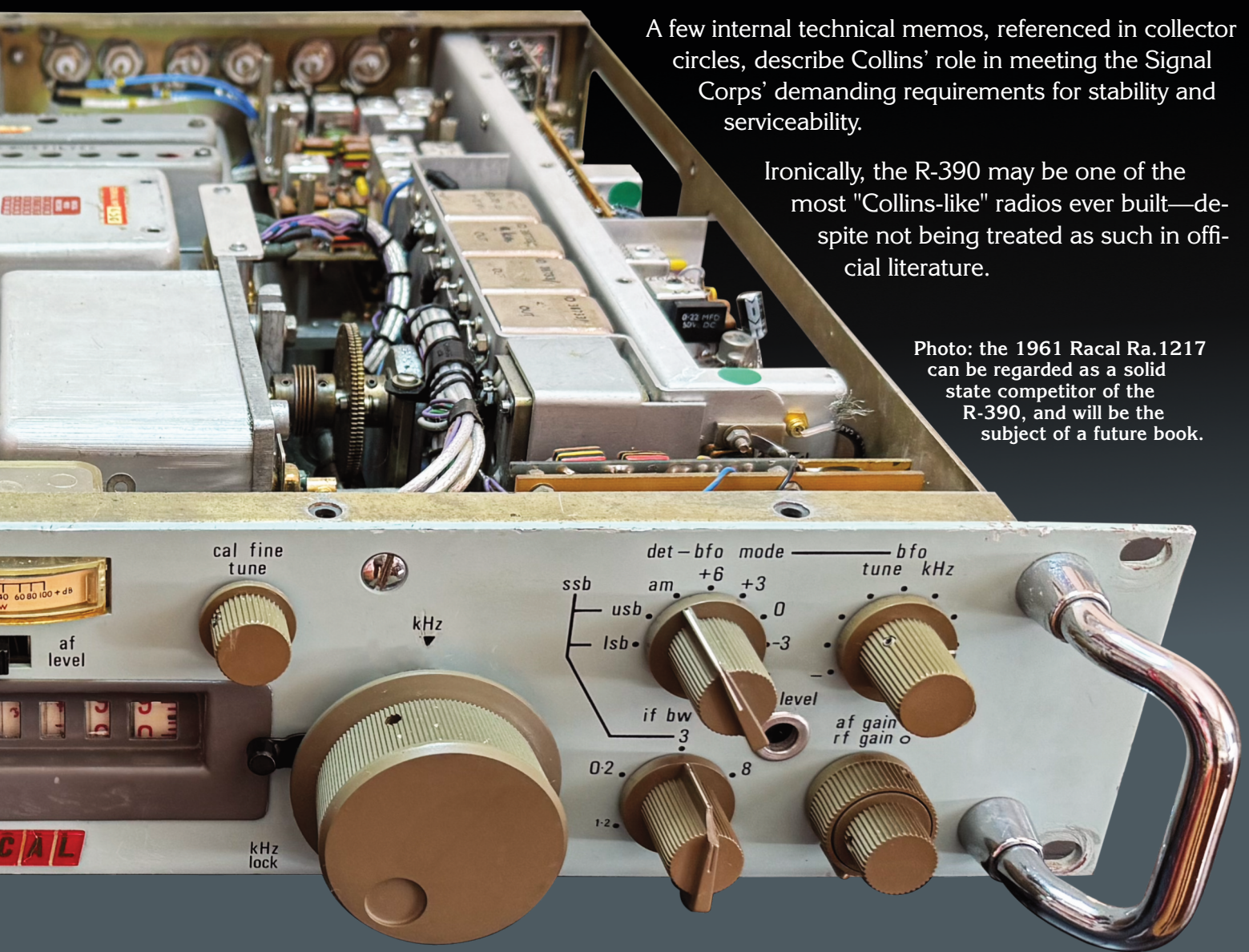


Photo: the 1961 Racal Ra.1217 can be regarded as a solid state competitor of the R-390, and will be the subject of a future book.

"Economical Enough"

In the late fifties, Collins introduced the **S/Line**, declaring that it was "economical enough to become the fastest growing method of communication used by hams throughout the world". Well, as we will see, one could argue about the interpretation of the term "economical".

A Gold Standard

The **Collins S/Line** is a legendary range of amateur radio equipment developed by Collins Radio Company that quickly became the **gold standard** for radio amateurs due to its superior engineering, modular design and unmatched performance for the time. It was one of the first sets to be designed specifically for SSB, a new frontier that everyone wanted to explore.

Introduced in 1958 by Collins Radio Company, the **S/Line** marked a turning point in amateur radio technology. Rather than offering an all-in-one transceiver, Collins opted for a **modular system,** i.e., separate receiver, transmitter, power supply, and accessories, each engineered to the highest stan-

Collins Classics

KWM-2, 30L-1 and 51S-1
History, Engineering, and Restoration

KWM-2 Transceiver

For your ham shack at home or for the mobile unit in your car — or for use in other installations such as aboard a boat or plane — Collins KWM-2 Transceiver gave you mobile, portable and fixed station single side-band communication on all amateur bands between 3.4 MHz and 29.7 MHz.

Circuit Description

Restorer's Tools

The restorer needs three weapons: the **block diagram**, the **electrical schematic diagram** and the **component layout**.

Block Diagram

Of course, the **block diagram** is the starting point for understanding how the smoke flows, so I completely redrew it to fit these pages without having to reduce the font size too much, and added colors to make things clearer. Still, I tried to keep the same look and feel of the original, and I found a font that is not exactly Collin's, but similar enough (Andale Monospaced, if you are interested).

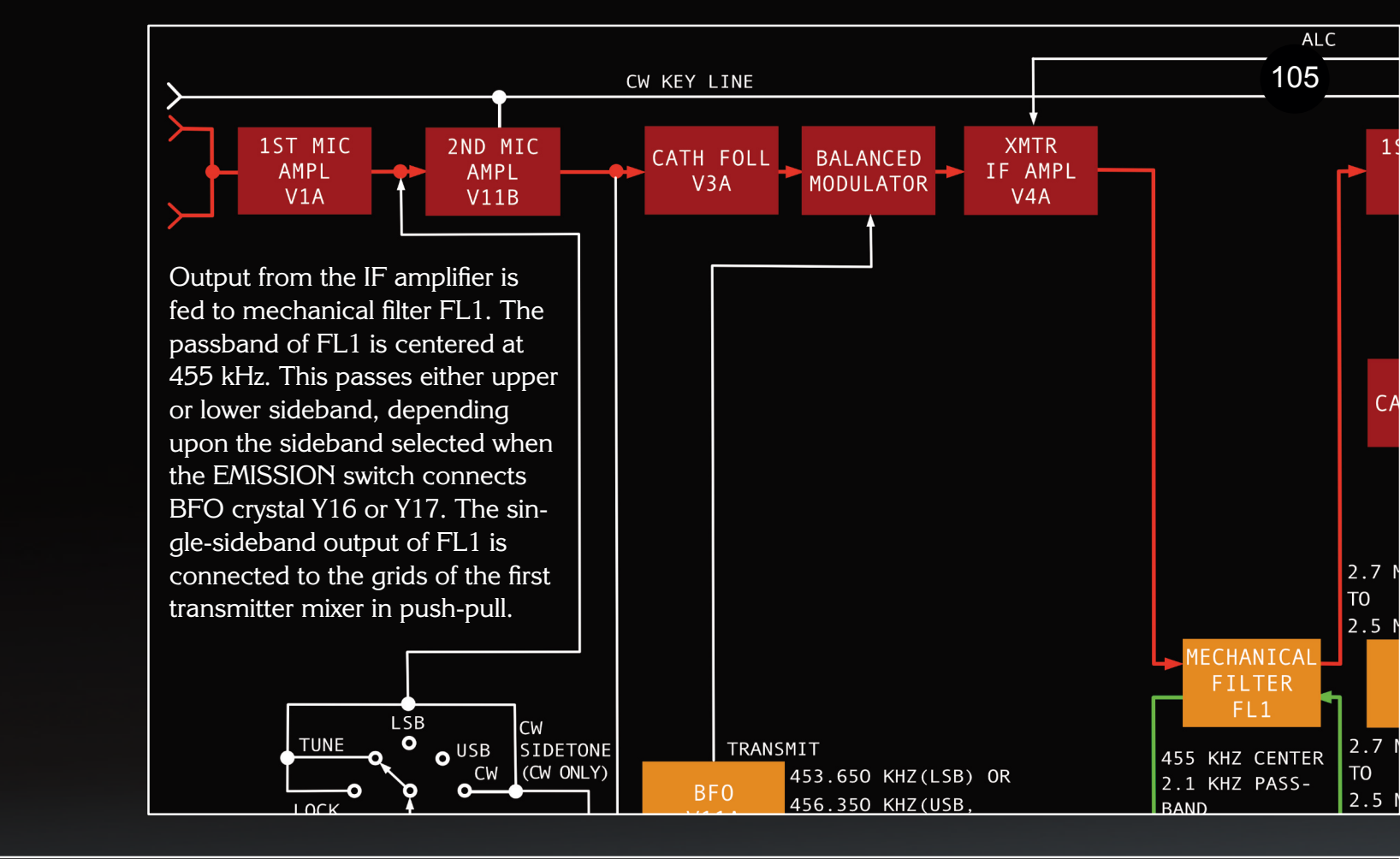
Electrical Schematic

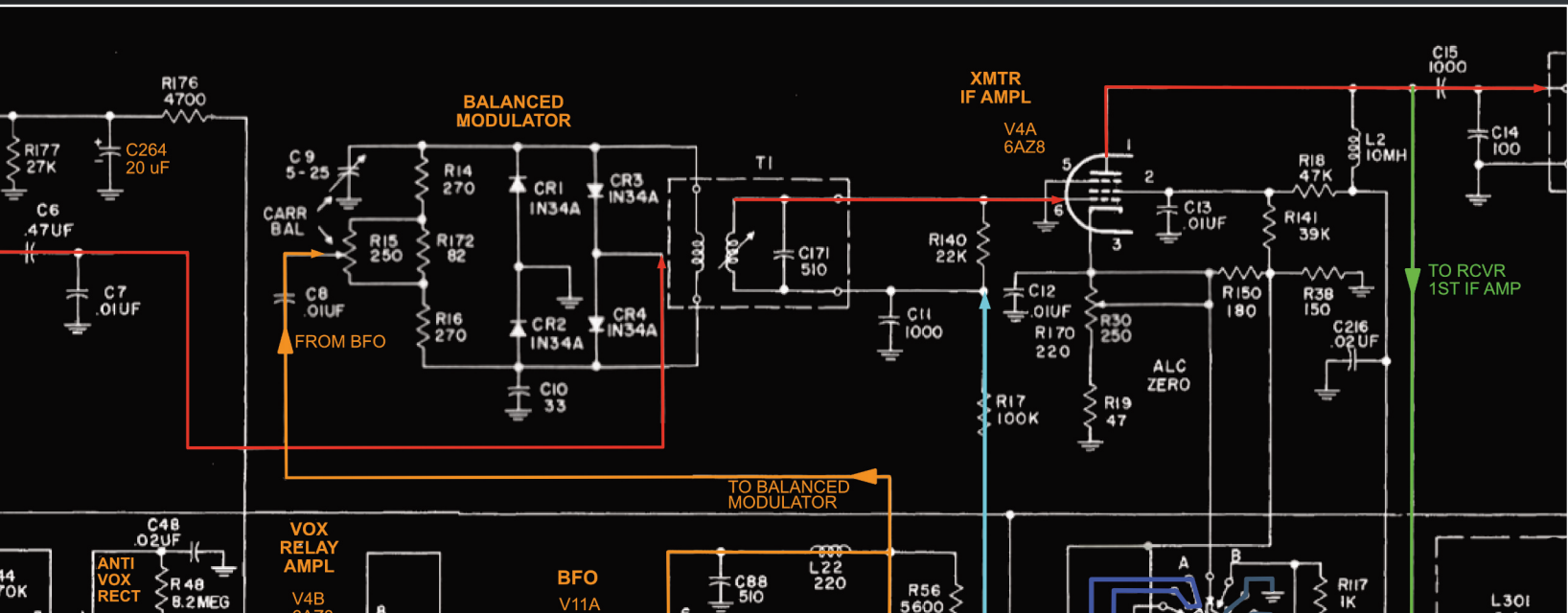
You can find two versions of the **schematic** of the KWM-2: the old version, where all the schematic is contained in one long page, and the new one, composed of more pages with extra-sheet references. Both scared me. The second one is made even more complicated by the crazy logic of the parts list, where each component is not simply called R23, C29 or V12 but has a number like 837. Not for me.

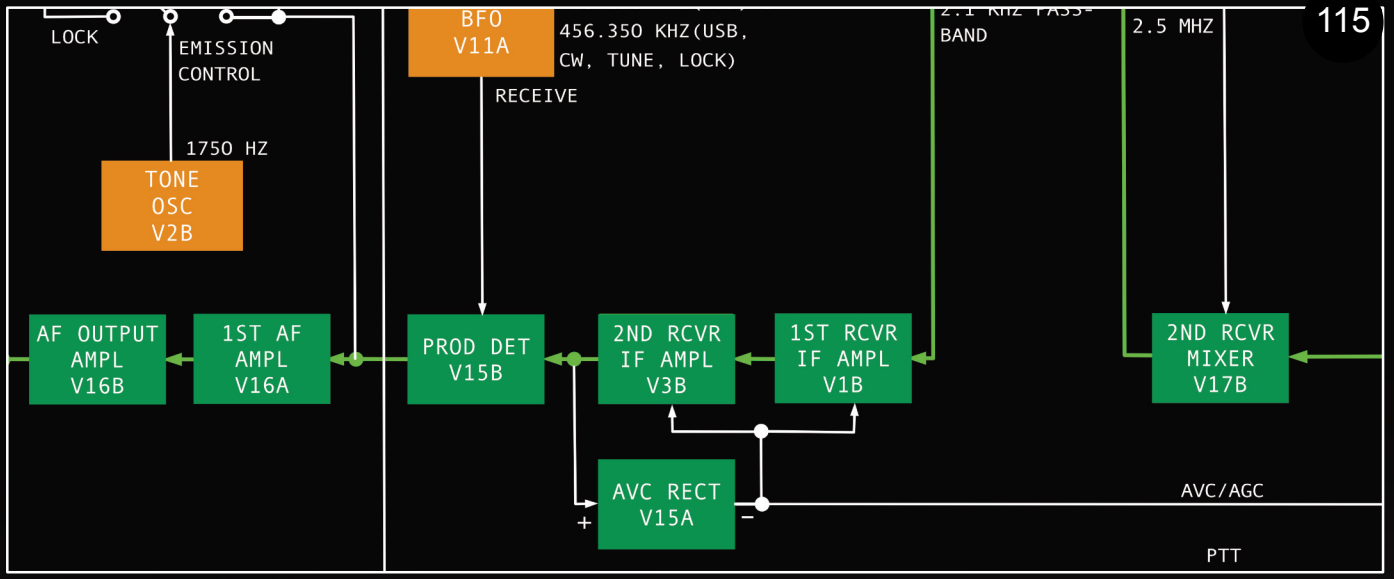
So I decided to take one schematic (the 1966 one) and try to partially restore it, adding references and highlighting some lines and logical sequences. I used several colors, but these in particular:

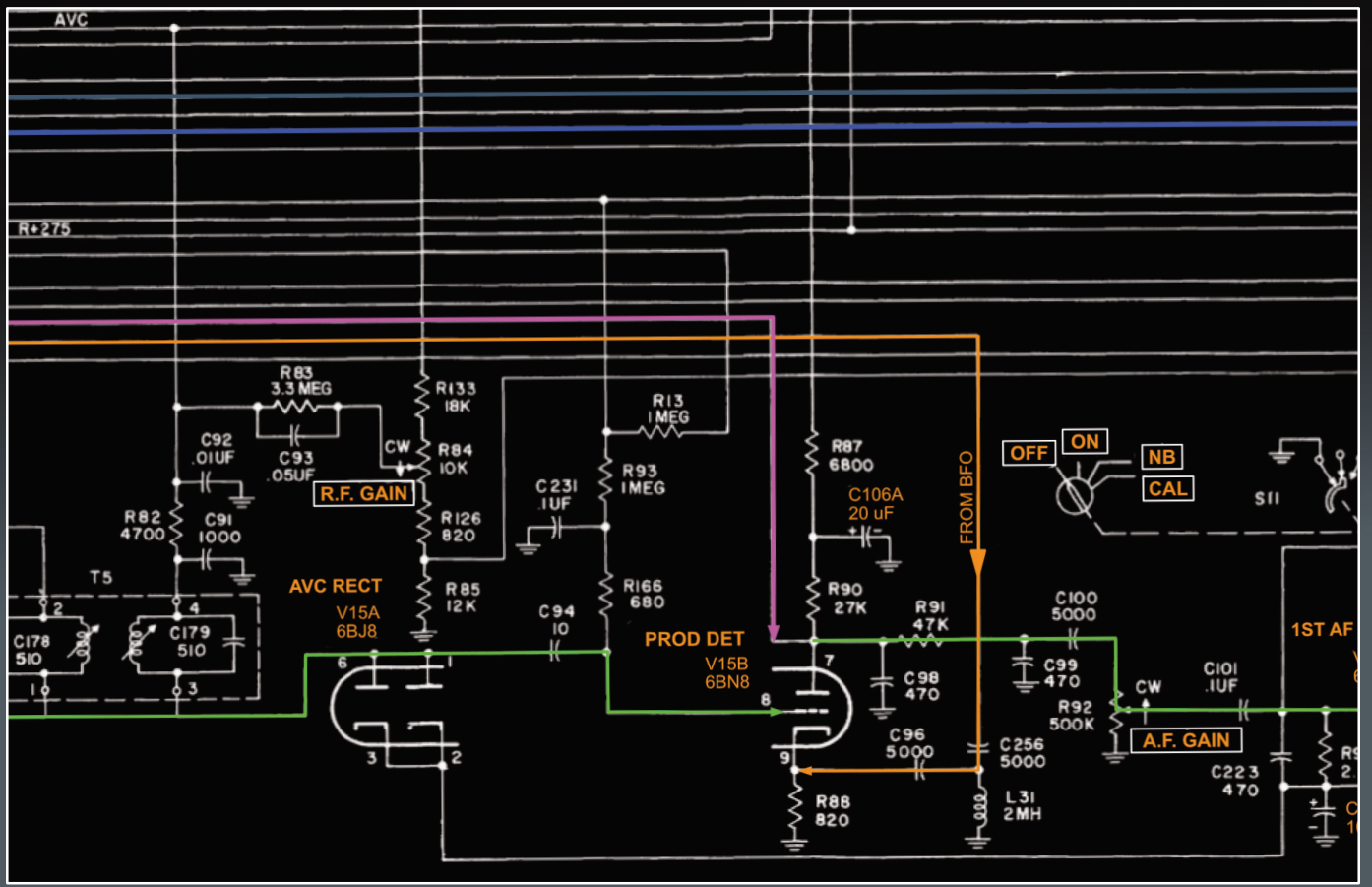
- in red: the signal flow for the transmitter section;
- in green: the signal flow for the receiver section;
- in orange: the signals of the circuits common to the transmitter and receiver;
- in cyan: the auxiliary circuits.

To make things easier, on the following pages you will find the schematic divided into two pages. This can be useful for an overview, but it is almost impossible to navigate. Then I took the circuit de-


ALC
105
CW KEY LINE
1ST MIC AMPL V1A
2ND MIC AMPL V11B
CATH FOLL V3A
BALANCED MODULATOR
XMTR IF AMPL V4A
Output from the IF amplifier is fed to mechanical filter FL1. The passband of FL1 is centered at 455 kHz. This passes either upper or lower sideband, depending upon the sideband selected when the EMISSION switch connects BFO crystal Y16 or Y17. The single-sideband output of FL1 is connected to the grids of the first transmitter mixer in push-pull.
LSB
TUNE
USB
CW
CW SIDETONE (CW ONLY)
LOCK
TRANSMIT
BFO
453.650 KHZ(LSB) OR
456.350 KHZ(USB,
MECHANICAL FILTER FL1
455 KHZ CENTER
2.1 KHZ PASS-
BAND
2.7 M
TO
2.5 M

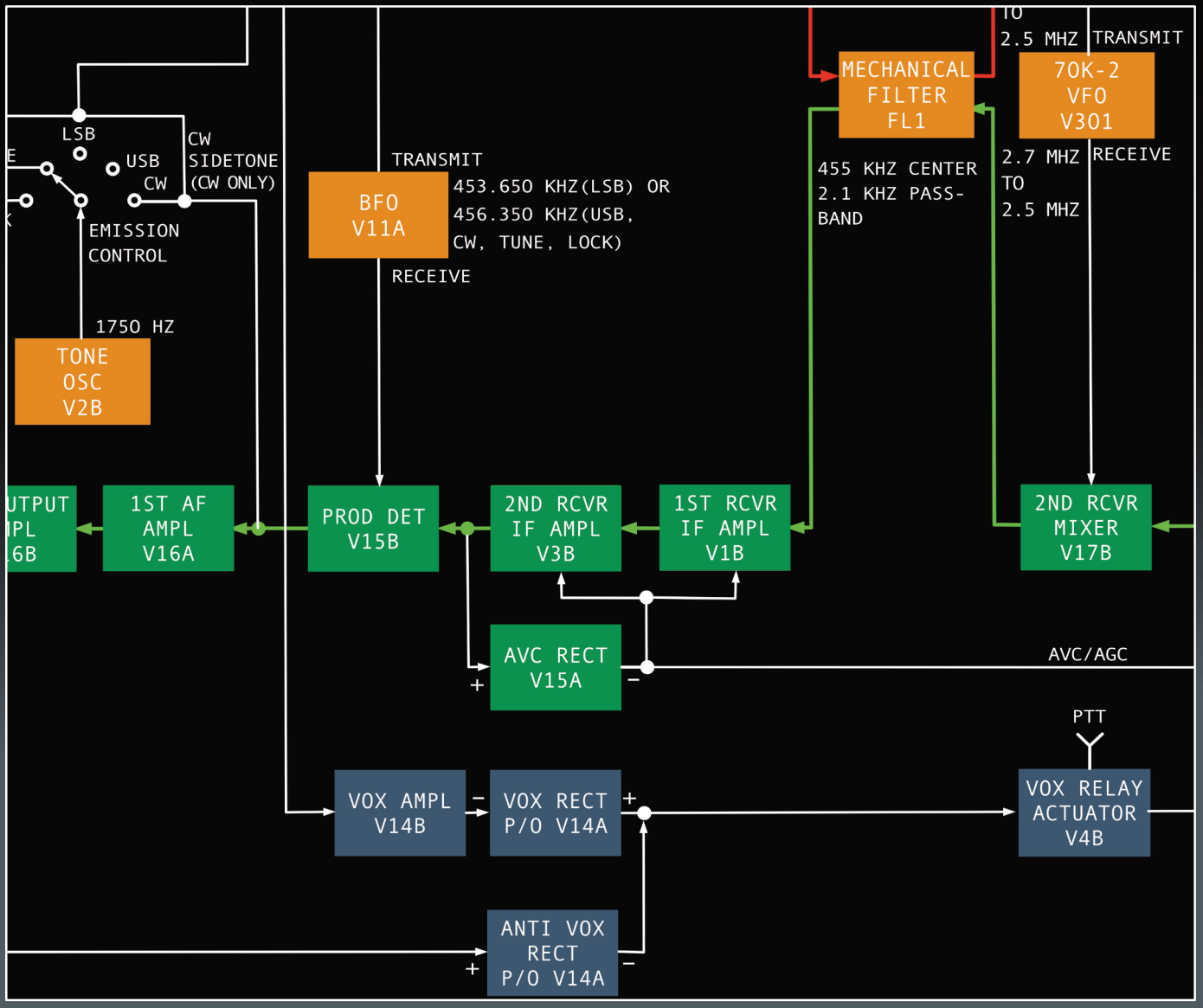

R176 4700
R177 27K
C264 20 uF
C6 .47UF
C7 .01UF
BALANCED MODULATOR
C9 5-25
CARR BAL
R14 270
R15 250
R172 82
R16 270
C8 .01UF
FROM BFO
CR1 IN34A
CR3 IN34A
CR2 IN34A
CR4 IN34A
C10 33
T1
C171 510
C11 1000
XMTR IF AMPL
V4A 6AZ8
R140 22K
R17 100K
C12 .01UF
R170 220
R30 250
ALC ZERO
R19 47
R150 180
R38 150
C216 .02UF
C13 .01UF
R18 47K
R141 39K
L2 10MH
C15 1000
C14 100
TO RCVR 1ST IF AMP
TO BALANCED MODULATOR
C48 .02UF
ANTI VOX RECT
R48 8.2MEG
VOX RELAY AMPL
V4B
BFO
V11A
C88 510
L22 220
R56 5600
R117 1K
L301

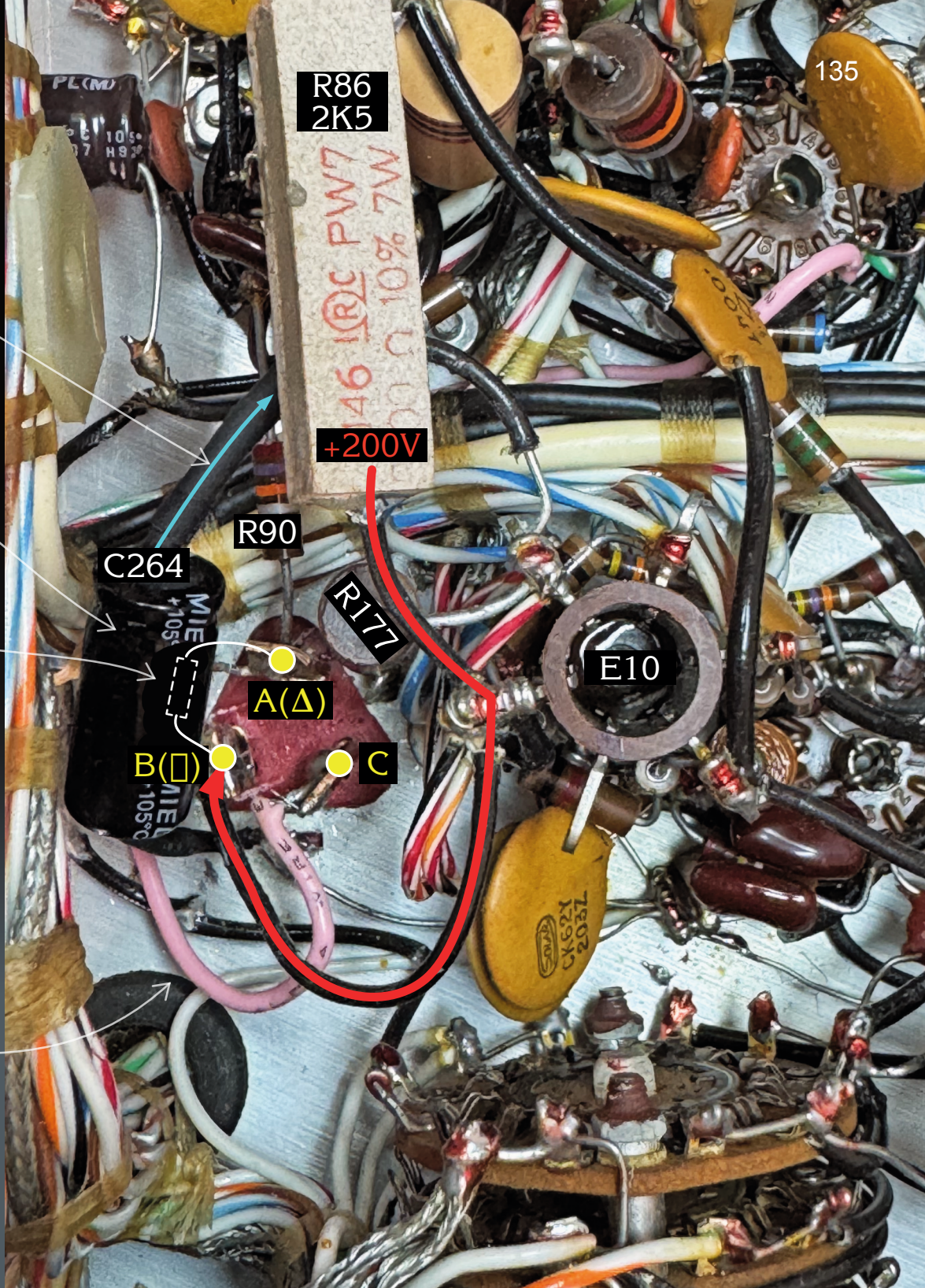

LOCK
EMISSION CONTROL
1750 HZ
TONE OSC V2B
BFO V11A
456.350 KHZ(USB, CW, TUNE, LOCK)
RECEIVE
BAND
2.5 MHZ
AF OUTPUT AMPL V16B
1ST AF AMPL V16A
PROD DET V15B
2ND RCVR IF AMPL V3B
1ST RCVR IF AMPL V1B
2ND RCVR MIXER V17B
AVC RECT V15A
AVC/AGC
PTT


AVC
R+275
R83 3.3 MEG
R133 18K
C92 .01UF
C93 .05UF
CW
R84 10K
R.F. GAIN
R82 4700
C91 1000
R126 820
R85 12K
C231 .1UF
R13 1MEG
R93 1MEG
R166 680
C94 10
T5
C178 510
C179 510
AVC RECT V15A 6BJ8
PROD DET V15B 6BN8
R87 6800
C106A 20 uF
FROM BFO
R90 27K
R91 47K
C98 470
C96 5000
R88 820
C256 5000
L31 2MH
OFF
ON
NB
CAL
S11
C100 5000
C99 470
R92 500K
CW
A.F. GAIN
C101 .1UF
C223 470
1ST AF

output voltage from the antiVOX rectifier, connected to the grid of V4B, provides the necessary antiVOX threshold. ANTI-VOX GAIN control R45 adjusts the value of the antiVOX voltage threshold so that loudspeaker output will not produce enough positive DC output from the VOX rectifier to exceed the negative DC output from the antiVOX rectifier and cause V4B to actuate K2.

However, speech energy into the microphone will cause the positive VOX voltage to overcome the negative antiVOX voltage and produce the desired action of K2.




R86
2K5
+200V
R90
C264
R177
E10
A(Δ)
B(□)
C
To V3 Pin 8
C264 4 µF
(originally it
was 20 µF)
R86 6K8
(hidden)
Pink Wire To
V16 Pin 8

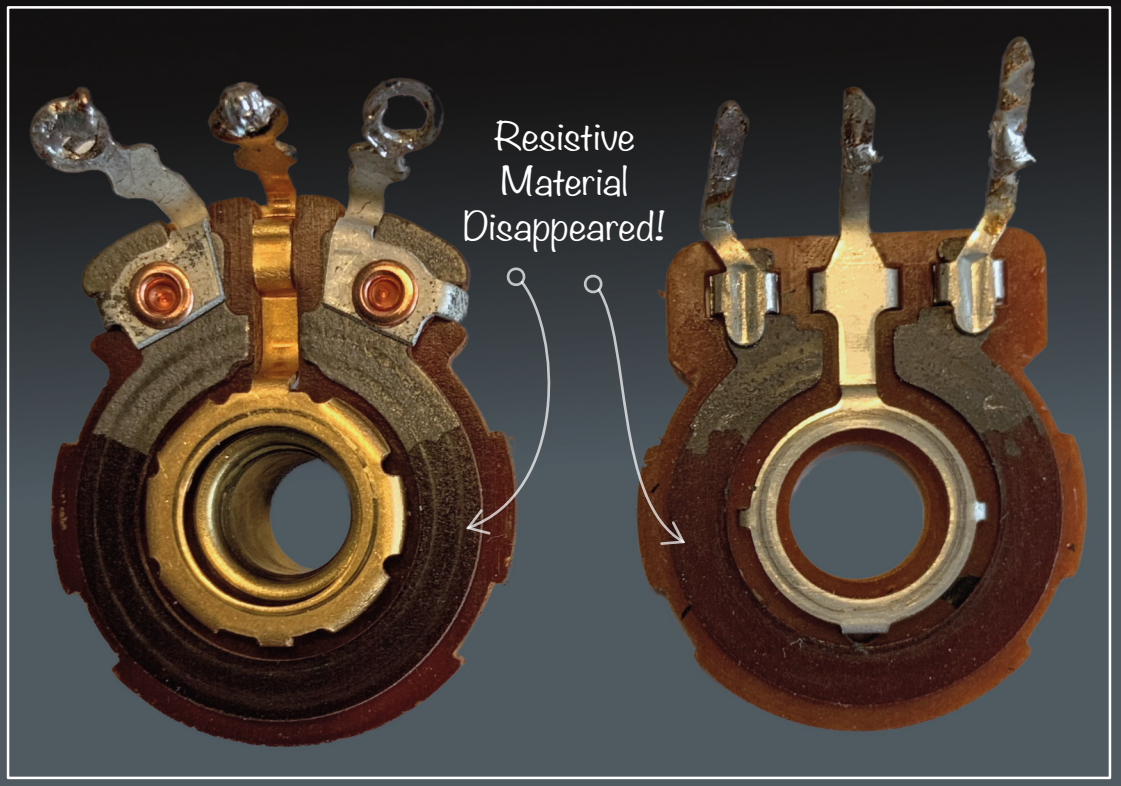
V11A (2ND MIC AMP) boosts the signal before the CATH FOLL which routes the signal to the balanced modulator, whose amplitude can be adjusted by the MIC GAIN potentiometer, subject of this discussion. Later, we will analyze more in detail this circuit.

The MIC GAIN Knob

The MIC GAIN knob is used during transmission to adjust the modulation level, but as mentioned above, it is also used during transmitter tuning to adjust the grid and PA current by using a locally generated tone instead of your voice. As mentioned above, this operation was extremely critical on my KWM-2, and its effect was to have zero or full scale current with just a touch of the knob.

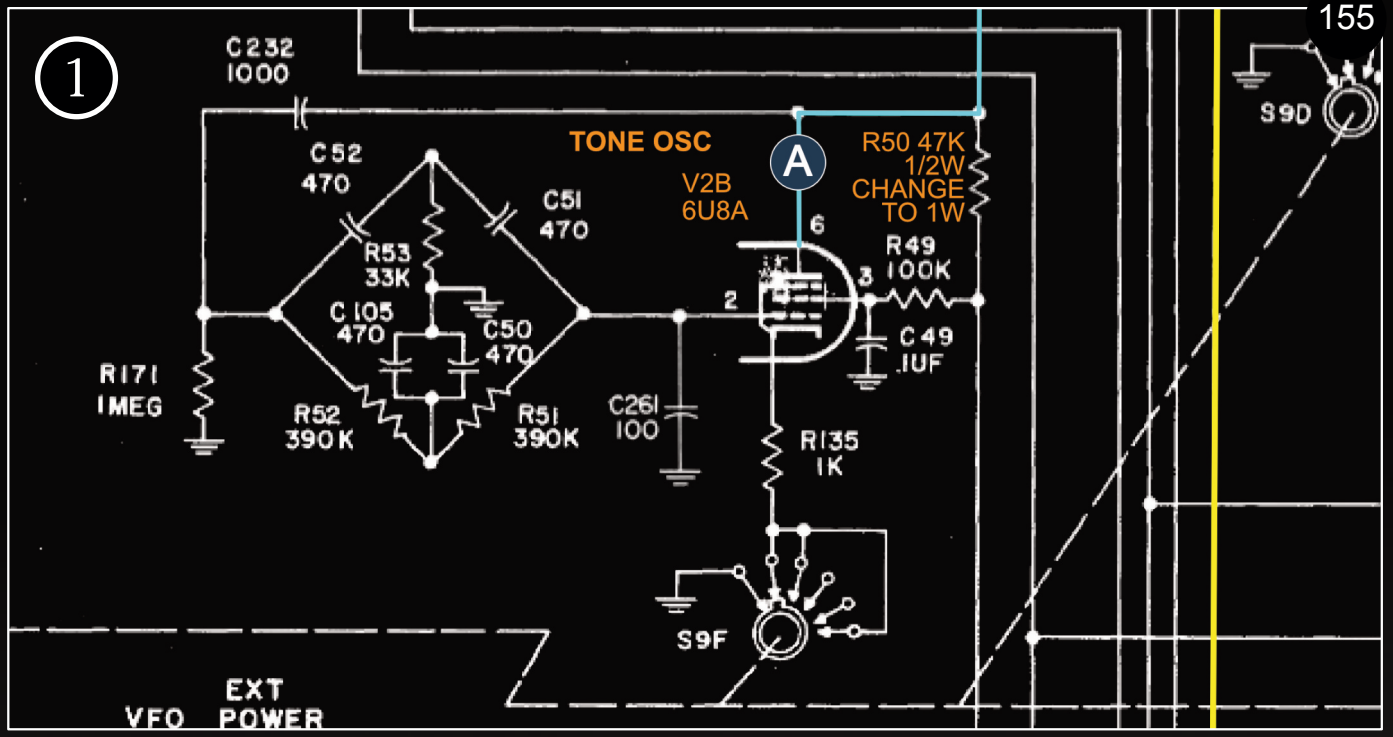
Broken Potentiometers

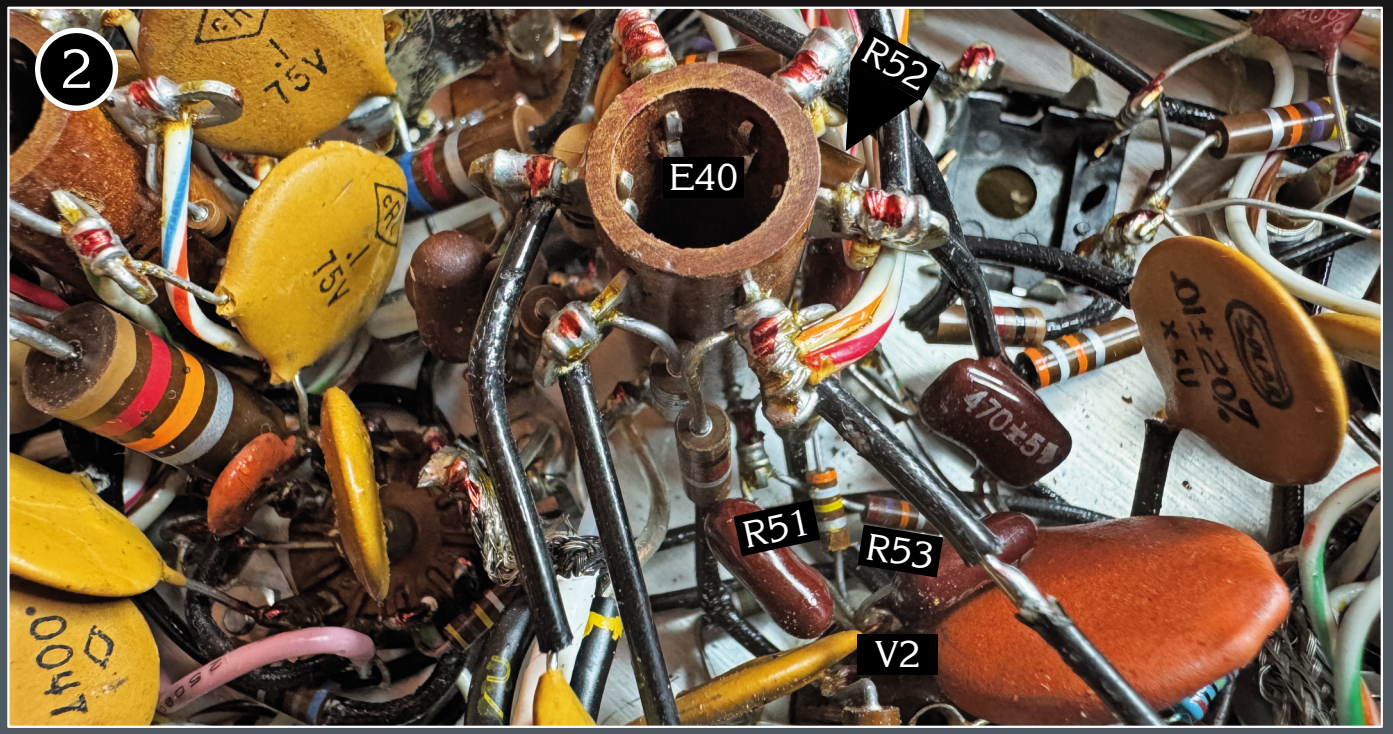
At first, I thought I had found the fault (as I did several times). Both the MIC GAIN (R8) and VOX GAIN potentiometer (R39) were open. Their resistive coating was completely erased, as shown in the photo below. I could find no explanation for this. After replacing both potentiometers, however, the problem of the excessive sensitivity of the knob was still there.



Both the MIC GAIN and VOX GAIN potentiometers were seriously damaged in the same way: the resistive layer was completely erased.

I checked all the components surrounding it, but could find no explanation for this.


1
C232
1000
TONE OSC
A
R50 47K
1/2W
CHANGE
TO 1W
V2B
6U8A
C52
470
C51
470
R53
33K
C105
470
C50
470
R171
1MEG
R52
390K
R51
390K
C261
100
R135
1K
R49
100K
C49
.1UF
S9D
S9F
EXT
VFO POWER


2
R52
E40
R51
R53
V2

How To Drive Your Car

As I mentioned earlier, this is my first real transmitter, so I not only had to repair it but also learn how to operate it properly. Fortunately, the KWM-2 was forgiving enough to tolerate some of my rookie mistakes.

This section will probably be of little interest to most experienced readers, who are already well acquainted with ham radio equipment. Still, I believe there are subtle aspects that not everyone agrees on, and I thought it worth sharing a few notes—especially from the perspective of someone learning the ropes.

In particular, I'm referring to the correct setting of the following controls:

- MIC GAIN
- EXCITER TUNING
- P.A. TUNING
- INCR LOAD

We've already talked at length about the MIC GAIN control, though it still deserves a few additional remarks. The EXCITER TUNING is relatively straightforward in its use. However, the last two—P.A. TUNING and INCR LOAD—require a more thorough explanation, as their adjustment can have a significant impact on both performance and equipment safety.

The Pi Network

To better understand the subject, let's me remind that most tube transmitters use in the output stage the pi network, a type of impedance matching circuit (see figure on the next page). It's called a pi network because its configuration resembles the Greek letter Π: a capacitor to ground (TUNE, P.A. TUNING knob), followed by an inductor, followed by another capacitor to ground (LOAD, INCR LOAD knob)

Its purpose is to match the high output impedance of the tube's plate (often several thousand ohms) to the standard 50-ohm load (antenna or transmission line). As an extra-benefit, it attenuates the

522-1170 00

Last Minute Update

When I first powered the KWM-2 using the 516F-2 supply, the receiver exhibited persistent background noise that made proper reception impossible. Interestingly, the radio worked flawlessly with the original PM-2 power supply.

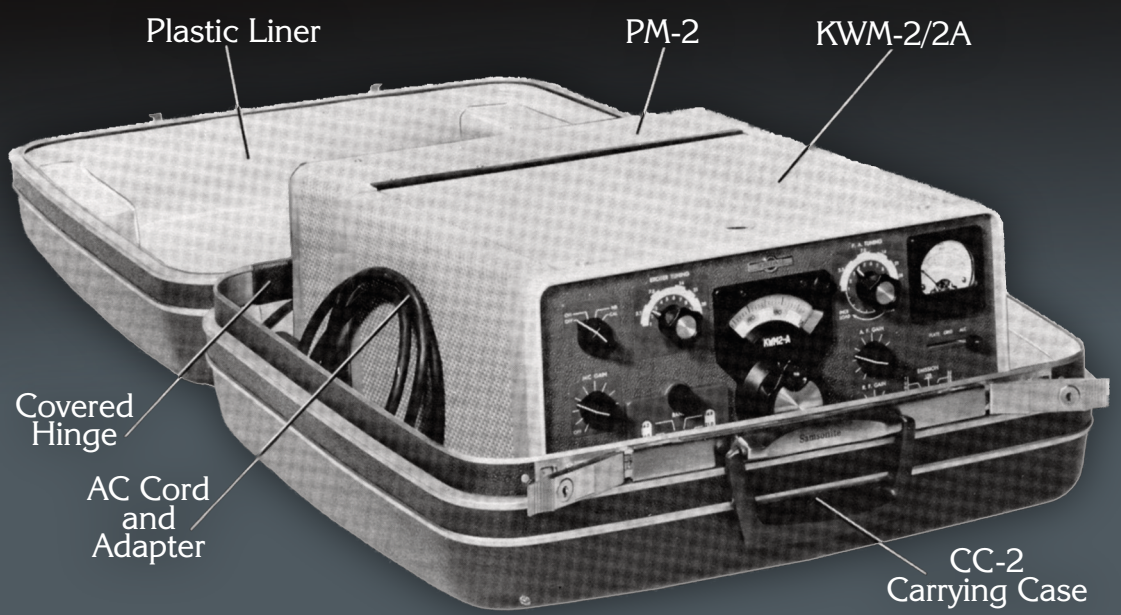
This led me to investigate the 516F-2, and I discovered that the issue was caused by the poor-quality 5V power supply I had used for the modification here described, with an inexpensive adapter from Amazon.

To resolve the problem, I replaced it with a socket for an external USB power source and tested several options using a spectrum analyzer. The best performer, by far, was an Apple iPhone power adapter, which produced the lowest noise levels.

The Spy's Suitcase

When it was introduced (the manual is dated 1959), only one type of power supply was available for the KWM-2: the 516F, produced in several versions for either AC or DC operation.

Shortly thereafter, the PM-2 Lightweight AC Power Supply was introduced, with the goal of creating a complete high-frequency single-sideband station housed in a suitcase-sized carrying case (for spies?). The complete station consisted of the KWM-2 transceiver, the PM-2 power supply, and the carrying case. The PM-2 converted 110- or 220-volt AC power into the voltages and currents required to operate the KWM-2.



A Station Controller

The Collins **312B-4** boasts the pompous name of **Station Control**, but what was is it? With a price in 1977 of $648.00 ($3,396.00 in 2025) I was expecting something more. It was a purely passive unit containing:

- a directional coupler and wattmeter;
- an inexpensive 4Ω speaker;
- a phone patch;
- appropriate switching circuitry.

Its sibling the **312B-5** also included also a variable frequency oscillator to provide separate transmit and receive frequencies when used with the KWM-2 or KWM-2A Transceivers.

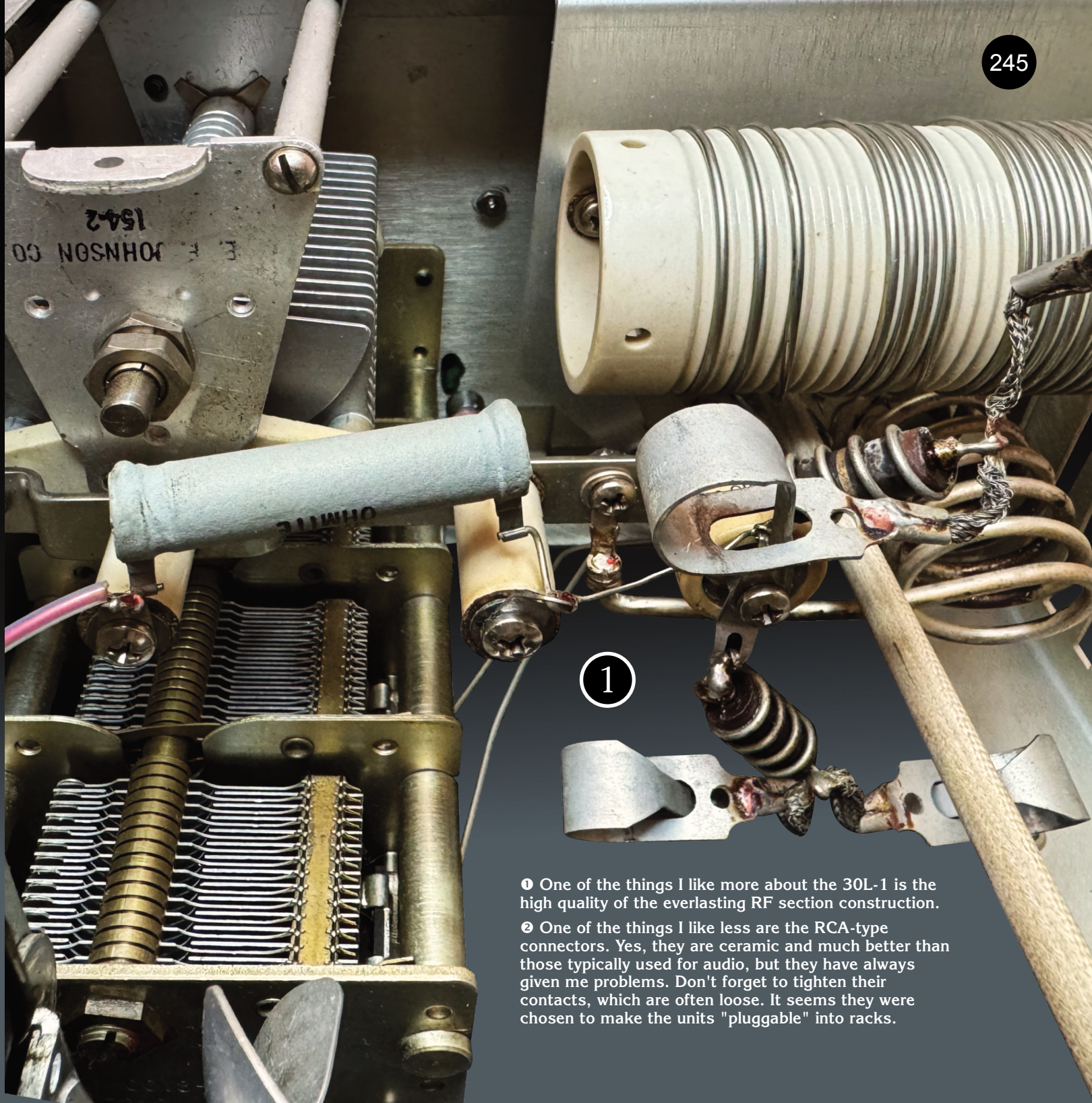
On the left, the 312B-4, the most common. On the right, the 312B-5 version had a second VFO for receiving and transmitting on different frequencies.

Collins Classics

KWM-2, 30L-1 and 51S-1
History, Engineering, and Restoration

30L-1 Linear Amplifier

One of the most famous HF linear amplifiers, still today appreciated by radio hams.



1

❶ One of the things I like more about the 30L-1 is the high quality of the everlasting RF section construction.

❷ One of the things I like less are the RCA-type connectors. Yes, they are ceramic and much better than those typically used for audio, but they have always given me problems. Don't forget to tighten their contacts, which are often loose. It seems they were chosen to make the units "pluggable" into racks.

Restoration

The 30L-1 and Me

Talking about the KWM-1, I confessed that it was my first "real" transmitter, although I had worked on the T-195, the BC-191, the BC-669, the WS 19, etc. in the past. In this case, however, the 30L-1 is the first linear amplifier I have ever touched, i.e. a real "first", and this intimidates me a little, even more when I think of all the voltage and power flowing through it.

For these reasons, I decided to proceed with extreme caution and try to read what I could before attempting to turn it on. What follows is a synthesis of the main points I analyzed and how I decided to proceed.

My 30L-1 was still as it left the factory. Too bad I had to replace the capacitors, but as you can see from this photo, it was impossible to even imagine saving them. Fortunately, the fluid that leaked did not cause too much damage.

Documents

There are many documents related to the 30L-1, a testament to its great success and the large number of amateurs who still use it.

Good places to find many of them are:

- https://collinsradio.org
- https://www.angelfire.com/de/vk3kcm/

General Approach

The 30L-1 had been resting for at least ten years, and the electrolytic capacitor had given up, as you can clearly see on the photo to the left.

I wasn't surprised, it's the same story as almost every other old equipment I've restored. But in this case I had a possible alternative: Francesco also gave me a very nice retrofit

ment, a hallmark of Collins design philosophy. Many service bulletins became standard references for technicians and restorers, and today they remain valuable historical documents that capture the evolution of some of the most respected radio equipment ever made.

The Bulletins and CCA

Thanks to preservation efforts by enthusiasts and organizations such as the **Collins Collectors Association** (CCA), these bulletins are still accessible and widely used by collectors, restorers, and historians. They continue to offer insight into Collins' meticulous engineering processes and the depth of care extended to its user base—a practice that helped solidify the Collins name as synonymous with quality and precision in the golden age of radio.

SBs for the 30L-1

One of the most remarkable aspects of the Collins 30L-1 is not simply its widespread popularity or long production life, but the stability of its design. Introduced in 1961, the 30L-1 remained in production for two full decades **with only minimal changes**, a fact that speaks volumes about the quality of the original engineering. From the outset, the amplifier struck a rare balance between cost, performance, and reliability—delivering solid power output in a compact, accessible form factor.

While a few Service Bulletins were issued over the years, these addressed **minor refinements** rather than fundamental flaws: improved wiring for 240V operation, a modest bias voltage adjustment to reduce tube idle current, and enhanced protection against rare component failures. The core circuit, layout, and operational concept remained unchanged. This enduring design integrity reflects not only the expertise of its creator, Gene Senti, but also the Collins ethos of doing things right the first time. In a field where many products evolve through successive fixes and redesigns, the 30L-1 stands out as a case of getting it right from the start.

Practically

My 30L-1 was already 230V, so SB-1 and -4 were not interesting for me, while SB-2 (backward meter deflection) and SB-3 (reducing idle current) were already applied. So only SB-5 was relevant in my case: R15 must be 5W; mine was 18x8 mm, and so 2W, and I replaced it.

Photo: The four JAN 811A are a spectacle in themselves. It is a pity to keep them closed in the 30L-1, but the high voltages required for their operation leave no other choice...

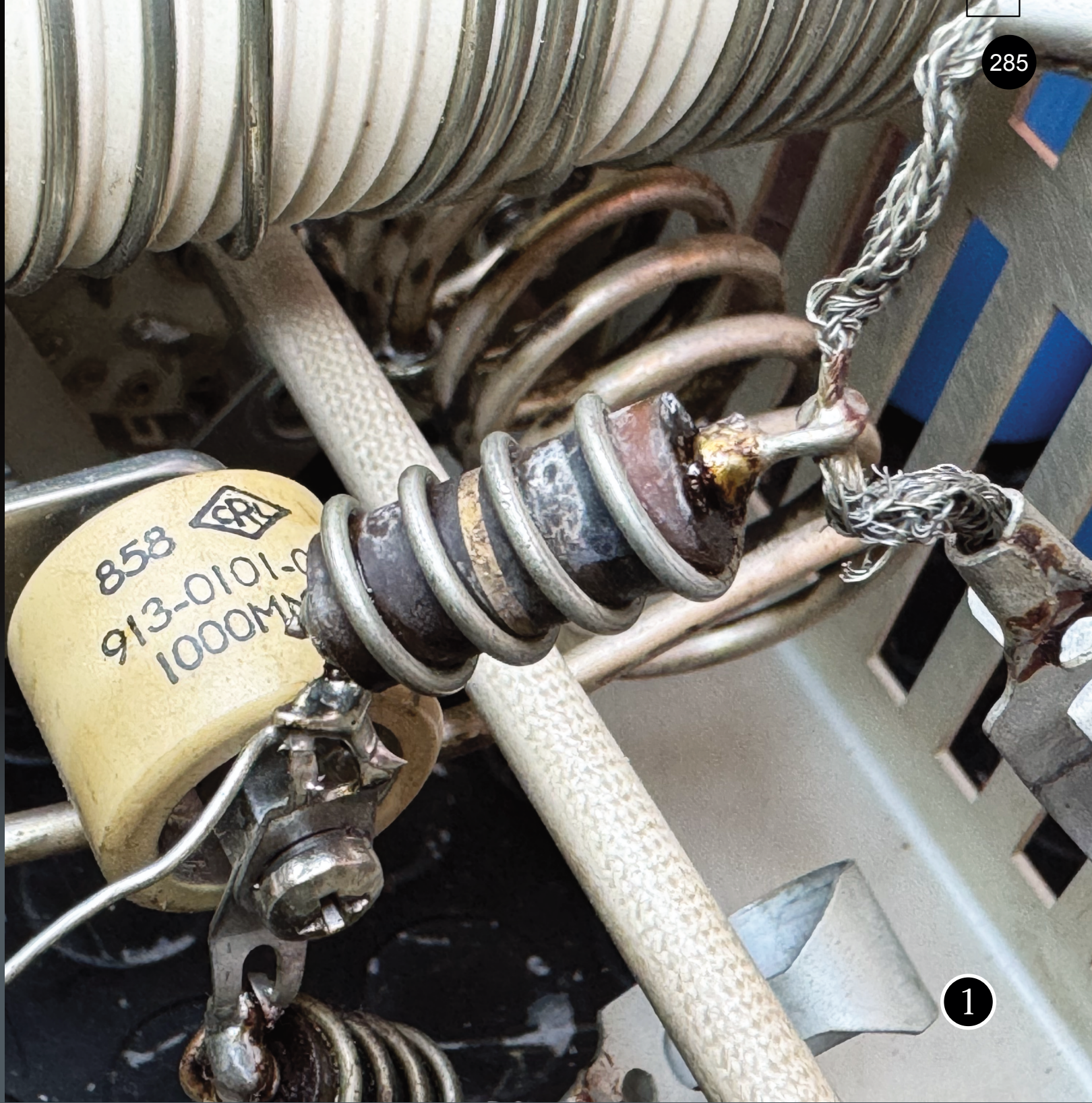
The Tube and the Glue

Choosing the Right Adhesive

However, the choice of **adhesive** is critical, and you can find many opinions on this in the various forums. I have learned that a high temperature epoxy is ideal. It can withstand the heat generated during tube operation and provides a strong, permanent bond. An alternative, slightly more forgiving option is high-temperature RTV silicone, which remains flexible and can absorb minor impacts or thermal expansion.

Certain glues should be avoided, especially cyanoacrylates (e.g., Attak), which cannot withstand high temperatures and can release corrosive fumes. Also, low-temperature hot melts are not suitable as they soften under operating conditions.

I decided to use **Permatex Ultra Copper** paste because it remains slightly elastic and is highly temperature resistant. I was afraid that it could be conductive, and of course I didn't like it, also because it



1

Timeless

Once again we are talking about the Collins 51S-1, described in more detail in [VRE]; this time we are going to go deeper into some service issues, and describe a third 51S-1 that required a bit more effort than the first two.

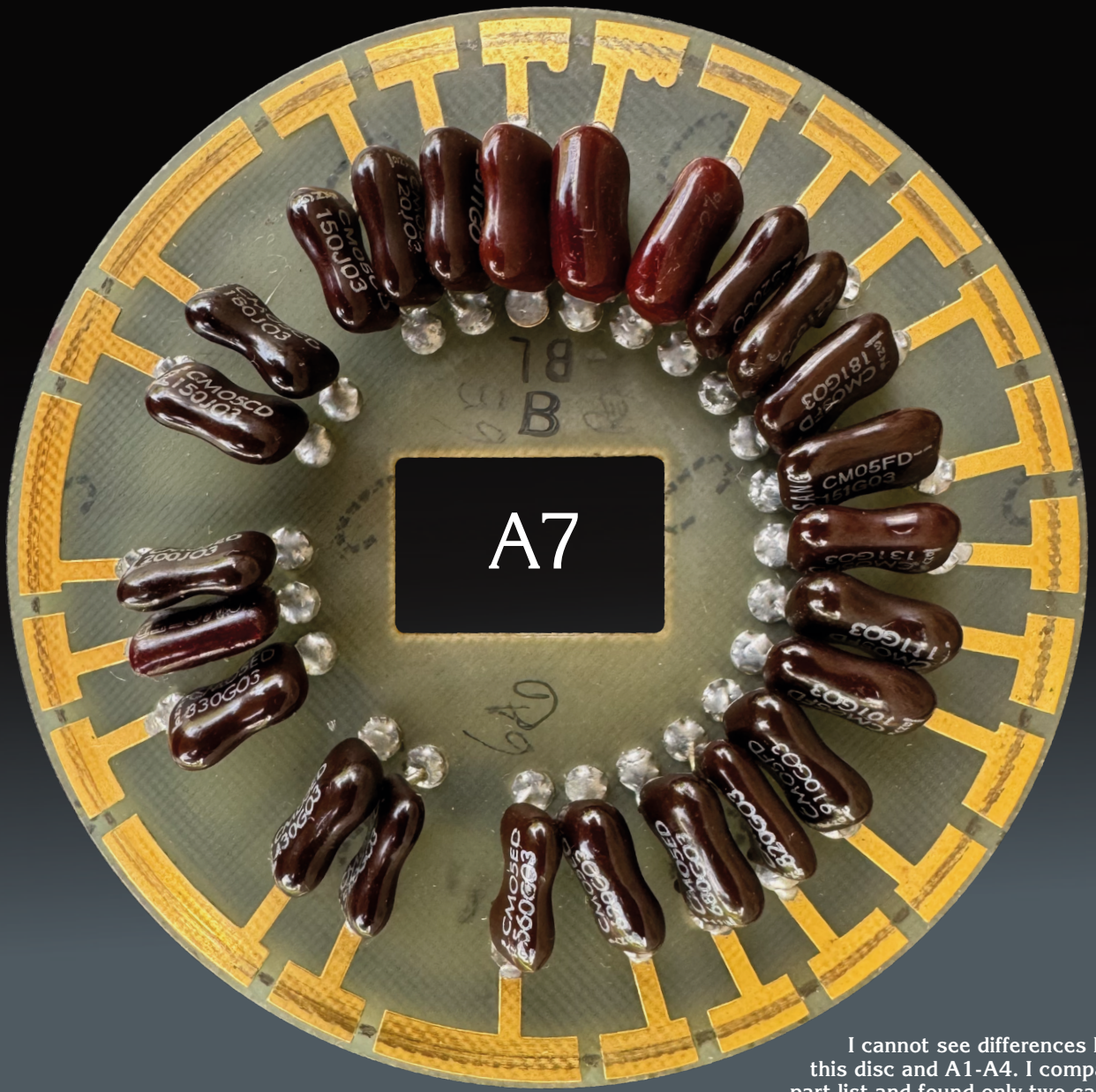
J'Adore

I have to admit that I literally adore this receiver, not only because it is probably the best one I own (OK, the concept of "best" is debatable...), but also because I love its ease of use and its timeless design, inspired by the other S/Line sets, even if, as we have repeated several times, the 51S-1 was not part of it; the S/Line was aimed at radio amateurs, while the 51S-1 was a professional product aimed more at the commercial and military/institutional markets.

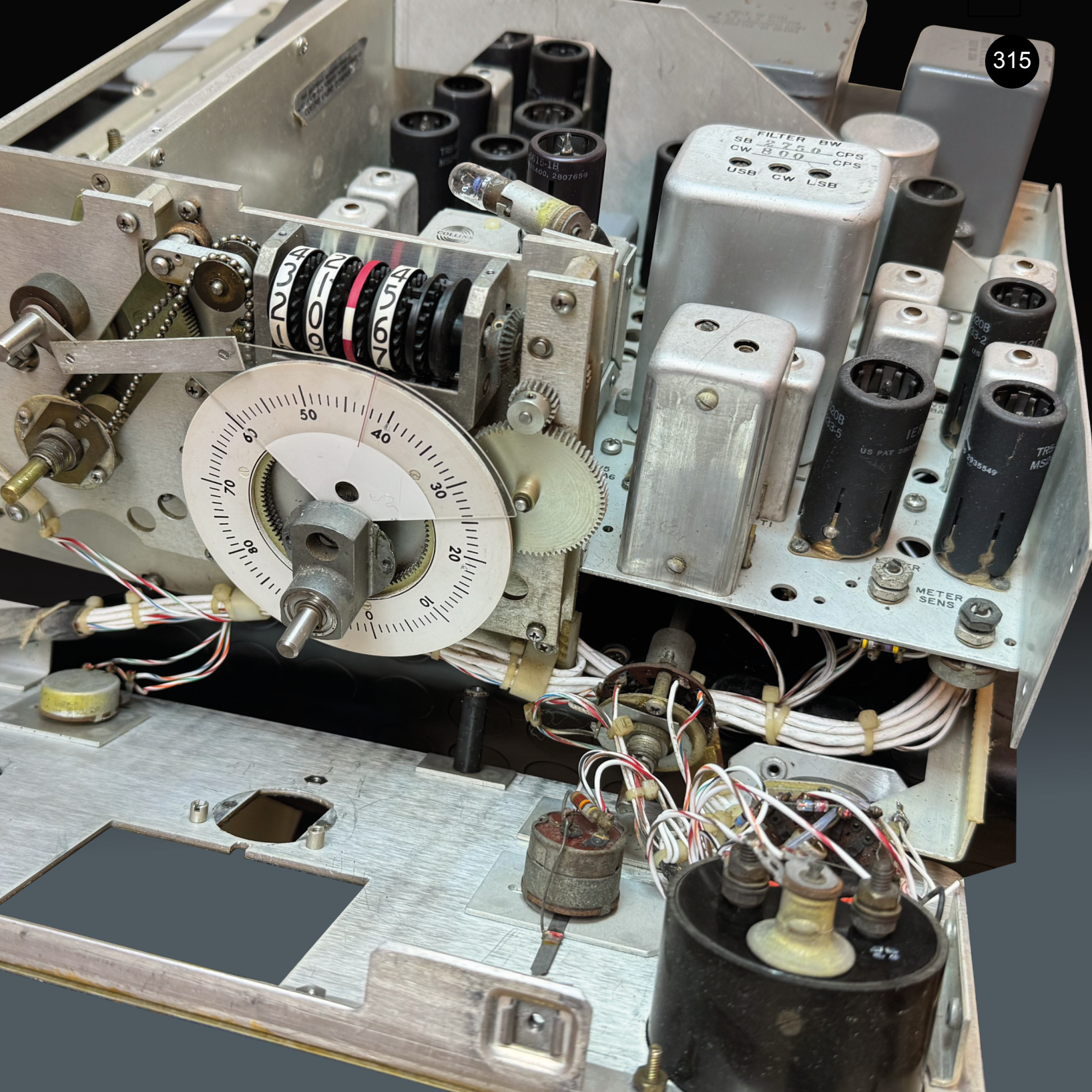
The Timeless Elegance

Few pieces of electronic equipment have achieved the iconic status of the Collins S/Line and the 51S-1 receiver—not only for their technical excellence, but for their understated, enduring beauty.

With their restrained gray cabinets, finely machined knobs, and clearly laid-out dials, these radios reflect a design approach driven by function rather than style. Nothing feels superfluous: controls are limited to what is necessary, labeling is clear and legible, and the overall layout is optimized for operation rather than visual impact. The matte panels and high-contrast nomenclature recall professional equipment built for long hours of use, where clarity and reliability matter more than appearance.



I cannot see differences between this disc and A1-A4. I compared the part list and found only two capacitors with minimal differences (435 pF instead of 430 and 220 instead of 200).


FILTER BW
SB 2750 CPS
CW 800 CPS
USB CW LSB
METER SENS

The Third Twin

Like a mother who, after giving birth to two twins, discovers that another one is coming, here is the third 51S-1, again from my friend **Francesco Sartorello**, who owns an unspecified number of these receivers. But **Terzo**, that's its name ("Third" in English), did not arrive as perfect as the first two, as you can see in the photo. So I have another wonderful opportunity to play with one of these technological monsters, and I will write this part of the 51S-1 chapter as a diary of its restoration.

First Interventions

The beast is not in bad shape. A little dirty, but complete and without any obvious signs of damage.

The first thing I do is to completely remove the **front panel**, which was partially disassembled. Quite tricky as some nuts are very difficult to remove. You can see what remains of the 51S-1 on the next two pages.

I want now to remove all the **tubes** storing them in a safe place. At the same time, I label them twice. In the past, I had to carefully analyze the insides of some tubes to understand what type they were, as the writing on the glass had been lost.

After that the **cleaning**; I don't like working on dirty equipment. But how to make it clean? I decide that it is time to equip my lab with an air compressor; I found one on Amazon, declared to be very quiet (58 dB), while most are at 98 dB. It arrives in less than 24 hours. It really is quite quiet and with my beloved Chanteclair detergent, brushes and sponges, I get a satisfactory result in less than a couple of hours. The aluminum was a bit oxidized, but not too much.

Then I start **reassembling the panel**; I had to use the old trick of the glue to reinstall the most critical washers and nuts, but the operation is not particularly difficult, and I can find almost every part in the accompanying box. The experience with the other two 51S-1 is helpful.

I notice that there are several new electrolytic capacitors already installed; this is not a good sign. Could it be that Francesco came across these areas years ago and identified this receiver as having a major defect? We shall see...


STBY
OFF
ON
CAL
ZERO SET
MEGACYCLES
RF GAIN
PHONES
S-LINE
51S-1
REJECTION TUNING
OFF
RF +10DBM 0DBM
EMISSION
USB
CW
LSB
AM
AF GAIN
Principale 16'
Principale 8'
Flauto 8'
Dulciana 8'
Voce Umana 8'
Ottava 4'
Flauto 4'
Duodecima 2⅔'
Sesquitera 2⅔'
Quintadecima 2'
Decimanona 1⅓'
Ripieno 5F
Bordone 8'
Viola Gamba 8'
Viola Celeste 8'
Oboe 8'
Principalino 8'
Salicional 8'
Flauto 4'
Nazardo 2⅔'
Flautino 2'
Ottavina 2'
Decimino 1⅓'
Quinta 1⅓'