October 2020 OVRC Meeting

October 14, 2020

Agenda

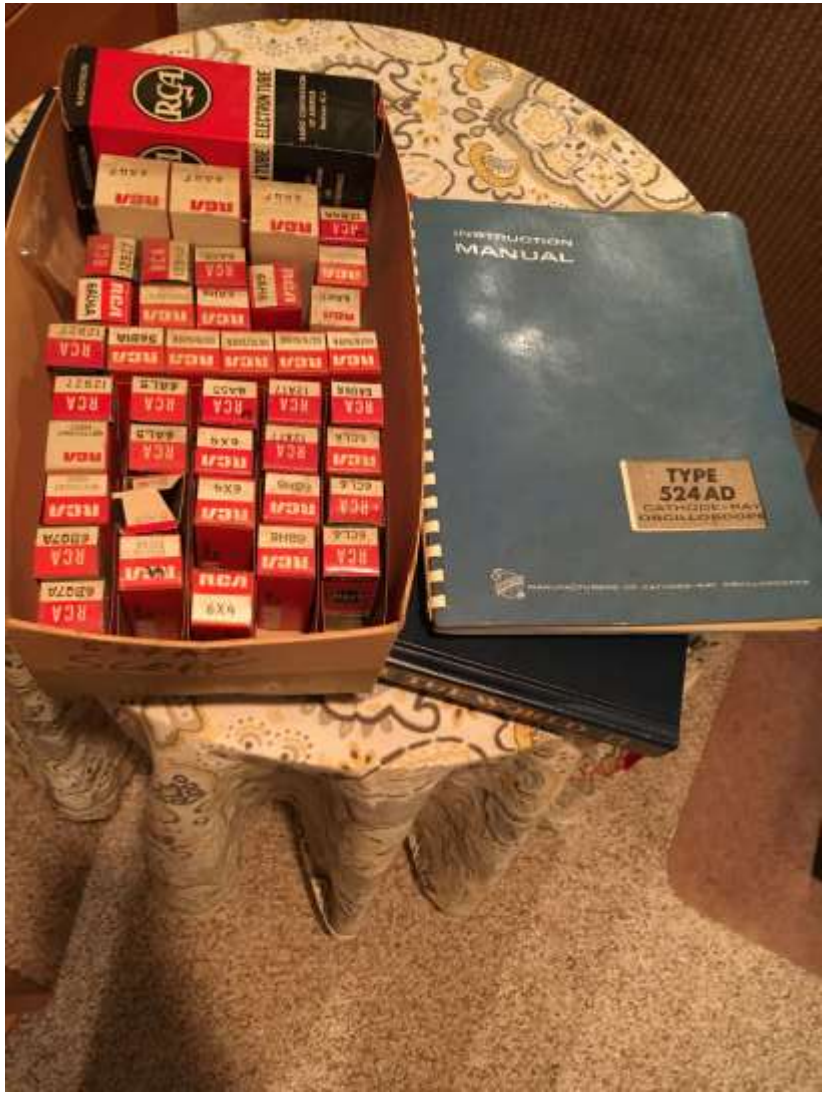
- Administrivia
- Adds
- Collins

Administrivia

- Next meeting: November 11. “Book Club” This meeting will run on audience participation. Come prepared to talk about your favorite old radio/electronic book.
- December meeting will be the AGM (Annual General Meeting) and Elections. This club would not exist without volunteers. We need YOU!
- Apologies for the odd behaviour of the latest newsletter attachment. (let me know if it is an issue for you)
- Lots of feedback on parts suppliers. Will update and put on the club web page.

For Sale: Tek 524AC scope

Contact Sol Rauch solrauch878@gmail.com



For Sale: Marconi Radio Phono

Contact Sol Rauch solrauch878@gmail.com

Motor

FADA Radio: Model # unknown. There is some delamination of the veneer on the end panels, but the veneer is all there. **Free to a new home** if someone wants it. Located in COLLINGWOOD Ont. *(contact Gord or Barry)*

Collins Radio

Ralph Cameron, John Gilbert, Bill Kirkland, Gord Rabjohn

Collins Overview

- Pre war
- War Effort
- Post War
- Technology
- Collins Canada

Collins Radio Overview

- Collins Radio was a well-respected manufacturer of amateur, military, avionics and commercial radio products.
- They never marketed to the consumer market.
- Although well known for quality amateur radio equipment, this market represented a small part of company revenue. However, Arthur Collins always had a special interest in this segment. Collins ham radio equipment was always considered the “Cadillac” in the industry.
- They had a Canadian operation in Toronto.
- Main emphasis is on radio equipment, not avionics or digital, up to merger with Rockwell in 1973 (40 years of operation).

Collins Manufacturing Floor
Cedar Rapids
Circa 1973

Collins Radio

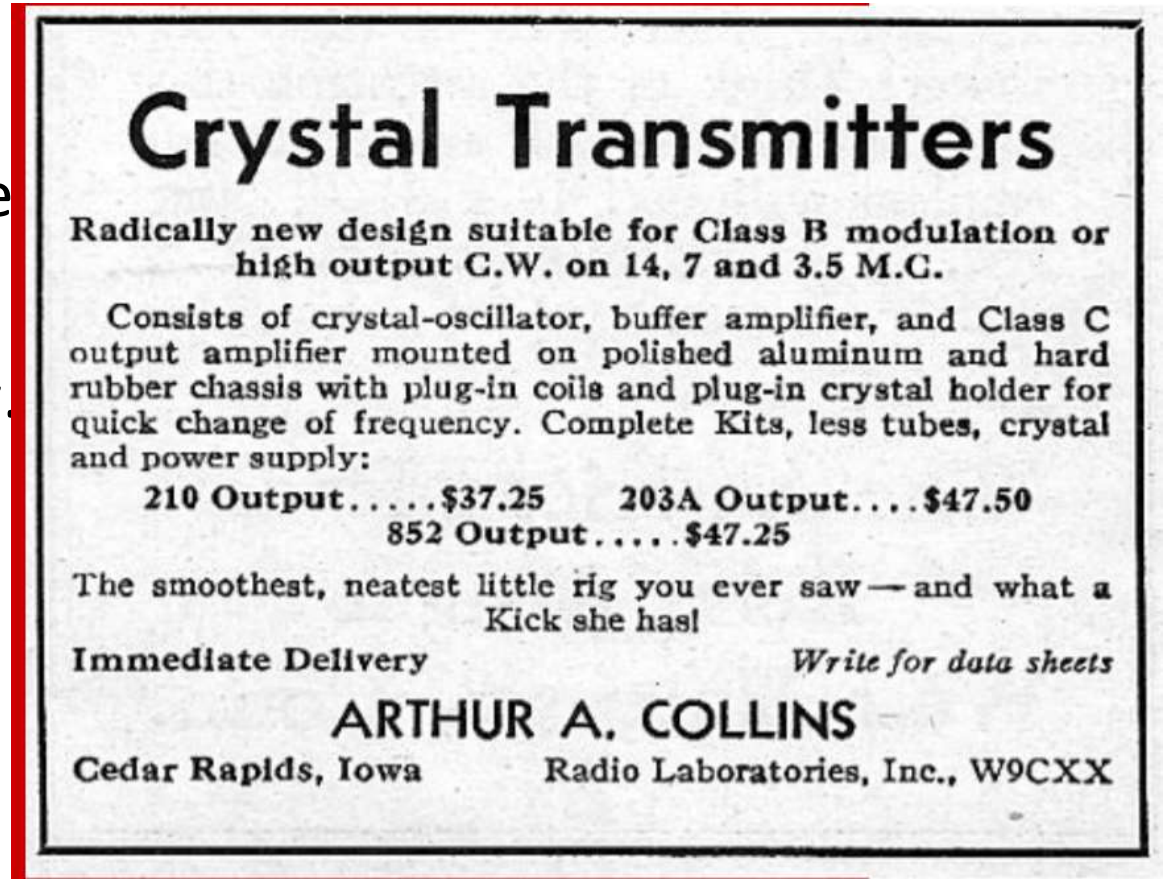
- Founded by Arthur A. Collins in Cedar Rapids, Iowa, in 1931 (at the age of 22). Incorporated 1933.
  - Born in 1909.
  - Avid ham.
  - Demonstrated that reliable day-time communications could be achieved on 20M (14MHz), and maintained contact with the MacMillan Arctic mission in 1925. (age of 16)
  - Wrote an article for “Radio Age” at the age of 16
- In 1933, did shortwave and commercial broadcast equipment.

Arthur Collins'
Ham Shack
Circa 1925

Collins Pre-WW2

- First time radio transmitting apparatus was available for purchase as an assembled and working unit.
- Collins *eliminated clutter by packaging equipment into neat units.*
- Correctly engineered construction stabilized circuitry and made its behaviour predictable;
- 30 series transmitters
- 45A transmitter
- 300E 300F broadcast transmitters (successful, >1000 sold before WW2)

Early Ad in QST (Jan 1932)



Crystal Transmitters

Radically new design suitable for Class B modulation or high output C.W. on 14, 7 and 3.5 M.C.

Consists of crystal-oscillator, buffer amplifier, and Class C output amplifier mounted on polished aluminum and hard rubber chassis with plug-in coils and plug-in crystal holder for quick change of frequency. Complete Kits, less tubes, crystal and power supply:

210 Output.....$37.25 203A Output....$47.50
852 Output.....$47.25

The smoothest, neatest little rig you ever saw—and what a Kick she has!

Immediate Delivery *Write for data sheets*

ARTHUR A. COLLINS

Cedar Rapids, Iowa Radio Laboratories, Inc., W9CXX

https://www.k4vrc.com/uploads/7/8/8/6/78865320/collins_history_presentation_tvarc_9-21_[w3my_russ].pdf

30FXB transmitter “It’s ultramodern dress will lend an air of distinction to anybody’s library”… 1937-39
203A final

TECHNICAL DATA

POWER OUTPUT—100 watts nominal rating (203A).

FREQUENCY RANGE—1500 to 15,000 kc. (standard). New isolantite coil forms are used.

FREQUENCY CONTROL—Crystal oscillator with isolation of oscillator from amplifier by a buffer stage.

POWER SUPPLIES—1000 and 1250 volts at 400 MA DC for modulators and power amplifier. 400 volts DC for crystal and buffer.

MODULATOR—Two 830B or 203A tubes are used in Class B.

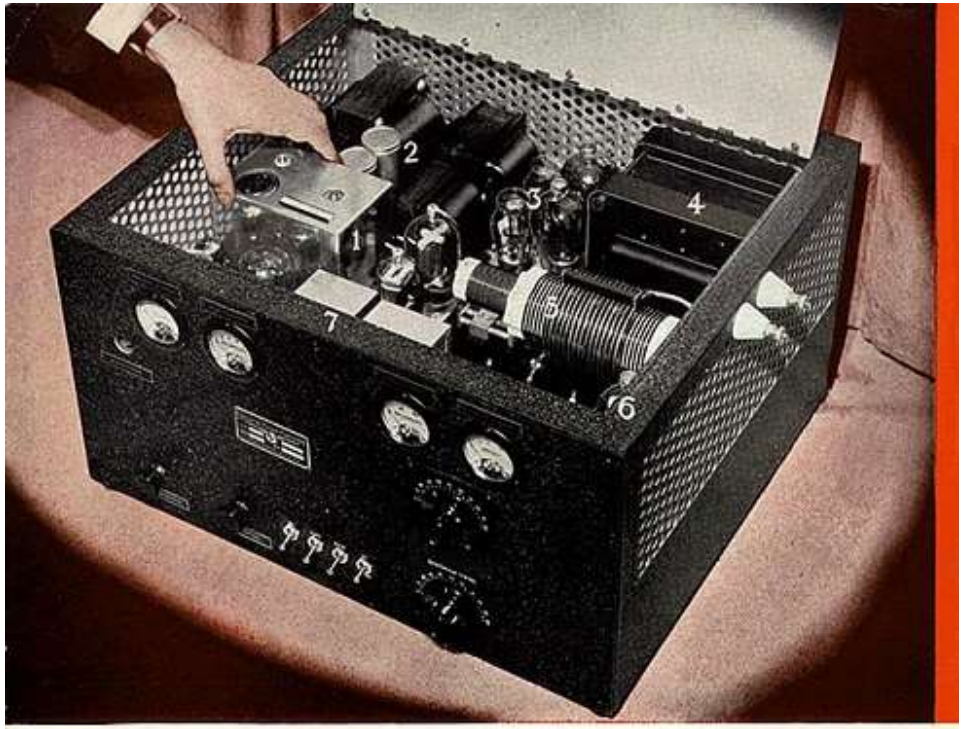
more and more amateurs are ordering Type 30-FXB Transmitters. Mail COLLINS RADIO a card and complete data on this moderately priced transmitter will be sent to you.

☆

Here is shown a typical Type 30-FXB Installation in the home of a well-known amateur—note its pleasing lines and the ease with which it fits into the well-appointed home.

☆

All collinsradio.org



INSIDE THE 45A

"Inside dope" on the 45A is no longer at a premium. The September issue of the COLLINS SIGNAL contains the full story. Write at once if you have not received your copy.

Shown above are: (1) Interchangeable frequency shift unit with built-in crystal, (2) low-voltage power supply and its impregnated dielectric filter condensers, (3) rectifier tubes, (4) 400 volt-ampere high voltage transformer, (5) radically new output circuit, (6) plate end of the C-211D output tube, (7) high fidelity speech amplifier.

Not shown are: (a) The neat arrangement of components beneath the chassis, and (b) the times-two factor of safety in every part which makes this transmitter a real high-powered baby.

. . . . . still another new model, a 600 watt set, will be described next month.

Collins Radio Company

CEDAR RAPIDS, IOWA, U. S. A.

New York
11 West 42nd St.

Mexico City
Edificio "La Nacional"

45A transmitter
1933-34 40W AM, 120W CW. 211H final tube.
Very Popular (Amateur, police, military)

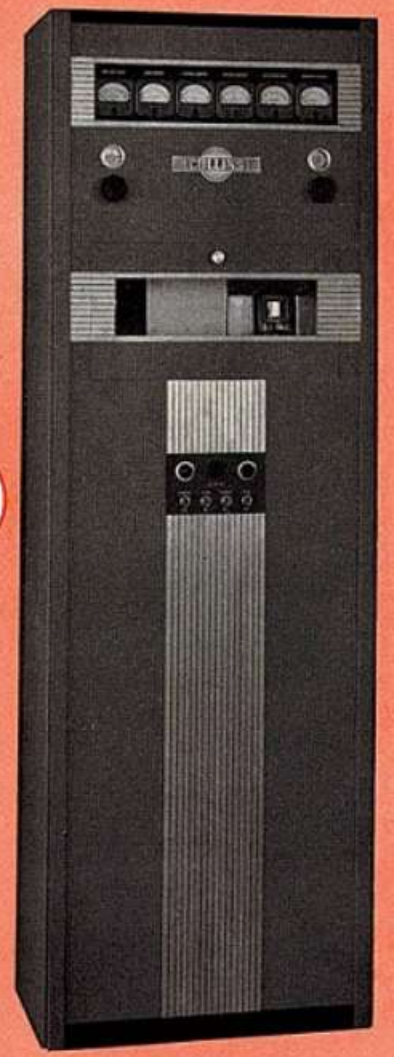
All collinsradio.org

It's Our Baby and We Love It

If you haven't already heard, we are talking about Collins' newest arrival, the 30J 250 watt Transmitter. With a power increase of 40% over the 30FXC, the 30J remains in the 30FXC price class. New styling and new mechanical features are a pleasure to the eye and an aid to better operating. Simplified tuning has been the key note of the design. Like all proud parents, we could go on and on, but a glance at the specifications will show you that we are not unjustly proud.

SPECIFICATIONS

POWER OUTPUT: 250 watts Phone and CW.
FREQUENCY RANGE: 1.5 to 30 megacycles (.5 mc. to 60 mc. on special order).
FREQUENCY CHANGE: Plug-in coils.
POWER SOURCE: 110 volt, 50-60 cycle, single phase A.C., 1200 V.A.
TUBE COMPLEMENT: 1 — C100D Oscillator.
1 — 807 First Doubler-Amplifier.
1 — 807 Second Doubler-Amplifier.
3 — 807 Third Doubler-Amplifiers.
2 — C101 Final Amplifiers.
2 — 6J5G Audio Amplifiers.
2 — 6F6G Audio Drivers.
2 — C120 Modulators.
2 — C219B Mercury Vapor Rectifiers.
2 — C866A Mercury Vapor Rectifiers.
1 — 5Z3 Low Voltage Rectifier.
MODULATION: High level, Class "B".
CRYSTAL: "A" cut in 29½ or 1A holder.
AUDIO FREQUENCY INPUT: From microphone — 40 db at 50,000 ohms.
AUDIO FREQUENCY RESPONSE: Plus or minus 1.5 db from 100 to 5000 cycles.
CARRIER NOISE: More than 40 db below 100% modulation.
OUTPUT CIRCUIT: Pi tank circuit for operation with balanced transmission line or feeder.
CABINET DIMENSIONS: 60" x 20" x 13"
WEIGHT: 300 pounds.
NEW MECHANICAL FEATURES: "Streamlined" cabinet. Hinged rear door. Tube access window. Rectangular instruments behind glass window. Pretuned excitation tank circuits adjustable through access window. Further refinements in workmanship.
NEW ELECTRICAL FEATURES: Simplified output circuit. Link coupling to pushpull final amplifier. Fixed grid bias. Stage by stage metering and switching. Three power supplies. Negative resistance oscillator. Beam excitation tubes. Convenient control circuits.



30J

COLLINS RADIO COMPANY

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1 — 5Z3 Low Voltage Rectifier.
MODULATION: High level, Class "B".
CRYSTAL: "A" cut in 29½ or 1A holder.
AUDIO FREQUENCY INPUT: From micro-

30J

1938-1941 Amateur, commercial, police…

Collins pre-war history: patent litigation with RCA.

- RCA claimed it had exclusive rights to the de Forest vacuum tube oscillator circuit patent (and other patents), and brought suit against Collins Radio and other purported infringers.
- Robert Goddard’s (of liquid rocket fuel fame) 1915 oscillator patent predated the de Forest patent.
- Collins met with Goddard to explain that RCA's tube monopoly was a serious impediment to competitive innovation in electronics.
- With Goddard's help, the practicality of the Goddard design was demonstrated in court and the suit was dropped in 1938, allowing Collins and others to freely develop new technology.

- (ref Wikipedia Collins radio)

Collins/Amperex C100A
“External Grid” tube

AVERAGE CHARACTERISTICS—COLLINS POWER TUBES

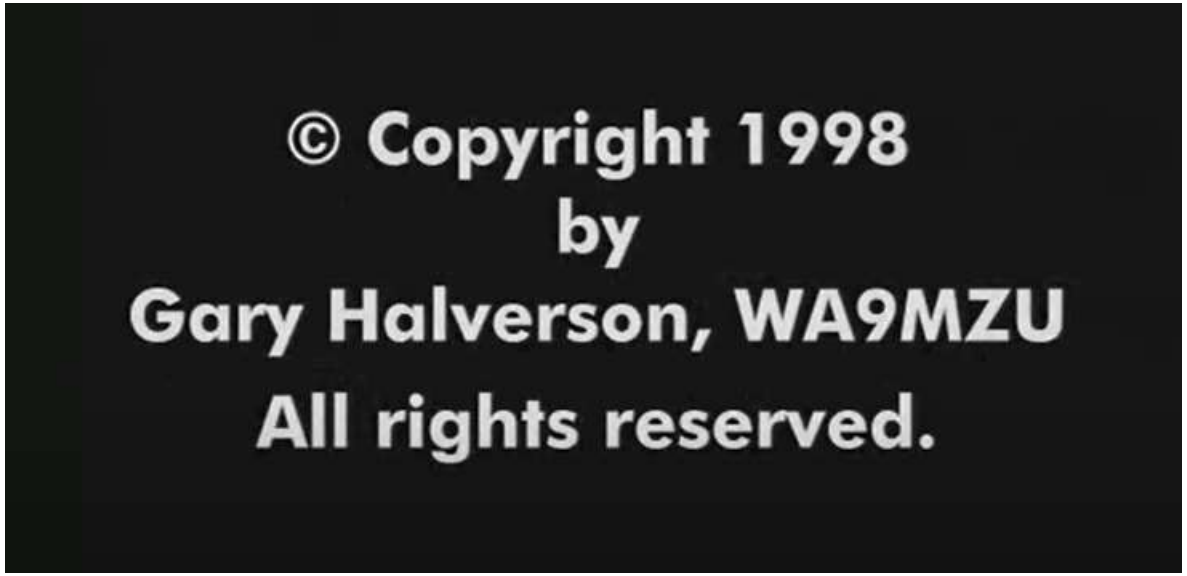
Type	Shape, Size and Base Figure	Filament V.	Filament A.	Max. Plate Dissipation W.	Plate Resistance Ohms	Amplification Factor	Max. D. C. Plate Voltage	Max. D. C. Plate Current	Max. D. C. Grid Current	Max. Freq. for Full Rating MC.	Interelectrode Capacitances Cgp	Cgf	Cpf	Typical Operation: Class Service	D. C. Plate Voltage	D. C. Grid Voltage	D. C. Plate Current	D. C. Grid Current	Plate Loss W.	Power Output W.	Peak A. C. Grid Volts	Load Impedance
C-204A	I	11	3.85	250	6300	25	2500	.275	.080	3	15	12.5	2.3	B, AF	2000	—60	.250		200	600*		8800†
														B, RF	2000	—70	.160		220	100		
														C Mod	2000	—260	.240		160	320		
														C Tel	2000	—175	.250		150	350		
C-211	M	10	3.25	100	3600	12	1250	.175	.050	6	14.5	6.5	5.5	A, AF	1250	—80	.060			20	75	9000
														B, AF	1250	—100	.160		85	260*		8000†
														B, RF	1250	—100	.106		90	42.5		
														C Mod	1000	—260	.150	.035	50	100		
														C Tel	1250	—225	.150	.018	57.5	130		
C-212E	J	14	6.0	275	1900	16	2000	.300	.080	15	18.8	14.9	8.6	A, AF	1500	—57	.167			50		5000
														B, AF	2000	—120	.275		250	600*		6000†
														B, RF	2000	—125	.185		270	100		
														C Mod	1500	—250	.285		100	325	415	
														C Tel	2000	—200	.275		100	450	425	
C-300	E	11.5	4.0	200	5500	24	3000	.275	.075	60	6.5	6.0	1.4	B, AF	2500	—105	.200		200	600*		10000†
														B, RF	2500	—105	.120		200	100		
														C Mod	2500	—350	.175	.050	127.5	310		
														C Tel	2500	—250	.240	.030	200	400		
C-100A	O	2.5	1.75	5.0	10000†	3	250							Oscillator	225‡		.022§			0.75		10000†

* Designates 2 tubes. † Plate to plate impedance. § Oscillating condition. ‡ Effective with 7500 ohms resistance in series with plate supply.

http://www.ase-museoedelpro.org/Museo_Edelpro/Catalogo/tubes/records_nw/C100A/C100A.pdf

Excellent half-hour video.

- http://www.collinsradio.org/cca-collins-historical-archives/the-equipment-of-collins-radio/historical-equipment/lost-decade-video/

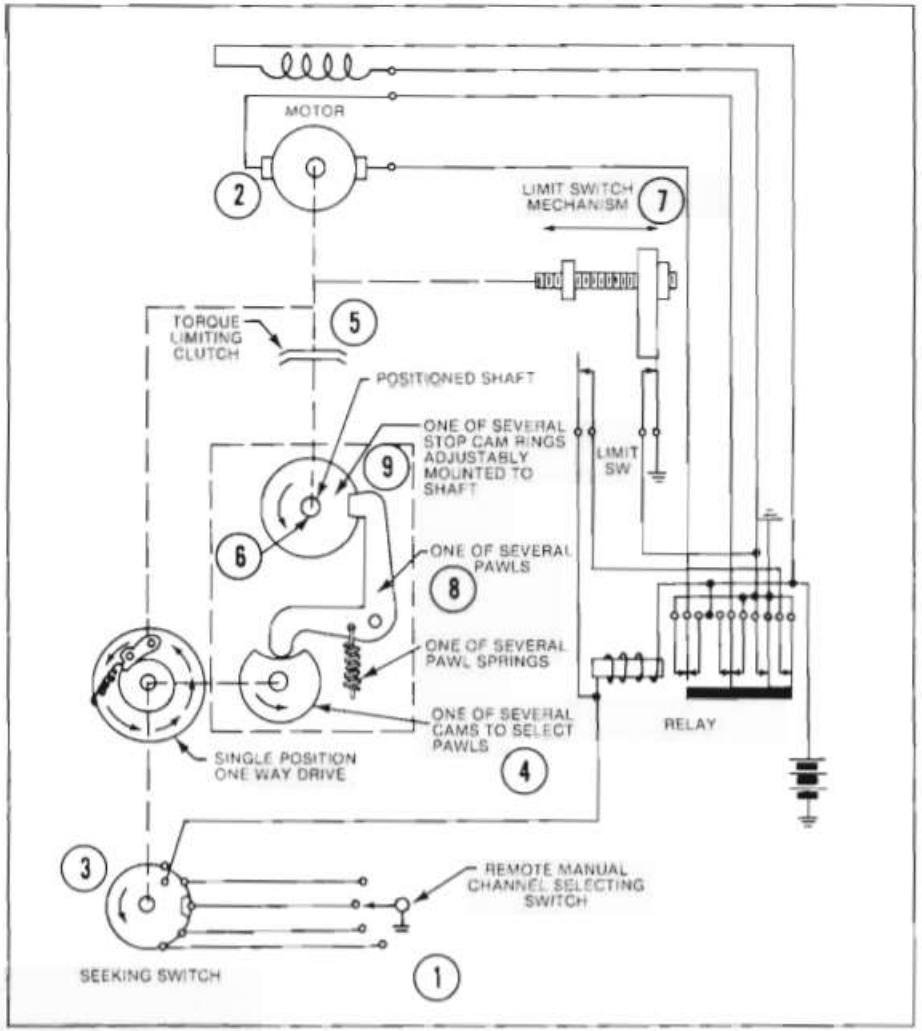


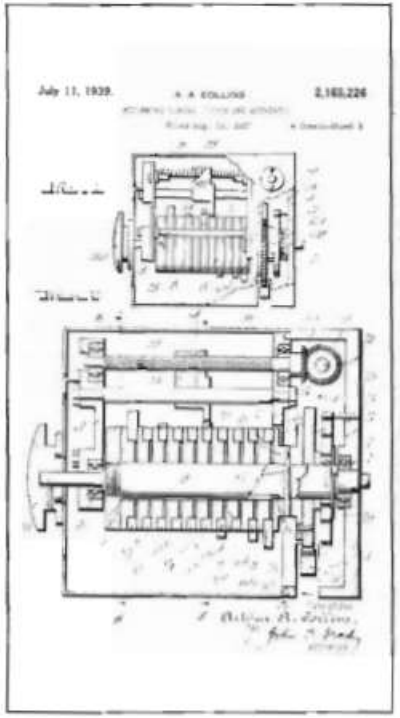
Collins War Effort

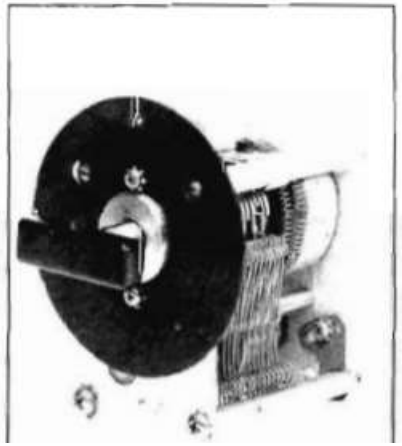
- Entire company converted to military work in 1941
- Automatic tuning: developed earlier but key in WW2
- PTO
- Many systems were developed for the Allies: ADF receiver for Canadian Lancaster, receivers, transmitters, transceivers for aircraft, ship-to-ship & ship-to-shore, HF and VHF. Too many to list!
- An example: AN/ART-13 transmitter

Autotune

- Airline operators had to switch frequencies within short periods of time (plane-to-plane, plane-to-ground, communications with the airport control tower etc).
- The Autotune linked all of the tuning controls of a transmitter into one common dialing system.
- A combination of mechanical engineering and electronics principles.





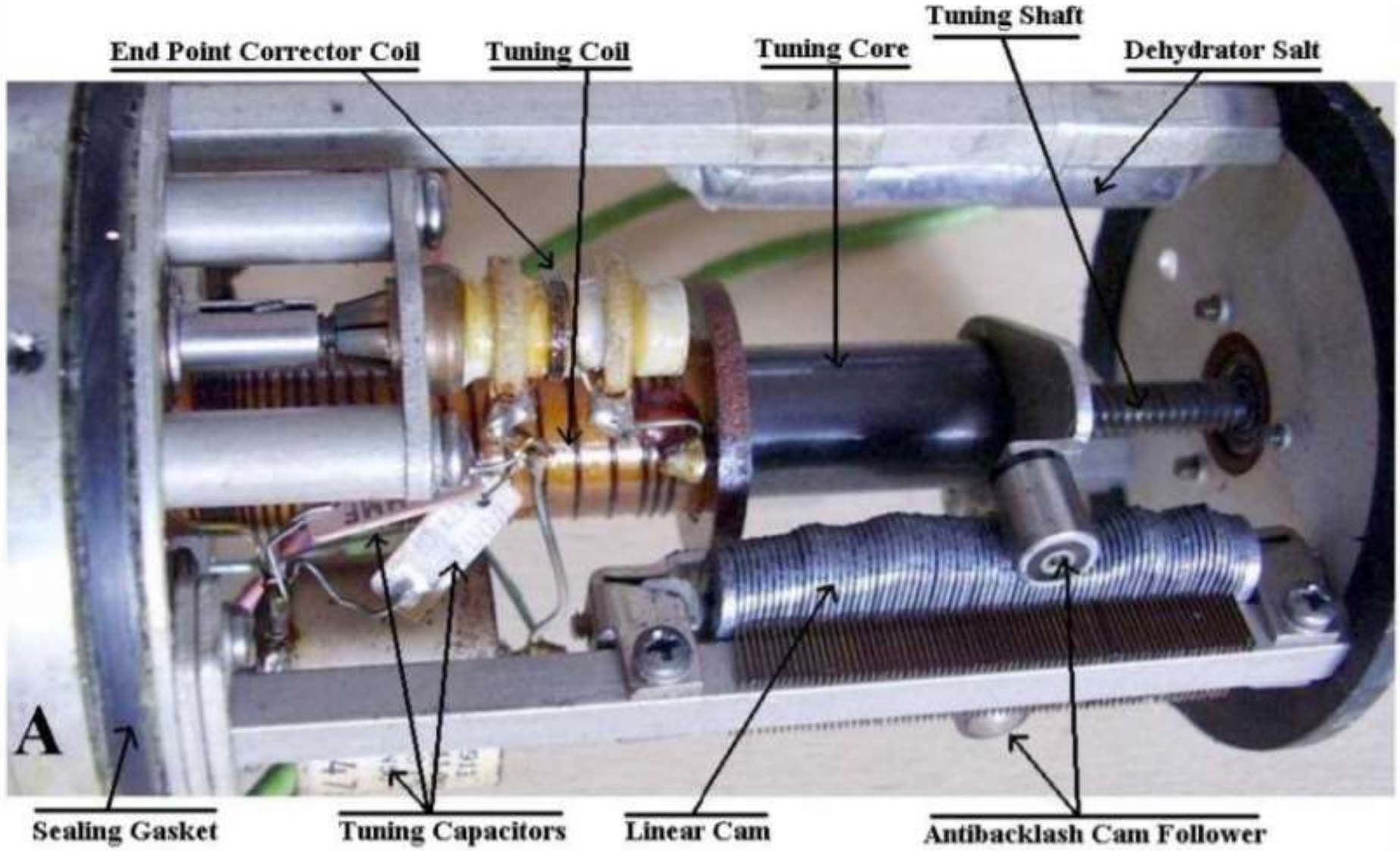


To select a frequency using the Autotune, the radio operator simply dialed a frequency on the channel selecting

the seeking switch remained stationary. The controls were then set and the proper pawl (8) was in posi-

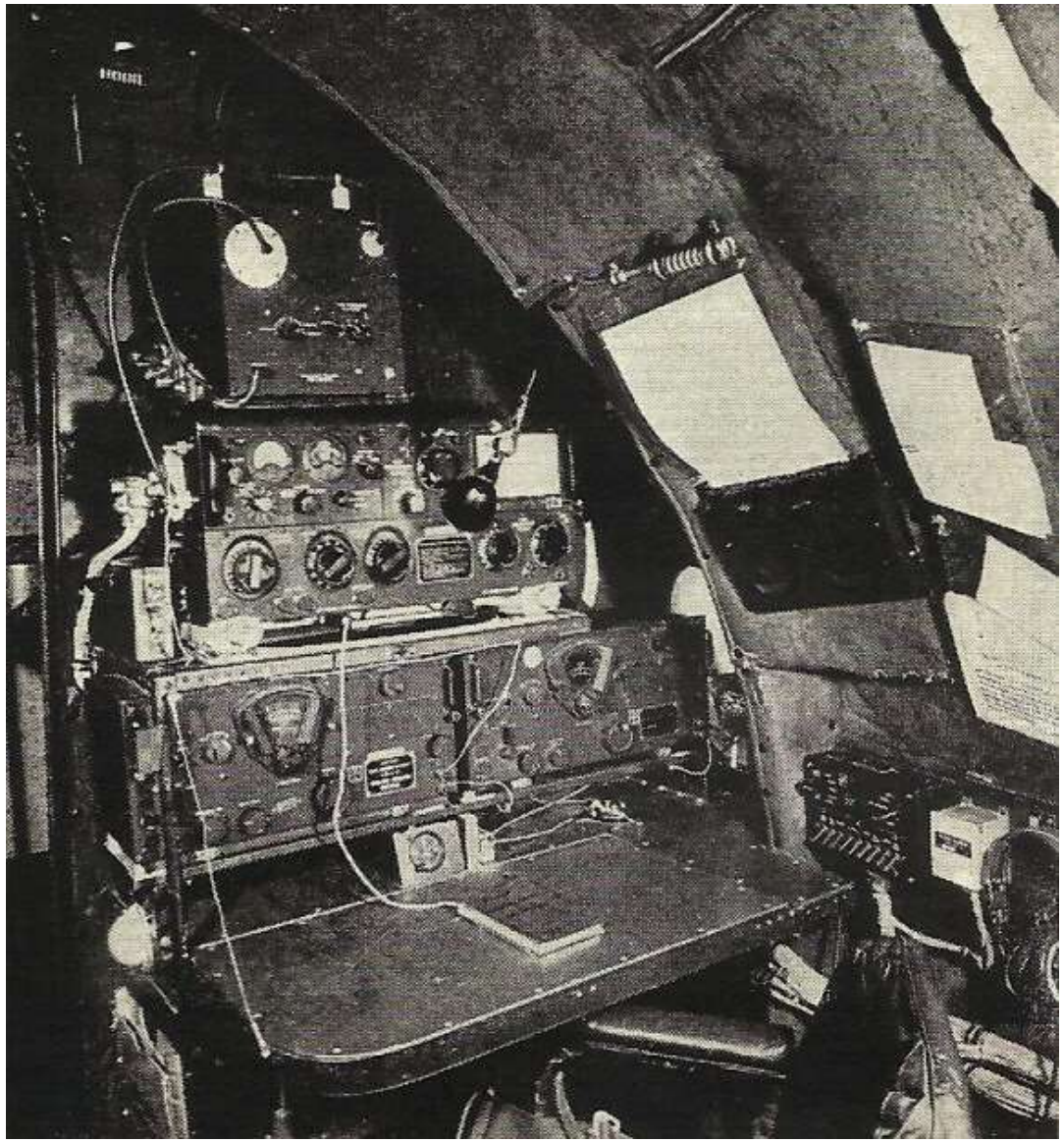
PTO Oscillators, Linear Tuning

- Rather than using variable capacitors, Collins pioneered the use of variable inductances (permeability tuning).
- Eliminates contacts.
- Very rugged.
- Almost linear tuning can be achieved with variable-pitch winding.
- Much research was put into creating stable ferrite cores.
- Linear tuning was fine-tuned with elaborate mechanical assemblies.


End Point Corrector Coil
Tuning Coil
Tuning Core
Tuning Shaft
Dehydrator Salt
A
Sealing Gasket
Tuning Capacitors
Linear Cam
Antibacklash Cam Follower

TCS system 1940-1944
Receive 1.5 to 12 MHz in three ranges; familiar metal tubes
Transmit 25W CW, 1625 (like an 807) final

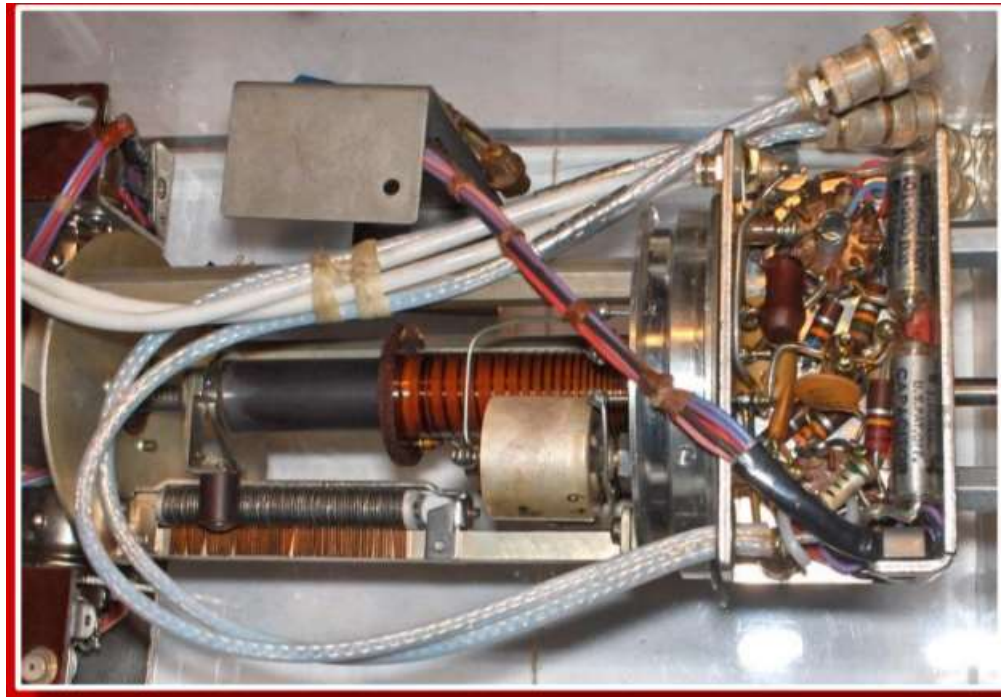
1941-1946 vintage AN/ART-13 Transmitter
Up to 100W up to 18MHz 813 final.
Was used into the 1970's
First use of permeability tuning

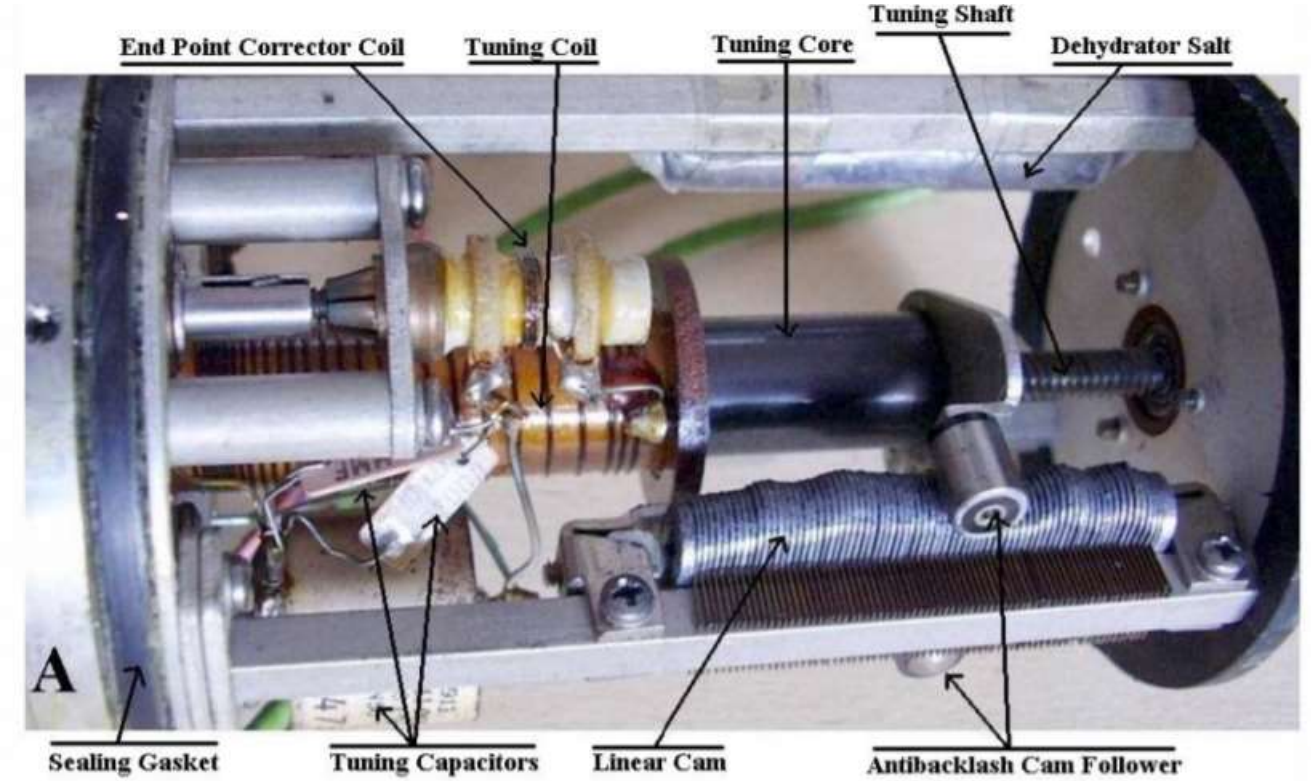


https://www.radioblvd.com/art13.htm

https://www.radioblvd.com/art13.htm

PTO in ART-13





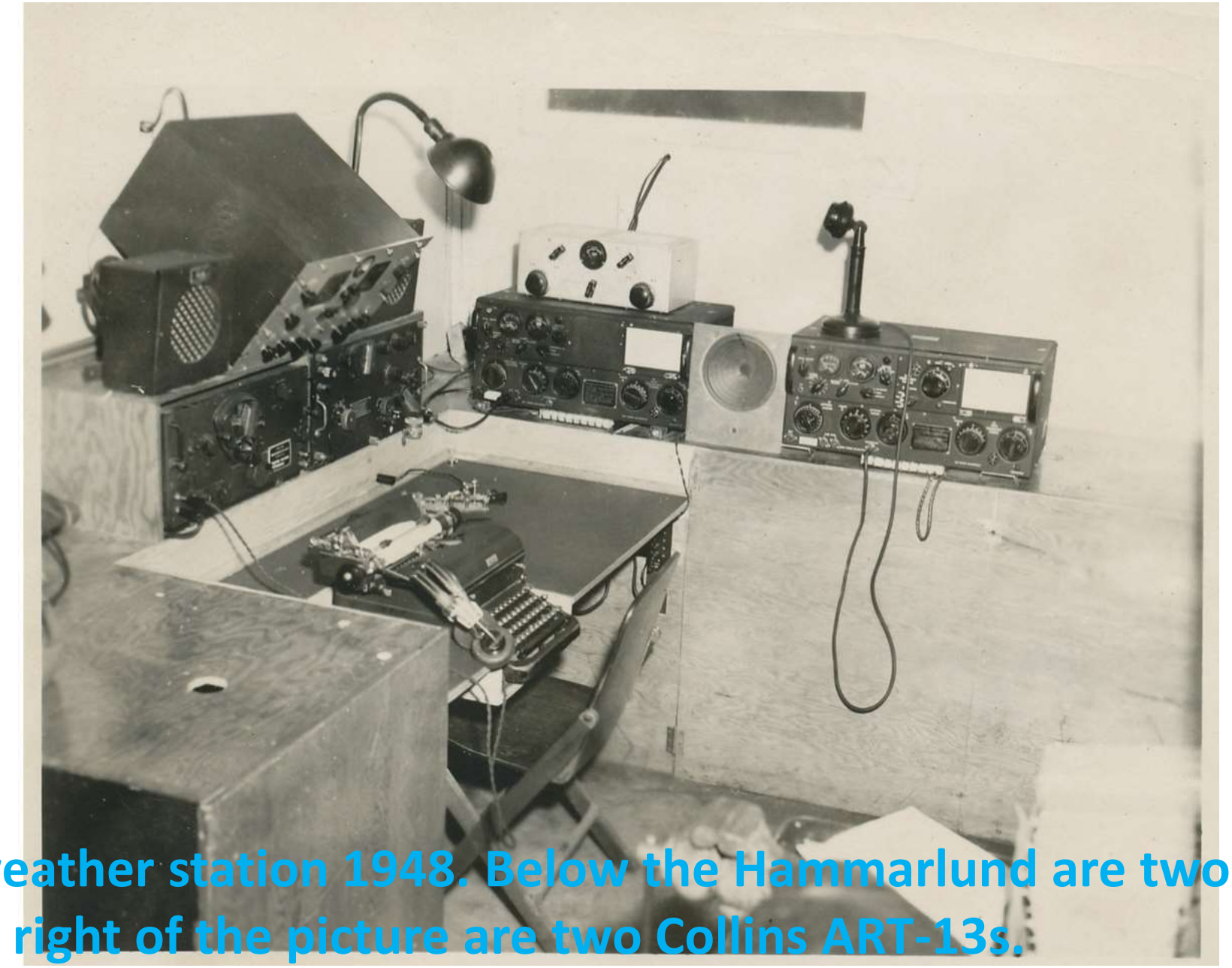
https://www.k4vrc.com/uploads/7/8/8/6/78865320/collins_history_presentation_tvarc_9-21_[w3my_russ].pdf

Wartime use of the ART-13

- Autotuned AN/ART-13 was the flagship of Collins efforts in WW2;
- Installed in Navy planes during the war;
- Installed in every B-29 bomber used in the Pacific Theatre of Operations
- Credited for saving the lives of American pilots in WW2.

Post War use of the ART-13

- Thousands of ART-13 sets available post war and the set was used in a variety of places;
- PLAYED A VITAL COMMUNICATION ROLE WHEN RCAF 308 SQN. USED 'SHORAN' TO MAP CANADA'S NORTH. (Source https://ingeniumcanada.org/ingenium/collection-research/collection-item.php?id=1986.0730.001)
- Basic transmitter for the Joint Arctic Weather Stations from 1947-53
- ART-13 was replaced on the stations around 1953-54 by Collins 30K-4
- ART-13 became emergency transmitter on the stations - battery or hand crank generator powered.



Isachsen weather station 1948. Below the Hammarlund are two BC-348s and on the right of the picture are two Collins ART-13s.

Collins 30K-4s in April 1956 at Eureka Weather Station.

Collins Post WW2

- Flight control instruments
- Radio communication devices
- Satellite voice transmission (earth-moon-earth too)
- Railroad! Atomic energy “Cycloyton”
- Space-based equipment
- Commercial AM transmitters
- Defense, like DEW line equipment
- Data Communications
- SSB ← Collins pushed Single Sideband Communication quite hard.
- And a cult of Ham Radio stuff!

Familiar Ham Radio Equipment

- 1947 75A dual conversion receiver
- 51J general coverage receiver
- R390 general coverage (government)
- 75S
- 51S-1 general coverage

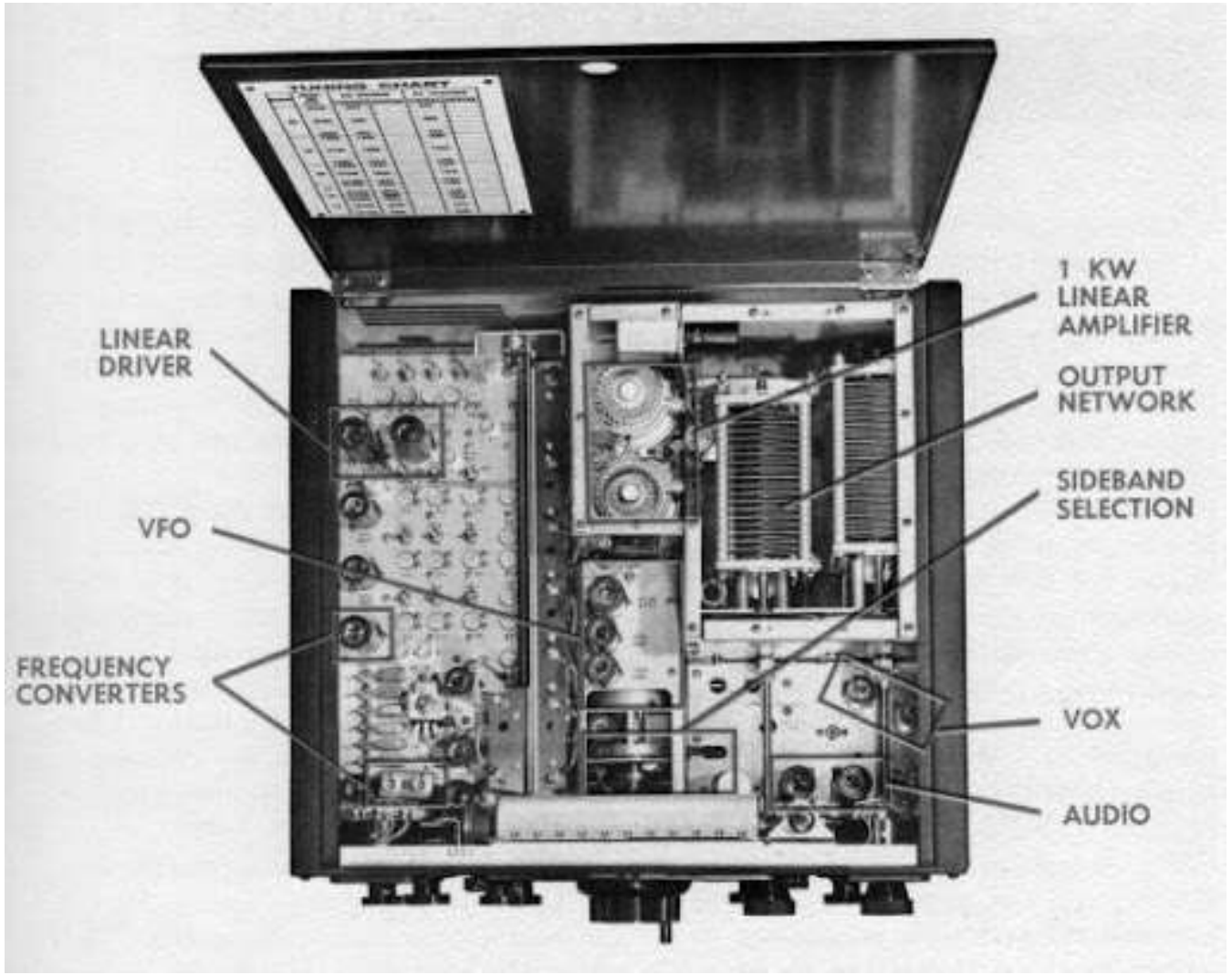
Collins 75A-1 receiver circa late 1947-49: 14 metal (octal) tubes, dual conversion, ham bands.
“Their first modern receiver”

Matching 32V3 transmitter 1949

Collins 51J-4 receiver circa mid 1952-1954: 22 miniature tubes, dual conversion, mechanical filter, general coverage

See Bill Kirkland's article: 51j_Gearbox.pdf

Collins 75A-4 receiver circa mid 1950's: 22 miniature tubes, dual conversion, ham bands



KWS-1 Transmitter 1948-66

KWM-1 Transceiver 1957-76
14-30MHz, miniatures + 6146 final
SSB, Mech filters.

Collins R390 general coverage receiver 1950-54

R390 URR

R390A

R390

- Designed in 1949-1952 for Signal Corps
- 0.5-32MHz in 31 1MHz wide bands.
- (sister R389 did 15kHz-1500kHz)
- R390 used crystal and LC filters. 390A used mechanical filters.

Design of 390 receiver is well-documented

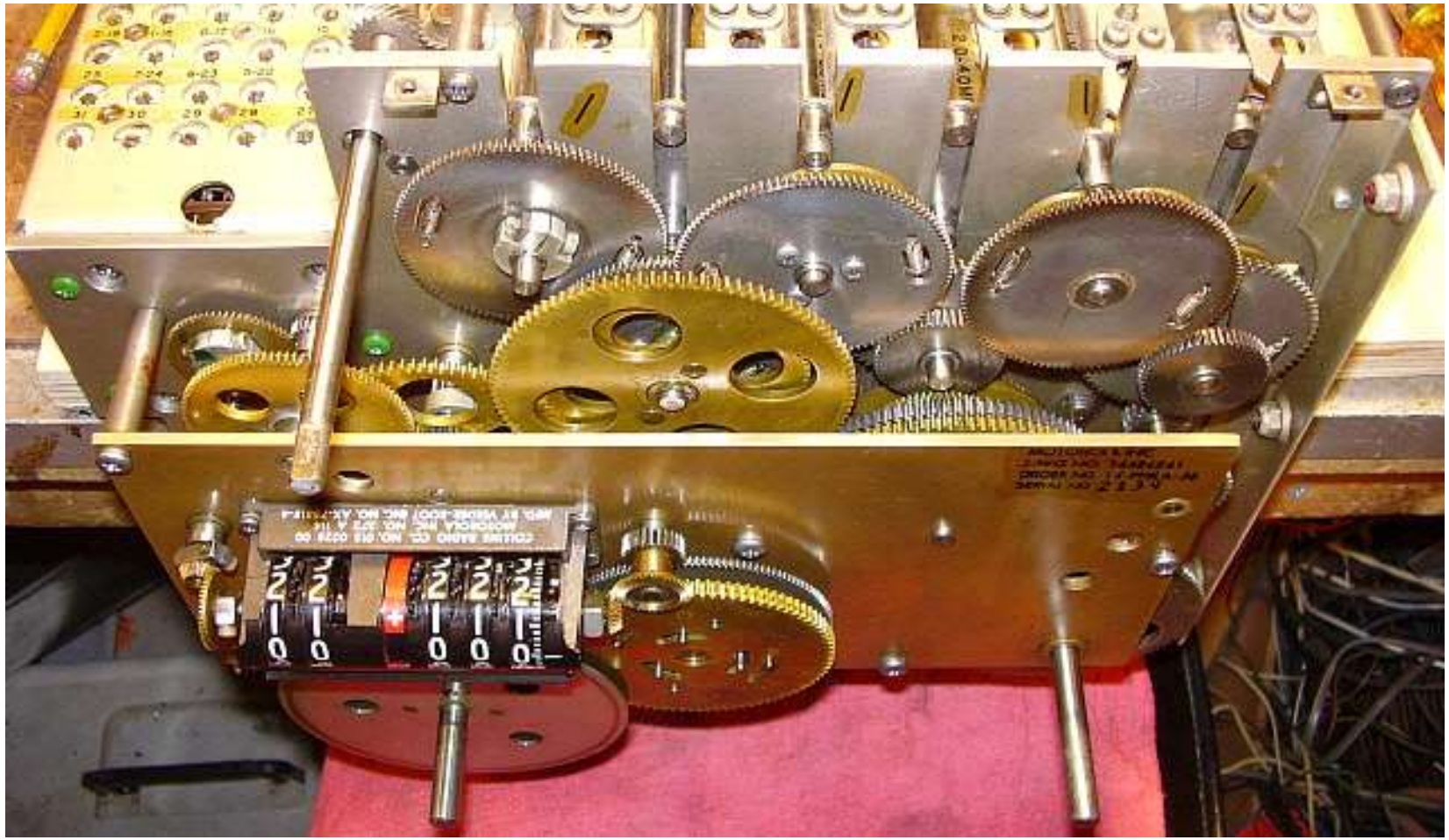
The design documentation (Sept 1953), including detailed design trade-offs is available in a publicly available report. Very educational.

http://www.collinsradio.org/wp-content/uploads/2012/04/R390-CER-No-297-Signal-Corp-Final-Eng-Rpt-Includes-R-389.pdf

Circuit Considerations

The actual circuit layout with tubes, resistors, etc. was designed mostly on the basis of laboratory experiment. It was found that the fill transformer, T-1, should be placed first in the line up. Otherwise the rise in gain on each side of resonance (about 9 db) could overload the last stages before the fill transformer. Also the change in gain between 4 kc (max. gain) and 16 kc(min.) positions had to be compensated. This was accomplished by switching cathode resistors in two stages of amplification.

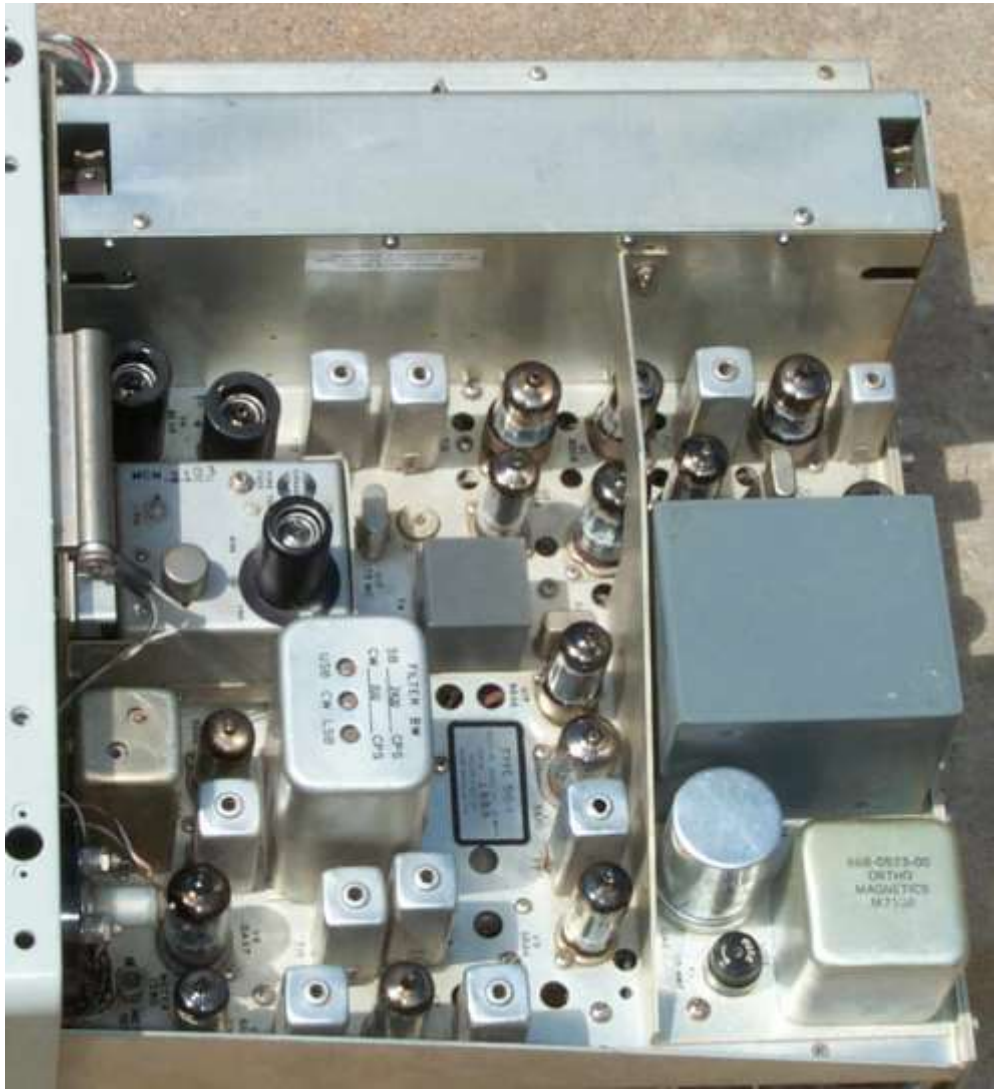
R390A Gears



51S-1 General Coverage Receiver 1959-72

51S-1 General Coverage Rx

- 0.2 to 30MHz in 1MHz bands
- 17 miniature tubes

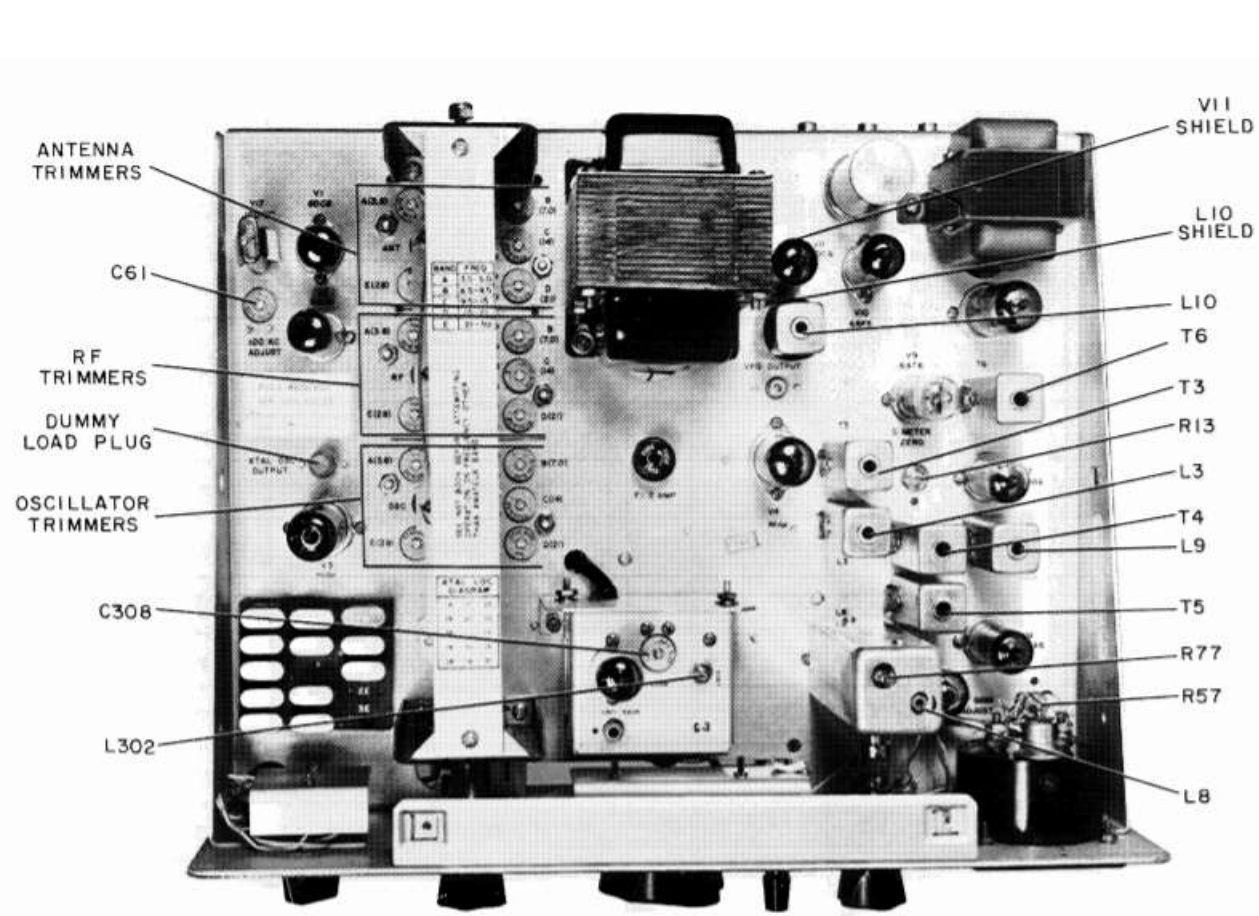


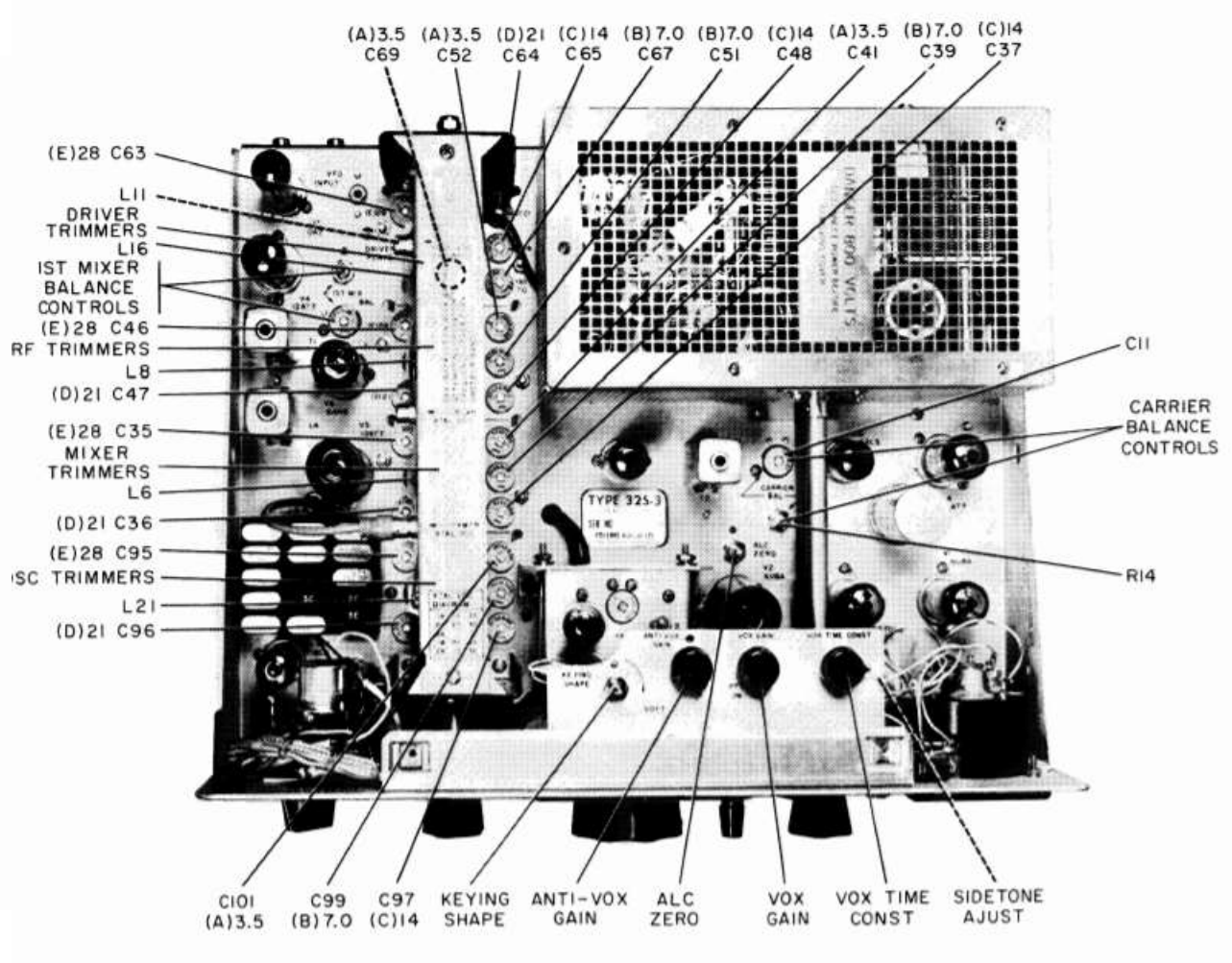
S-line Ham Radio Equipment

Collins S/Line – 516F-2 power supply, 75S-3B receiver, 32S-3 transmitter, 312B-4 console, SM-1 microphone, circa 1969.

-Receiver:12 tubes (miniatures), dual conversion, permeability (inductance) tuned.

-Transmitter:15 tubes (pair of 6146 in parallel at output), 175W DC into final, dual conversion, much like the receiver.


ANTENNA TRIMMERS
C61
RF TRIMMERS
DUMMY LOAD PLUG
OSCILLATOR TRIMMERS
C308
L302
V11 SHIELD
L10 SHIELD
L10
T6
T3
R13
L3
T4
L9
T5
R77
R57
L8

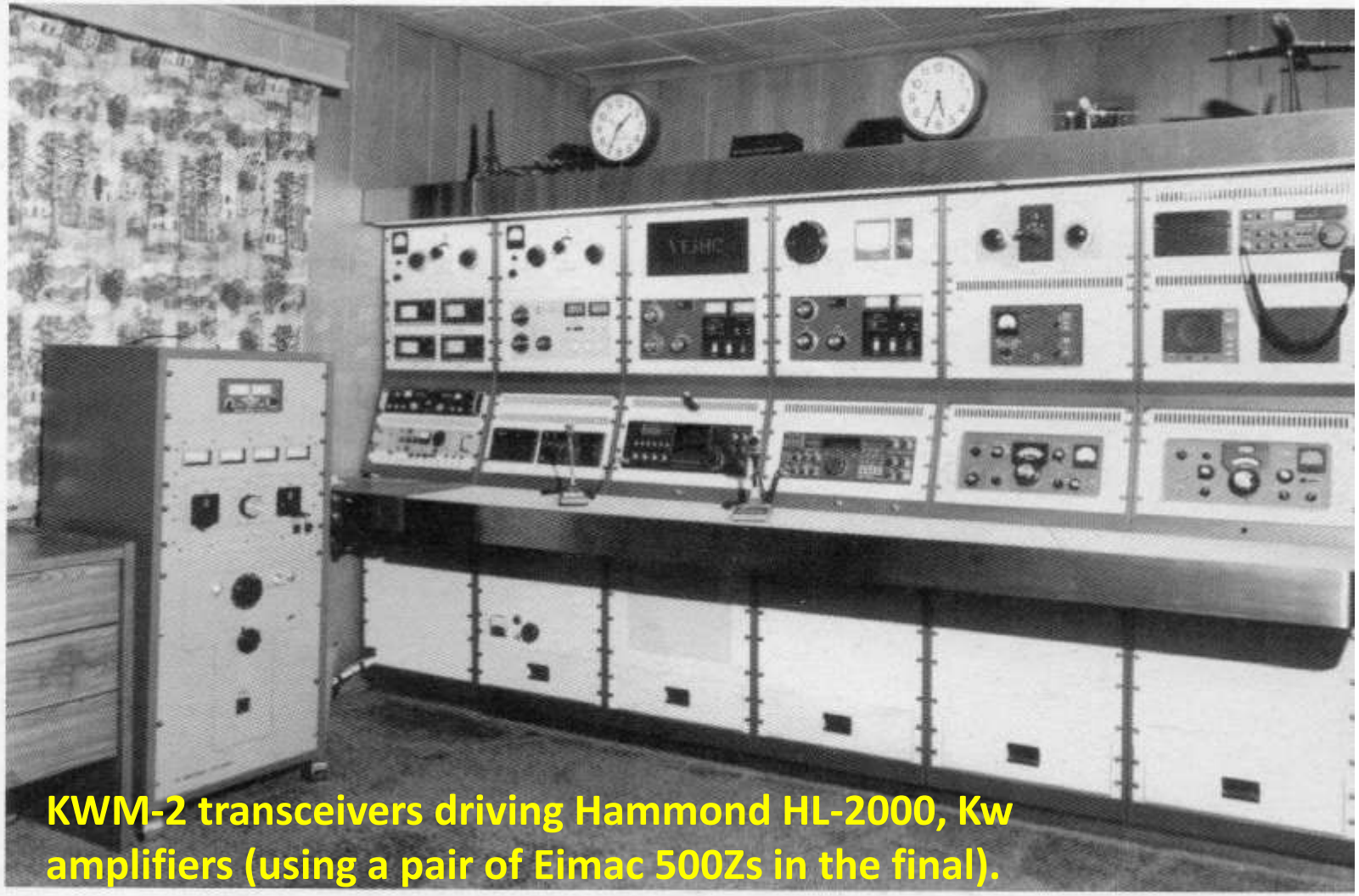

(A)3.5 C69
(A)3.5 C52
(D)21 C64
(C)14 C65
(B)7.0 C67
(B)7.0 C51
(C)14 C48
(A)3.5 C41
(B)7.0 C39
(C)14 C37
(E)28 C63
L11 DRIVER TRIMMERS
L16 IST MIXER BALANCE CONTROLS
(E)28 C46 RF TRIMMERS
L8
(D)21 C47
(E)28 C35 MIXER TRIMMERS
L6
(D)21 C36
(E)28 C95 OSC TRIMMERS
L21
(D)21 C96
C11
CARRIER BALANCE CONTROLS
R14
C101 (A)3.5
C99 (B)7.0
C97 (C)14
KEYING SHAPE
ANTI-VOX GAIN
ALC ZERO
VOX GAIN
VOX TIME CONST
SIDETONE AJUST

KWM2 Transceiver
17 tubes

Ralph Cameron at the Hammond Museum Surrounded by Collins Equipment

Fred Hammond's Station, Lots of Collins here.

VE3HC, first licensed in 1929 and has always been active on the various amateur bands except during the war years. This photograph is of the present day station (1994).



KWM-2 transceivers driving Hammond HL-2000, Kw amplifiers (using a pair of Eimac 500Zs in the final).

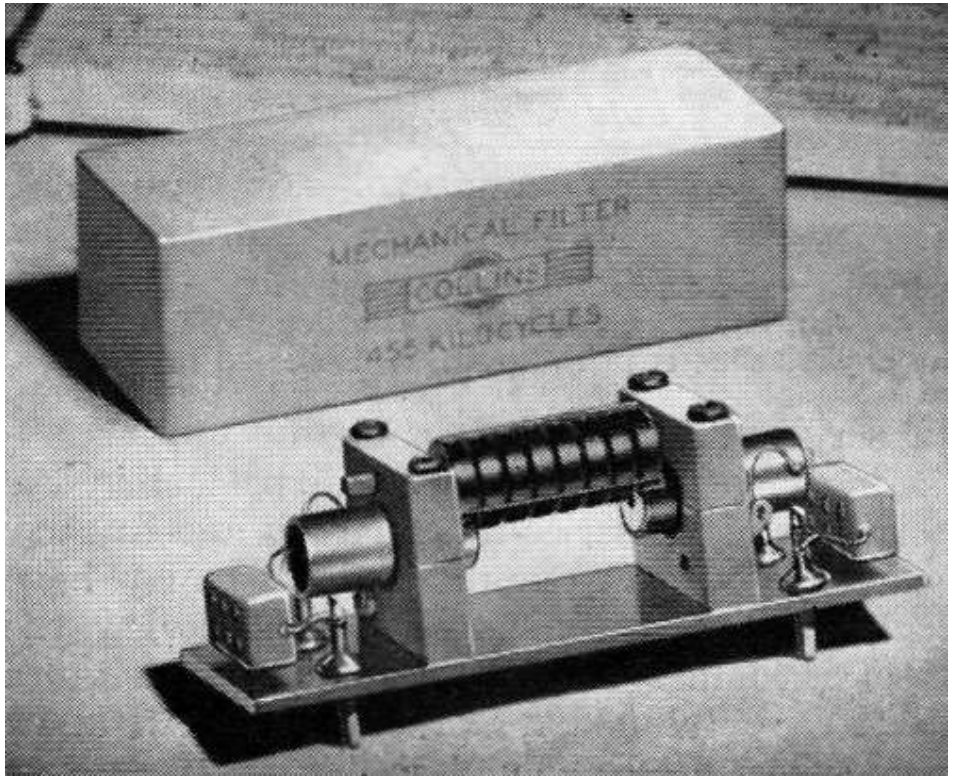
Collins Technology

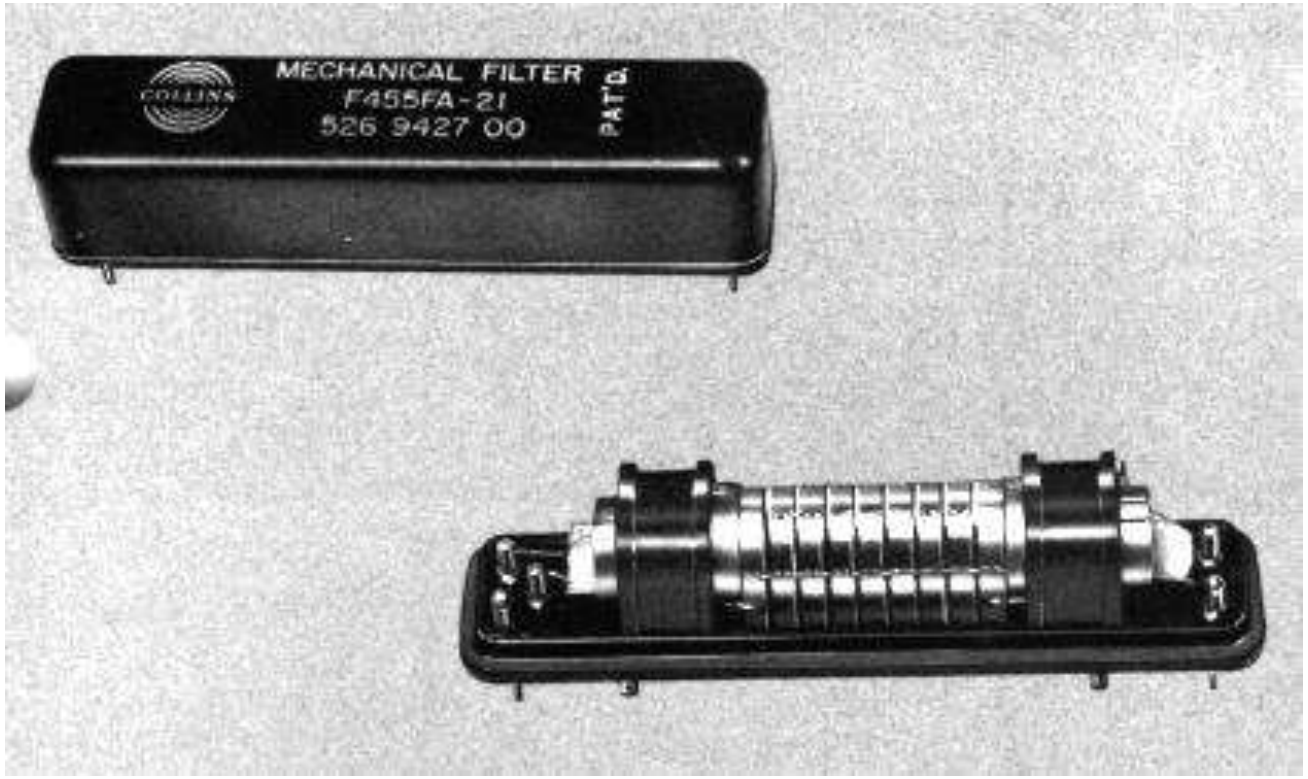
- Mechanical filters
- Linear tuning. Spacing between frequencies on the dial was exactly linear, making Vernier tuning easy.
- Permeability (inductance) tuning. Developed stable magnetic materials. Non-uniform pitch in wound coils.
- Automatic tuning.

Technology: Mechanical Filter

- Well-behaved narrow-band IF filters are a critical need in many communications systems, esp. single sideband (SSB) radio. L-C filters (IF filters) at ~455kHz are OK for AM radios, but for SSB, and when multiple channel are tightly spaced, better filters are required.
- Crystal filters (and close cousin ceramic filters) offer one option.
- For 455kHz IFs, mechanical filters (based on the physical resonance of metal disks) offer an excellent alternative to crystal filters. Very stable, low loss. Compact.
- Collins invention. Early 1950

Mechanical Filters



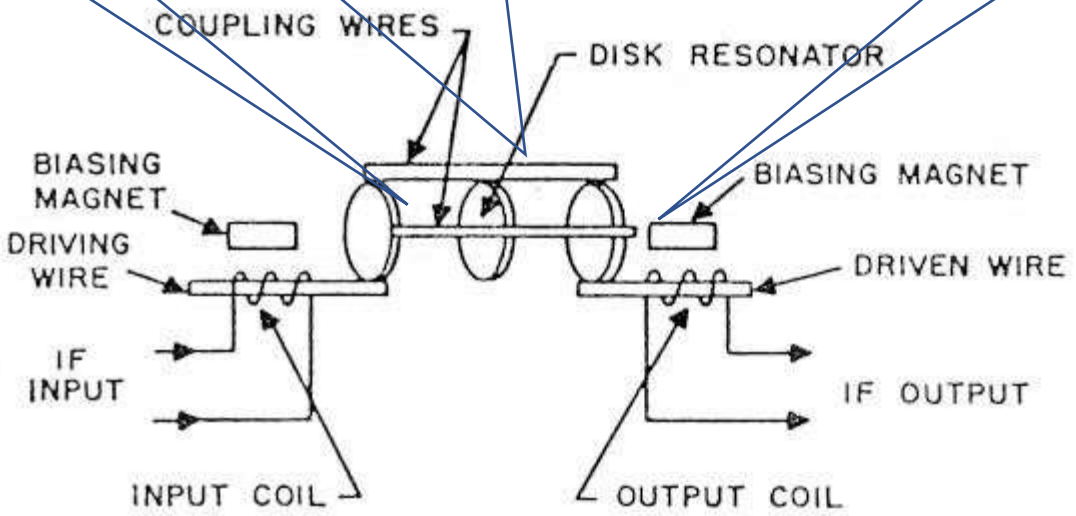


Mechanical Filter Operation

Convert electrical signal to vibration. Magnetostrictive or piezoelectric transducer.

Apply vibration to a series of coupled mechanical resonators. Resonators can be arranged for particular bandpass characteristics.

Convert vibration back into electrical signal



COMPONENTS OF A MECHANICAL FILTER

TO 31R1-2URR-452 TM5820-358-35-16

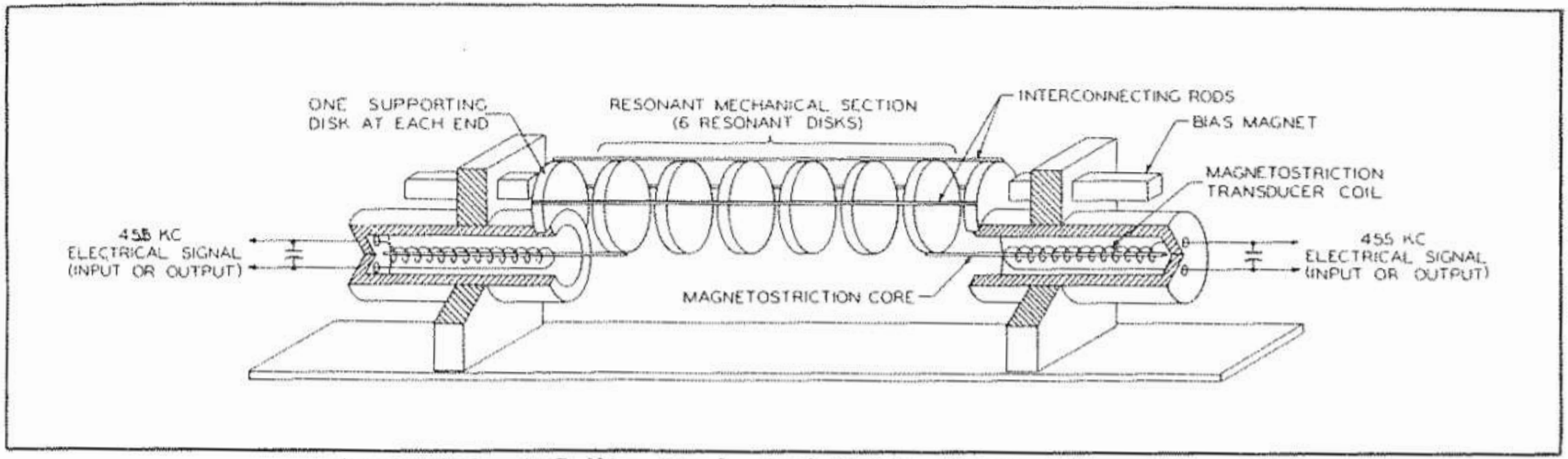
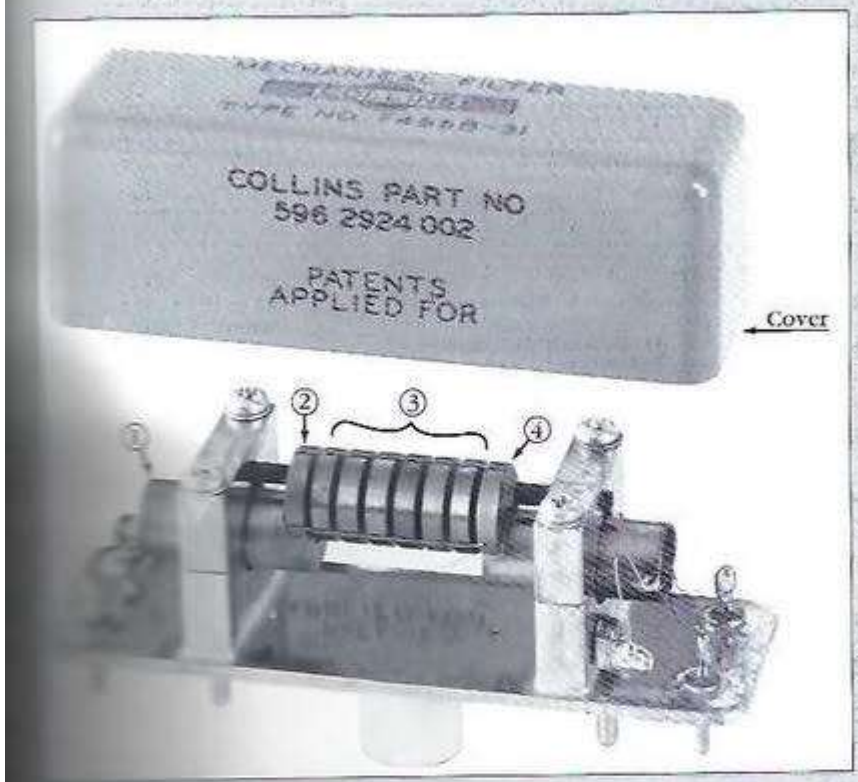


Figure 4-2. A Collins Mechanical Filter, Functional Diagram

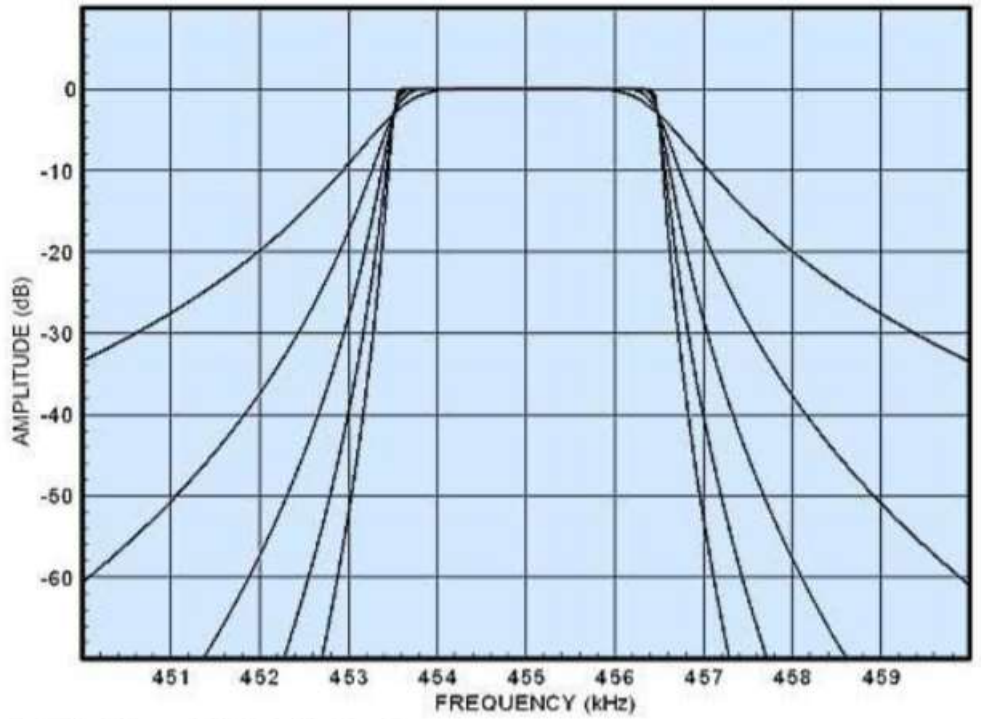


the desired signal. Then each disc down the line (3) carries this signal and helps purify the signal by weeding out other vibrations.

The last disc (4) feeds the sorted signal into the main circuit of the receiver. This amounts to a translation of an electrical signal into mechanical force, then translation back into electricity after filtering.

Besides being efficient from an engineer's viewpoint, the mechanical filter performed the job at less cost than other devices could at the time.

Mechanical Filters



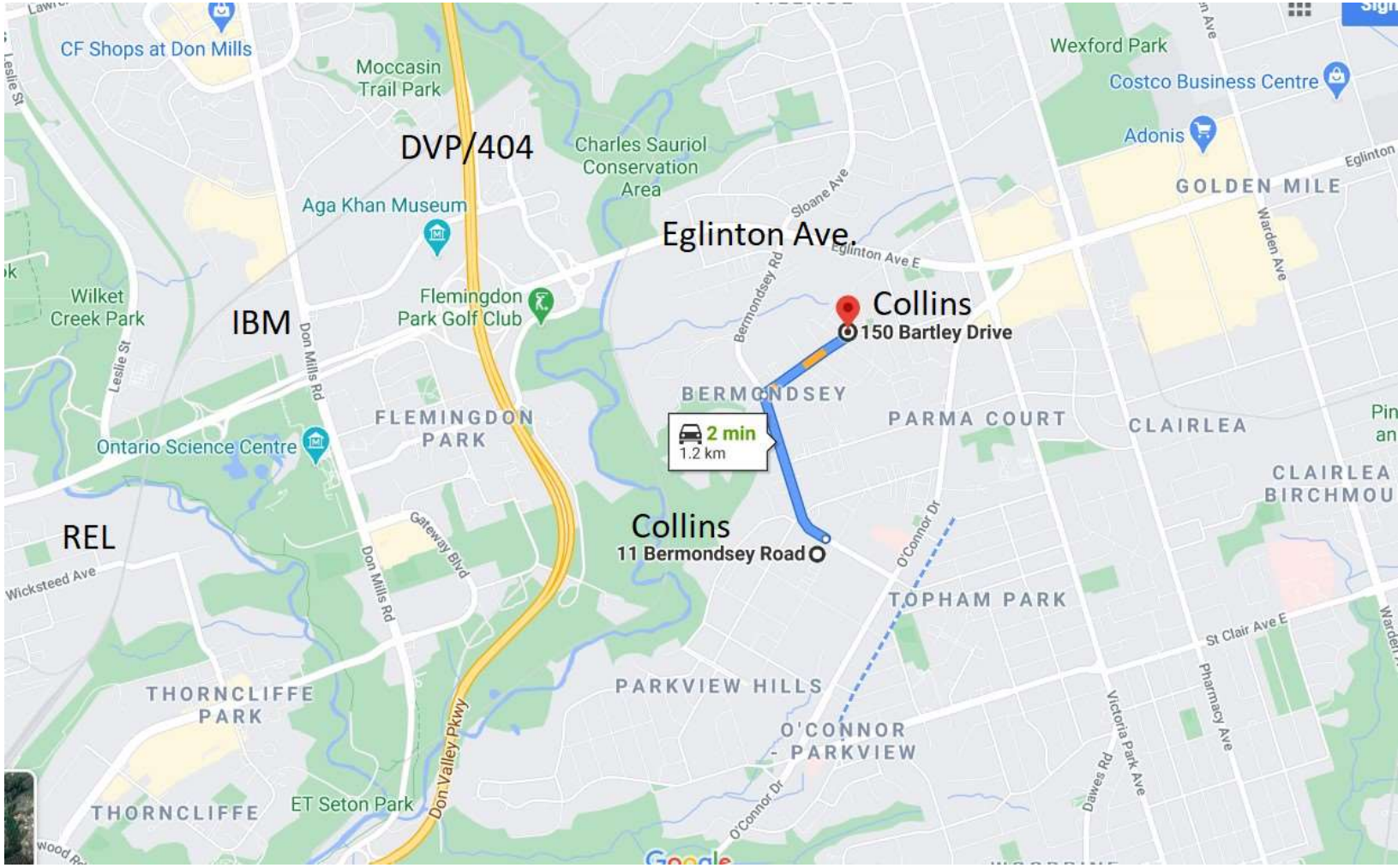
3, 5, 7, 9 and 11 Pole Designs

COLLINS RADIO COMPANY OF CANADA

- 1953: the Collins Radio Company opened a sales office in Ottawa.
- July 1956: manufacturing plant was opened in Toronto employing 550 production, engineering and office staff. The 11 Bermondsey Rd. plant became the first major manufacturing operation outside of the U.S.
- 1961: the 55,000 sq. ft. manufacturing plant was completed at 150 Bartley Drive.
- The 30,000 sq. ft. plant on Bermondsey Rd. was renovated to house engineering, research and development, and sales divisions.
- 1965: Bermondsey Rd. plant was closed; all activities were transferred to Bartley Dr. facility.
- Due to continuing decline in world defense markets, Collins Radio Company of Canada closed its door on April 1, 1991 with 190 workers out of a job.

Collins Canada

- 150 Bartley Dr., Toronto
- 11 Bermondsey Road, Toronto
- Eglinton/Victoria Park area (across the highway from REL & IBM)
- 1956-1991



Two subsidiaries formed

Collins Radio Company of Canada was founded in 1953 as a wholly-owned subsidiary of the parent company in Cedar Rapids. An office was established in Ottawa to provide technical assistance to a Canadian manufacturer of Collins-designed equipment, to maintain liaison with the Canadian government and to promote sales of Collins products.

In 1954, the headquarters moved to Toronto and operated from a hotel room for several months to lay the groundwork for production facilities. Collins of Canada leased a building in February, 1955, and production got under way at the new plant the following July. Key product lines in the early history of Collins of Canada were UHF radios for the Canadian government and the DEW Line. With expansion of the original building and the leasing of a second building, total floor space reached 50,000 square feet by 1956. The Toronto plant also housed a research and development lab, Collins-Canada sales headquarters and a field service repair depot.

A second subsidiary was formed in January, 1956, when

Collins Canada

Employees Receive Service Awards

The following employees received their 15-year pins from Hal Davis on April 11, 1975. The employees honored during this meeting were (left to right, seated) Bernie Allen and Phyllis Bell. In the back row, (left to right) Alex Sloanes, Les Lambert, and Hal Davis. Not pictured is Dick Sidgwick.

Patent Filing Award

Collins Canada engineers Les Iwata and Ken Lepper are presented with award checks for their invention of a radio-frequency switch mechanism used in a new automatic antenna coupler. Making the presentation is Hal Davis, President of Collins Canada, assisted by Don Gerrior, Director of Engineering.

Bartley Dr. Plant

Collins Radio in the Avro Arrow

- The Legendary “Avro Arrow” Canadian Fighter Jet used Collins radio equipment.
- See Gord Hamilton’s article in the last issue of the newsletter.
- ARC-552, Canadian version of the ARC-52.

ARC-552 Specifications:
Power output: 20 watts average over the frequency range.
Mode: Amplitude Modulation (AM).
Frequency: 200 MHz to 400 MHz
Primary Power: 115VAC 400 Hz 3 phase, 4 wire, 155 watts.
Physical: 8-1/16 inches high by 11-13/16 inches wide by 22-3/4 inches deep and weighed 56.7 lb.

The Demise of Collins Radio

- Arthur Collins was eager to enter the computer business, and invested heavily in this area. Created the C-line computer. 1968 was a record year for sales, so this research could be supported.
- However, sales fell (for several reasons) over the next three years, but Collins continued to pursue computers.
- Ross Perot (Presidential candidate, billionaire) tried and failed to buy Collins.
- 1971: Rockwell International invested in Collins in 1971; owned it by 1973
- Business continued as Rockwell-Collins for many years (though arguable the best Collins equipment was designed before Rockwell).

Collins Aerospace

Now in Kanata and Montreal

- Having read so much about Collins, it seems to me that the company reflected the man. Arthur Collins clearly had a vision from the start of what properly designed radio equipment should look like, and the Collins Radio Company consistently made equipment of high quality, uncompromising performance, and high price!
- Our panel of experts will answer your questions:
  - Ralph Cameron
  - John Gilbert
  - Bill Kirkland

Resources

- Collins equipment had (and still has) a cult-like following. www.collinsradio.org
- Hammond museum (Guelph) has an excellent collection.
- Excellent resource at https://www.k4vrc.com/uploads/7/8/8/6/78865320/collins_history_presentation_tvarc_9-21_[w3my_russ].pdf
- http://www.collinsmuseum.com/
- https://worldradiohistory.com/Archive-Catalogs/Collins/Collins-First-50-Years.pdf
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- http://www.collinsradio.org/wp-content/uploads/2012/04/R390-CER-No-297-Signal-Corp-Final-Eng-Rpt-Includes-R-389.pdf