

RECEIVERS

in the beginning...

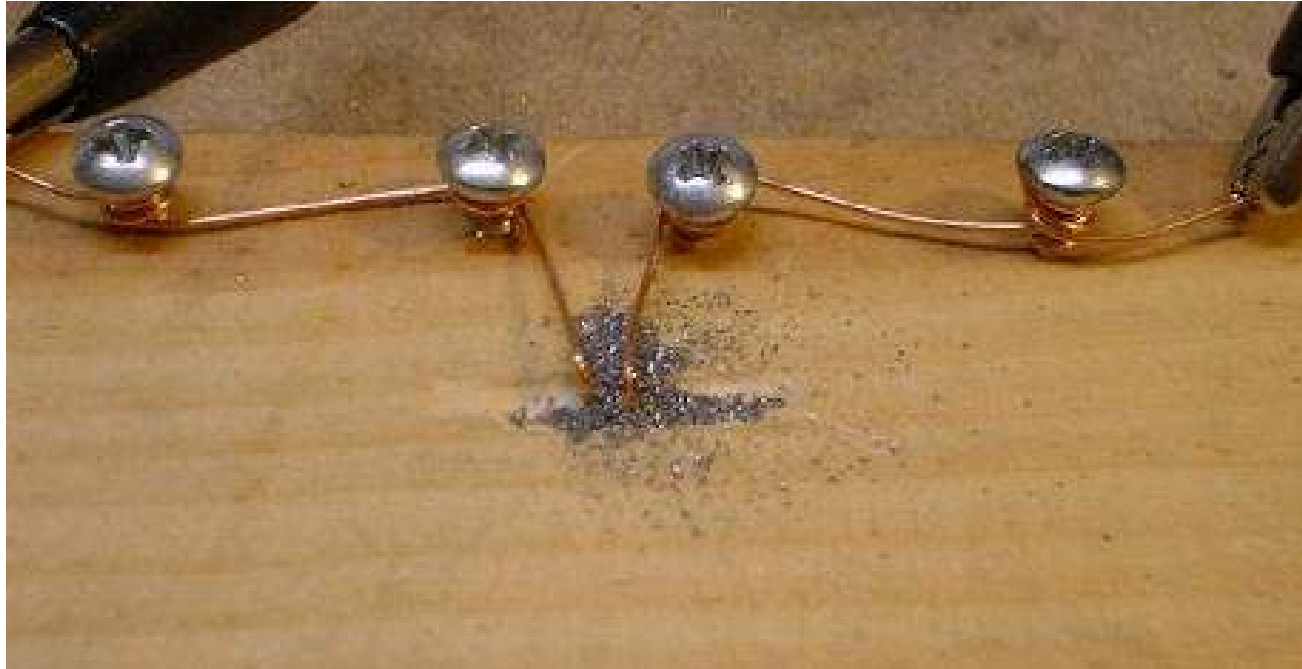
BEN FRANKLIN

JAMES MAXWELL

HEINRICH HERTZ

EDOUARD BRANLY

THE COHERER



A CRUDE COHERER:

**SHARPLY CUT NICKEL & SILVER SHAVINGS WERE
“EXCITED” BY AN EXTERNAL ELECTRICAL CURRENT**

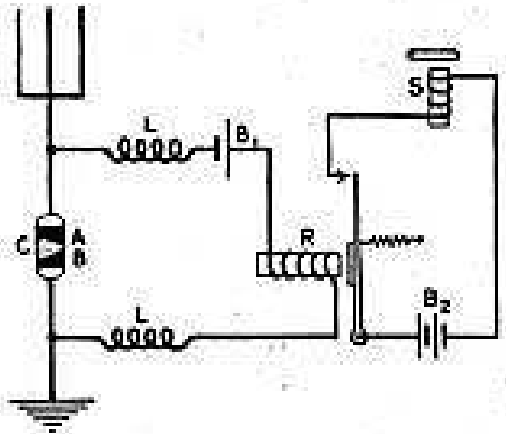
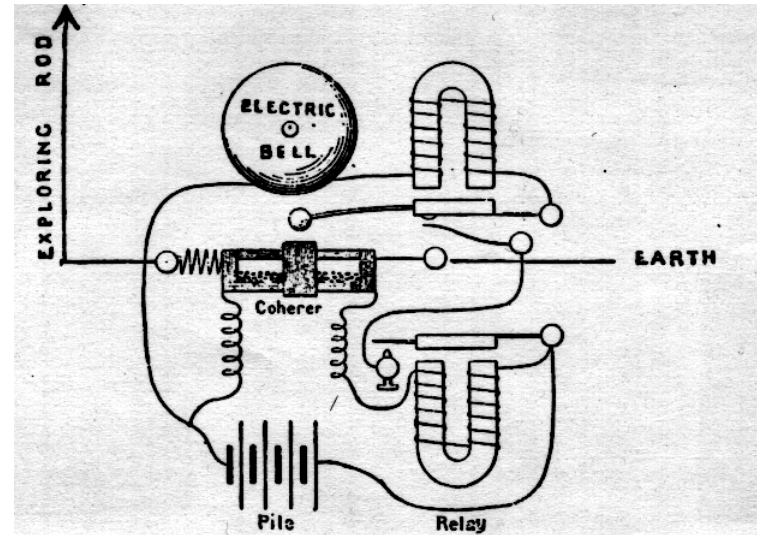
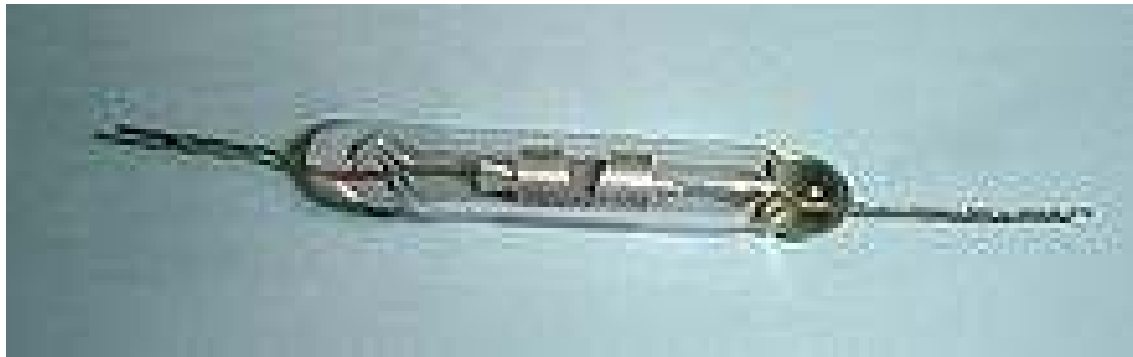


Fig. 101. Marconi 1896 Receiver.

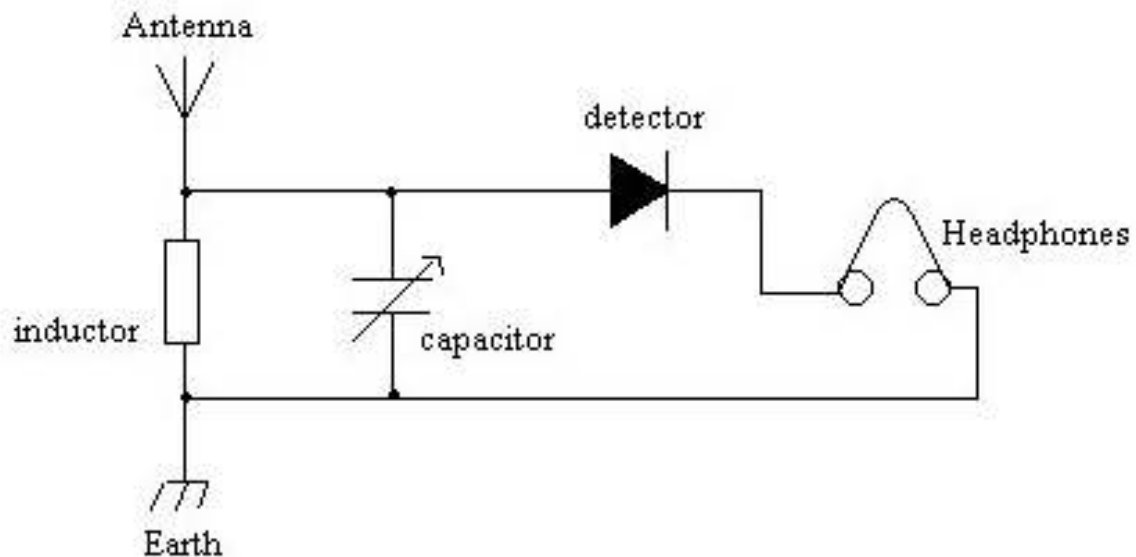
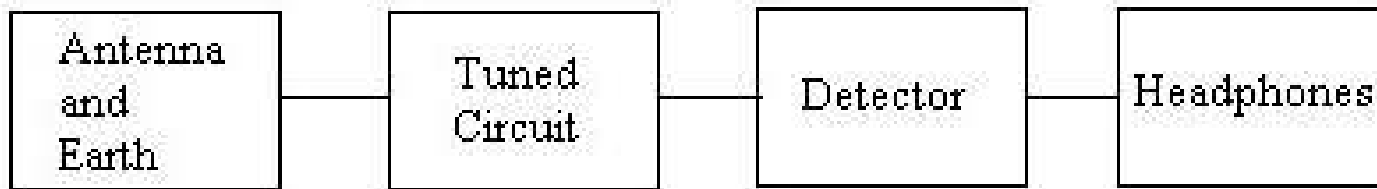


MARCONI UNTUNED COHERER RECEIVER



THE CRYSTAL SET

THE BASIC 'CRYSTAL SET' RADIO



GALENA CRYSTAL CATSWHISKER



THE VACUUM TUBE
REVOLUTION:

AUDIO & RF AMPLIFICATION

AC POWERED RADIOS after 1926

LOUDSPEAKERS

TUBES OF EVERY MAKE AND DESCRIPTION

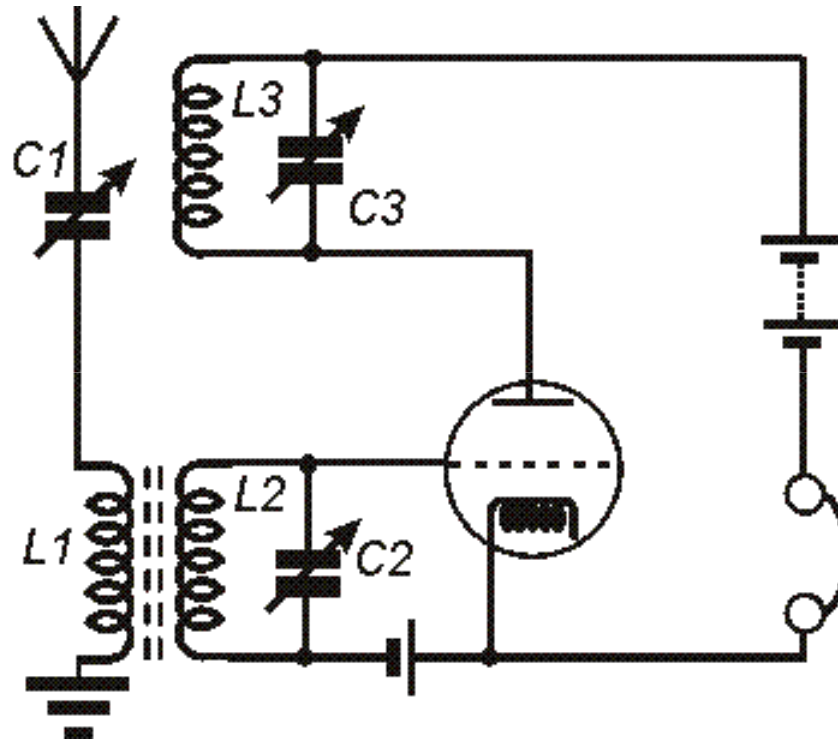
THE REGENERATIVE RECEIVER

REGENERATION=FEEDBACK

EXAMPLES OF FEEDBACK

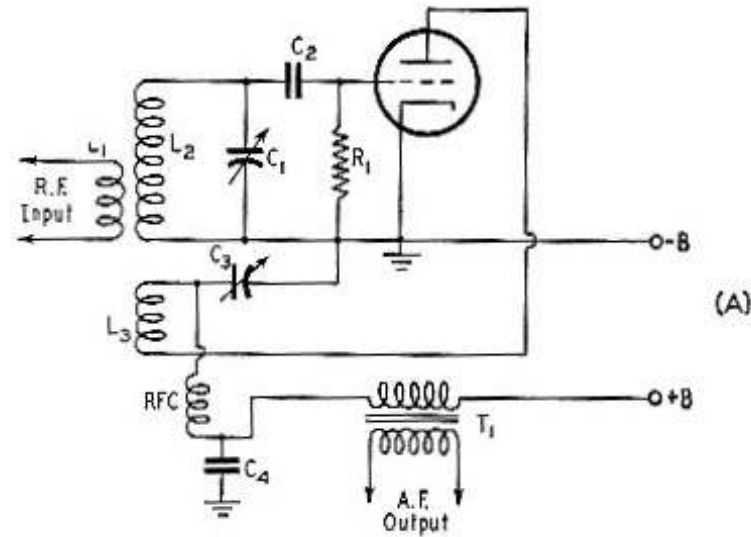
**“EVERY OSCILLATOR IS AN AMPLIFIER, EVERY
AMPLIFIER IS AN OSCILLATOR”**

A SIMPLE REGENERATIVE AM RECEIVER

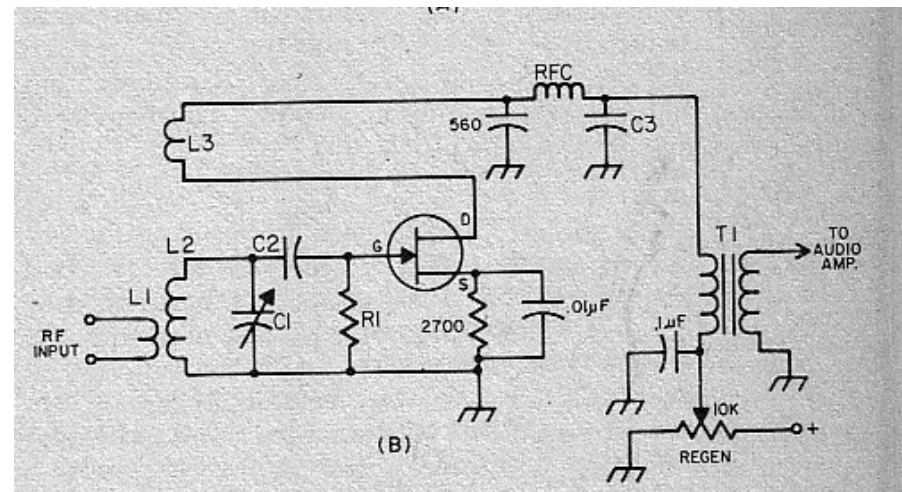


MORE REGENERATIVE RECEIVERS

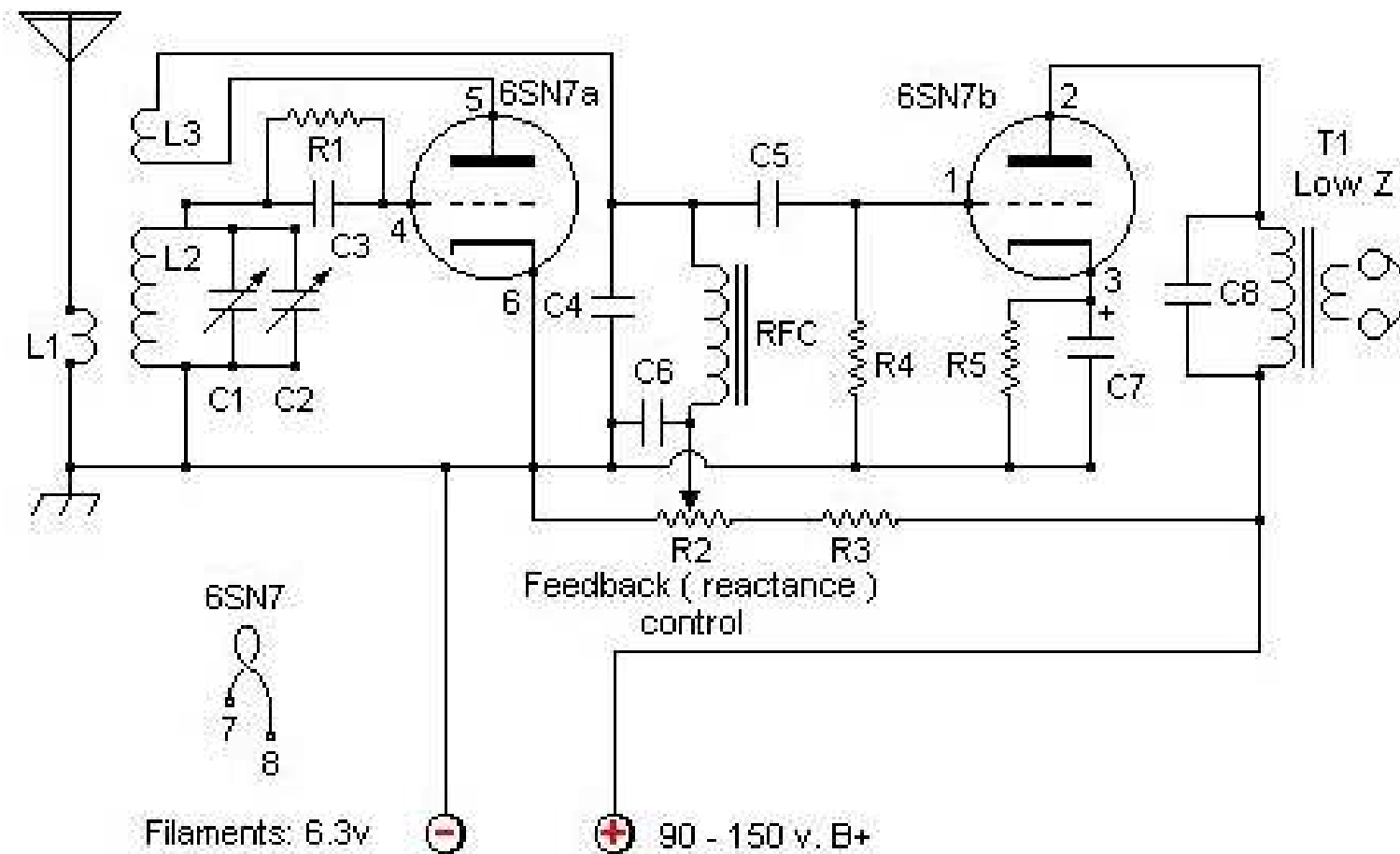
TRIODE REGENERATIVE RECEIVER



TRANSISTORIZED REGENERATIVE RECEIVER



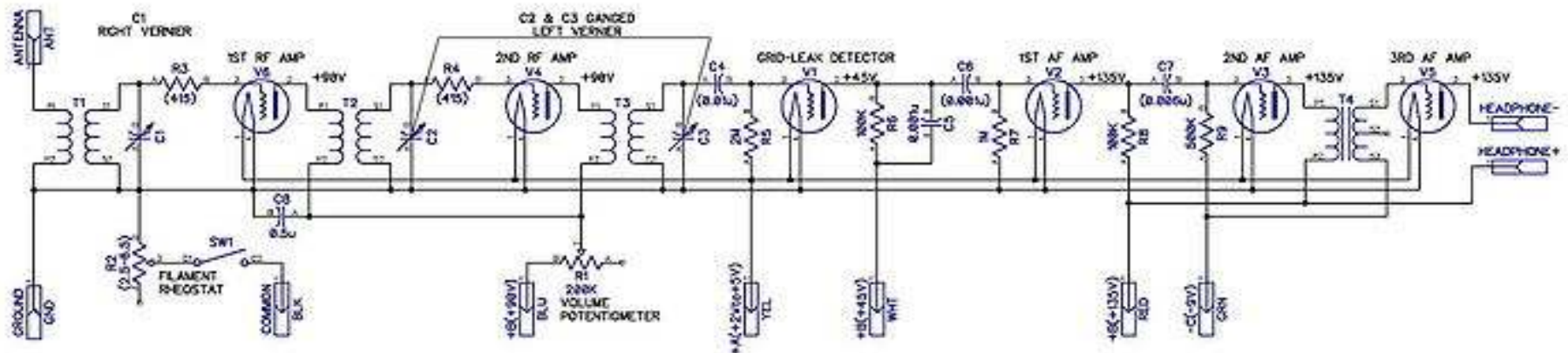
A REGENERATIVE RECEIVER USING A 1950S ERA DUAL TRIODE



THE TRF RECEIVER

THE REGENERATIVE SET BECAME COMPLICATED!

TUNED RADIO FREQUENCY RECEIVER



NOTES:
VALUES IN PARENTHESIS ARE MEASURED, OTHERS ARE AS MARKED ON THE COMPONENT
ALL TUBES ARE '61A' TROCKS

***SIMPLE REGENERATIVE
and TRF RECEIVERS:
SEVERE LIMITATIONS***

DAWN OF A NEW ERA: THE
SUPERHETERODYNE

EDWIN ARMSTRONG 1932

CONVERSION HETERODYNE

INTERMEDIATE FREQUENCY

ADVANTAGES OF THE SUPERHETERODYNE RECEIVER

INCREASED ADJACENT CHANNEL SELECTIVITY

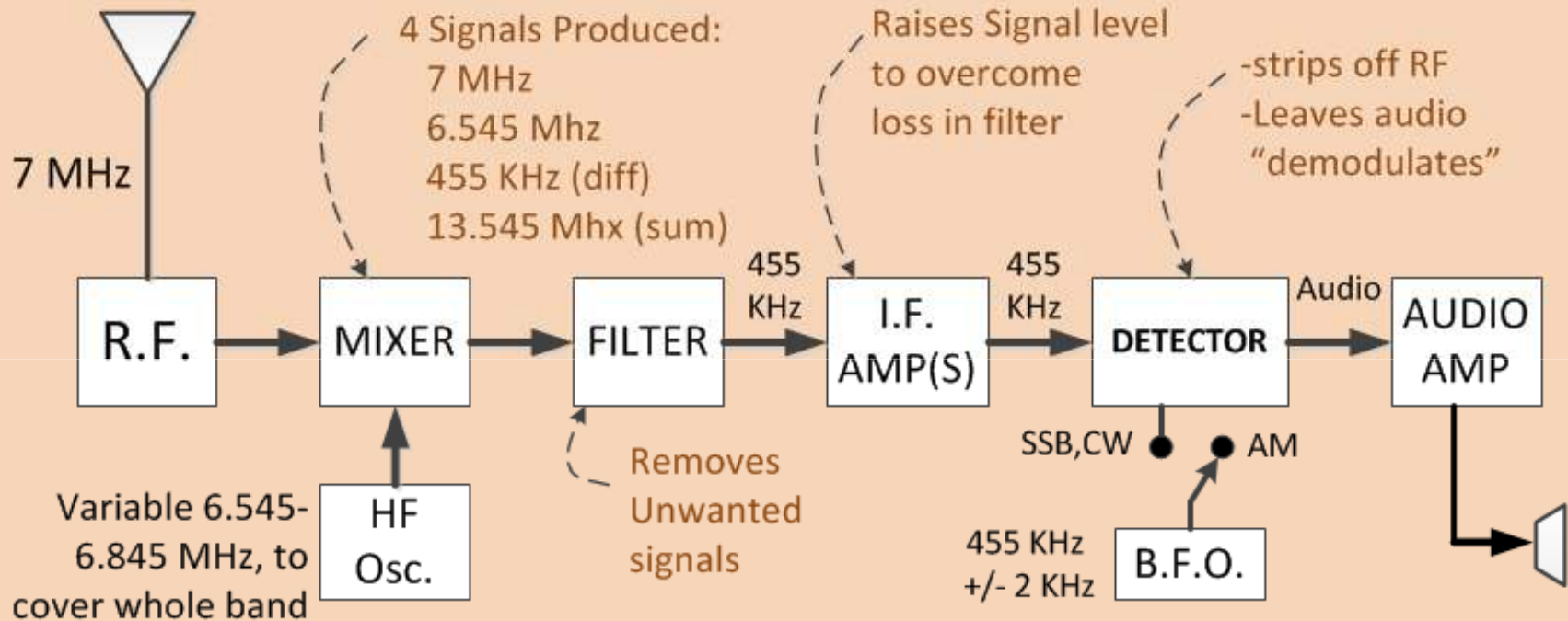
EASIER TO OBTAIN SELECTIVITY

GREATER IMAGE SUPPRESSION

**EASIER TO DESIGN STAGES FOR GREATER GAIN AND
STABILITY AT ONE IF FREQUENCY**

THE SUPERHETERODYNE RECEIVER for AM, CW & SSB

Simple Superhet Receiver

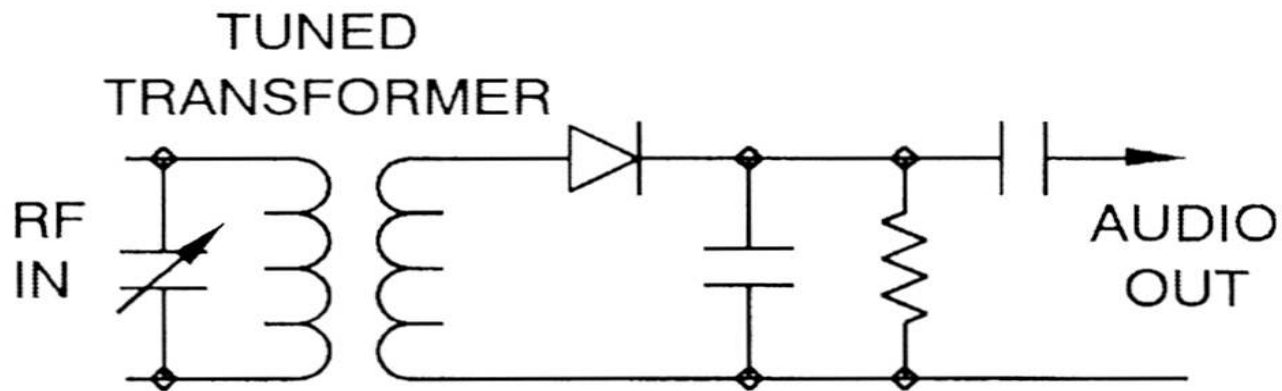


Images of 13.545 mixed to produce 455 KHz must also be filtered

Options:

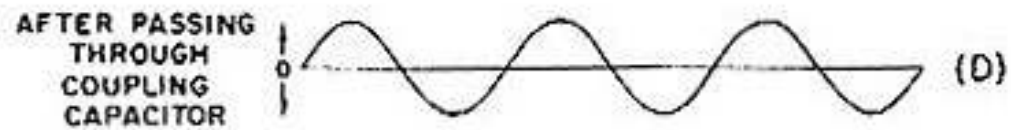
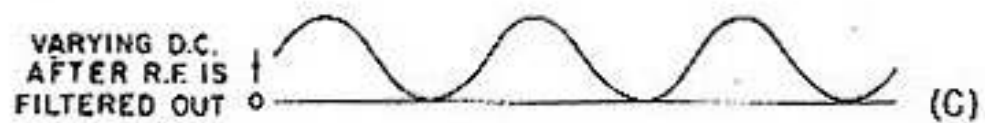
- 1- Add a 2nd mixer – "Double Conversion"
- 2- Add a buffer between HF Osc, and mixer(s) for added stability
- 3- add "AGC" or "AVC" stage
- 4- add a Q-multiplier, more filters, IF-shift for greater selectivity

SIMPLE LINEAR or ENVELOPE DETECTOR (used for am & cw)



(NOTE THAT DIAGRAM IN THE OLDER VERSION OF
THE MANUAL IS INCORRECT)

RECOVERING THE AUDIO COMPONENT



THE BFO

“BEATING”

VARYING CW NOTE

**“SLOPE-DETECTION” OF SSB SIGNALS ON OLDER
AM RECEIVERS**

AN OBSOLETE CONCEPT

THE PRODUCT DETECTOR: AN
IMPROVEMENT

**DEVELOPED ESPECIALLY FOR SSB
RECEPTION in the 60s**

A “MIXER on STEROIDS”

REDUCED DISTORTION, BETTER LINEARITY

**THE STANDARD DETECTOR IN MODERN
RECEIVERS**

PROBLEMS WITH SUPERHET **RECEIVERS**

**IMAGES: “OTHER SIDE” OF LOCAL OSCILLATOR and
2X THE IF FREQUENCY AWAY**

ELIMINATION OF IMAGES

“BIRDIES:” PRODUCTS OF MULTIPLE CONVERSIONS

ELIMINATION OF BIRDIES

NOISE vs GAIN: LOW IF vs HI IF FREQUENCIES

MODERN RECEIVER
ARCHITECTURE

STANDARD FOR SEVERAL DECADES NOW OBSOLETE

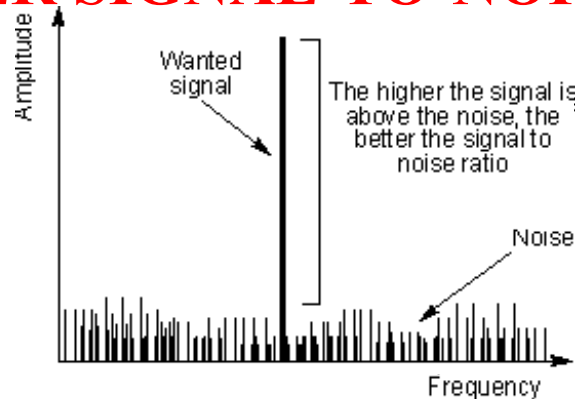
MODERN CONCEPTS (EXAMPLE: K3)

RATIONALE FOR CHANGED ARCHITECTURE

ENDLESS POSSIBILITIES

THE FM RECEIVER

BETTER SIGNAL-TO-NOISE RATIO



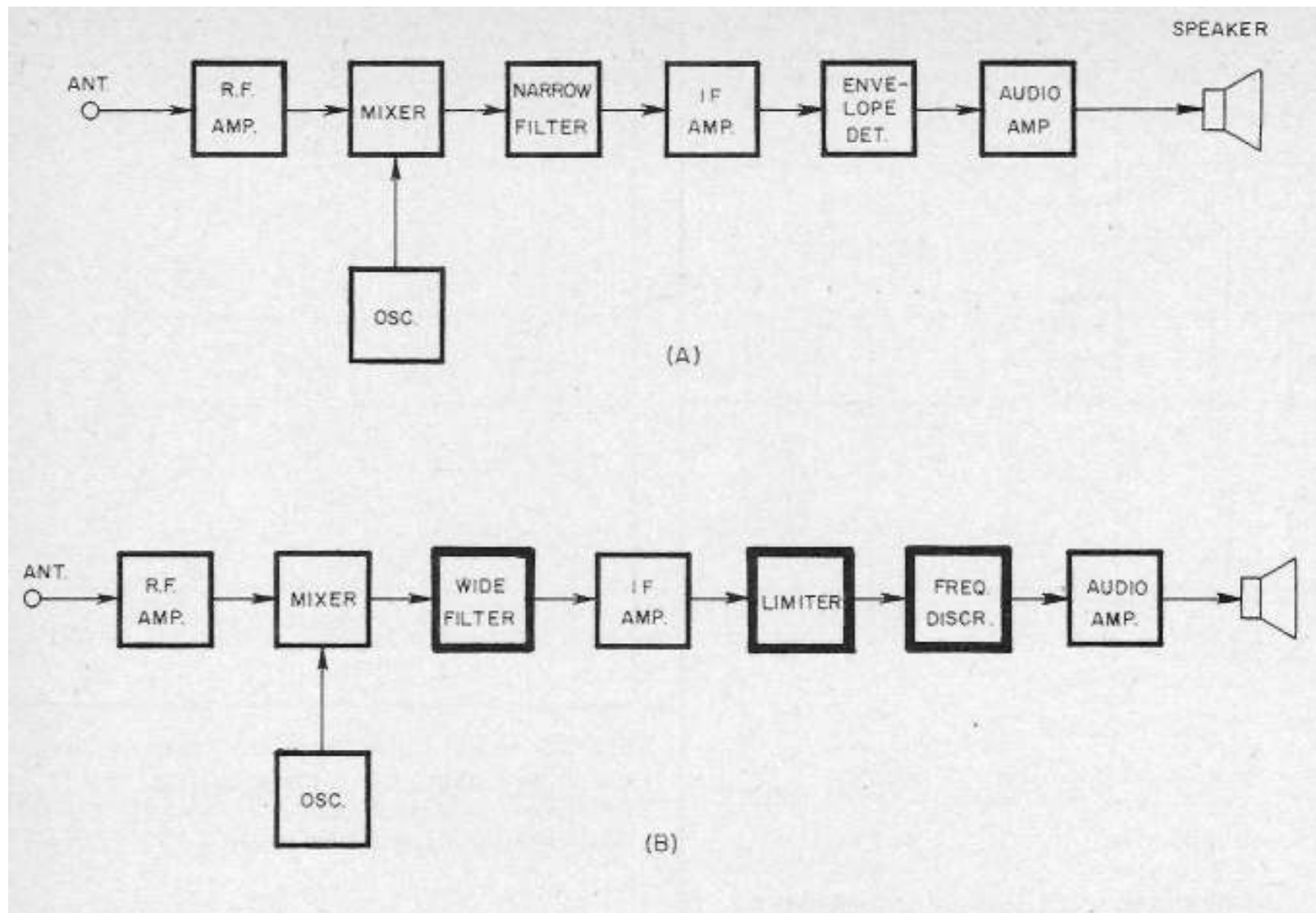
**FM USED PRIMARILY AT HIGHER FREQUENCIES
WHERE THERE IS LESS MAN-MADE NOISE**

**HIGH-GAIN AMPLIFIERS POSSIBLE WITHOUT
PROBLEMS OF LOWER FREQUENCIES**

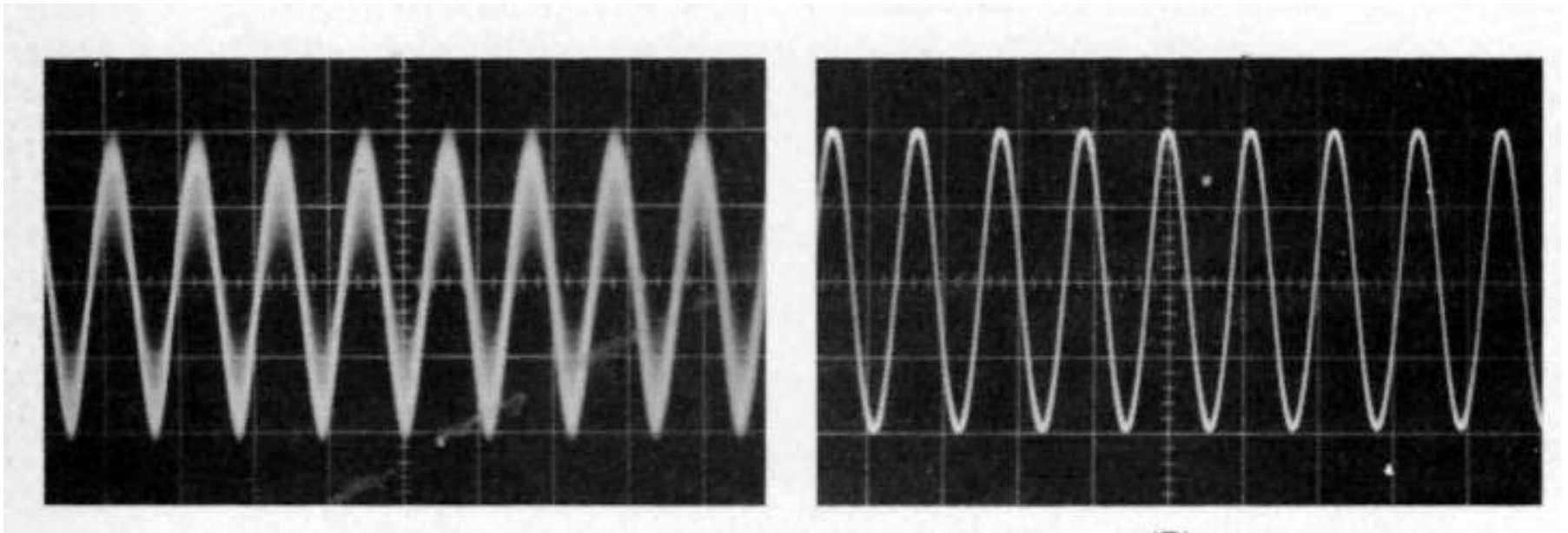
CHANNELIZED OPERATION

CHANNEL SPACING

THE FM RECEIVER IN COMPARISON WITH AM



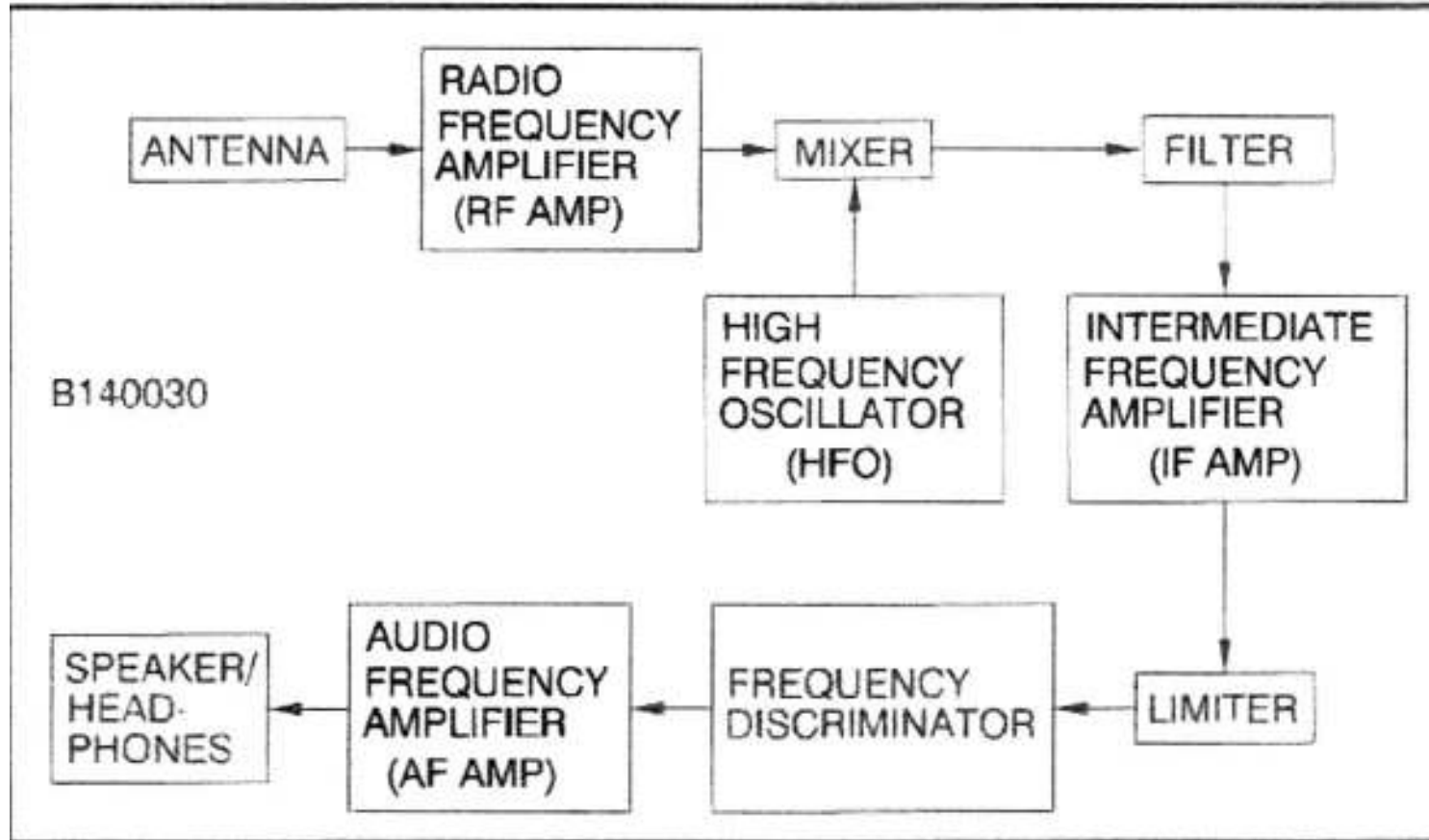
HOW THE LIMITER WORKS



**SIGNAL WITH NOISE
AND AM COMPONENT**

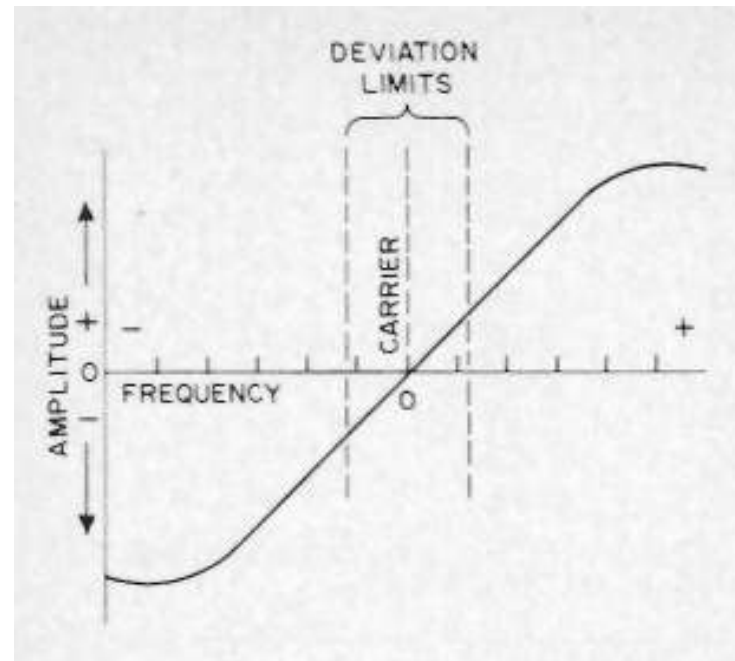
**SIGNAL WITH AM &
NOISE STRIPPED BY
LIMITER**

SUPERHETERODYNE FOR FM



THE FM DISCRIMINATOR

CONVERTS FREQUENCY VARIATIONS TO VOLTAGE VARIATIONS



WHEN THE FM SIGNAL HAS NO MODULATION and CARRIER IS AT 0 THE DISCRIMINATOR HAS NO OUTPUT

ADDITIONAL ASPECTS OF FM
RECEIVERS

THE SQUELCH CIRCUIT

FREQUENCY SYNTHESIS

MODERN PLL DETECTORS

PREAMPLIFIERS AT VHF and UHF

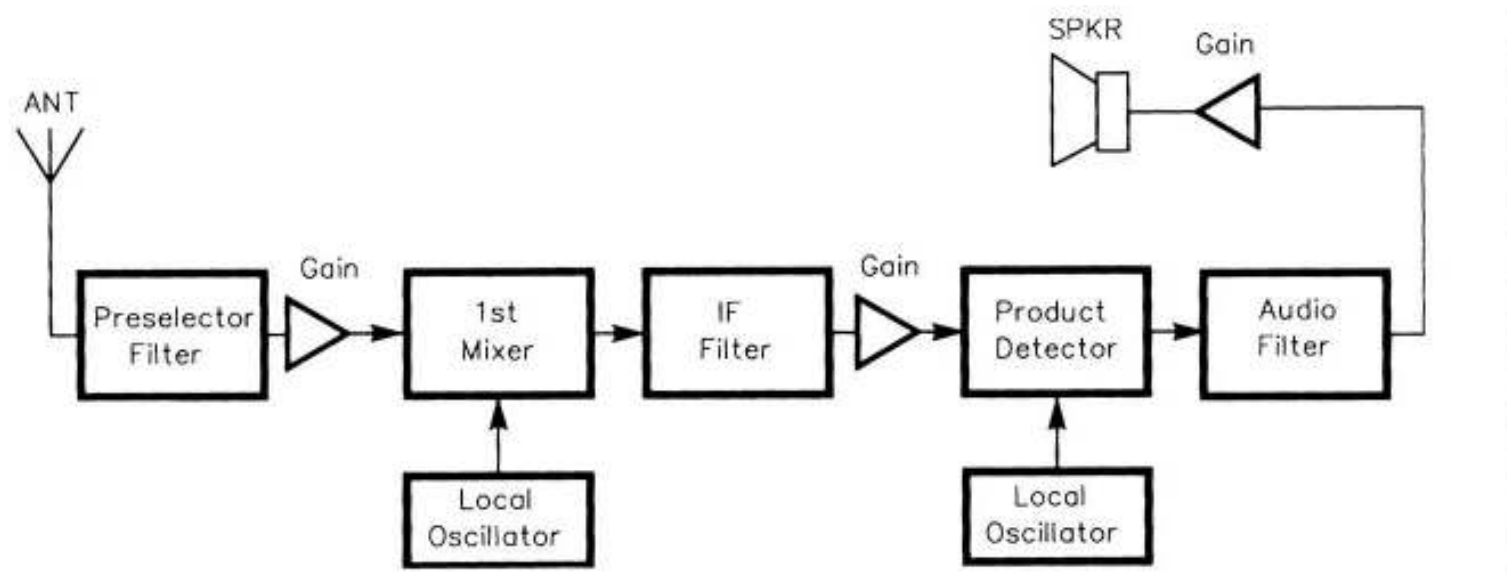
FILTERS

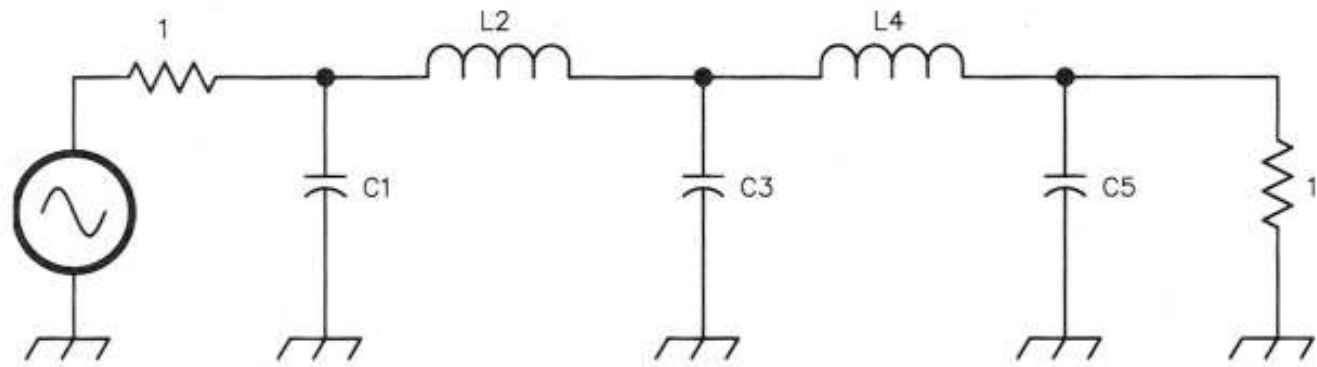
EARLIEST TYPES LC, RC, RCL

MECHANICAL

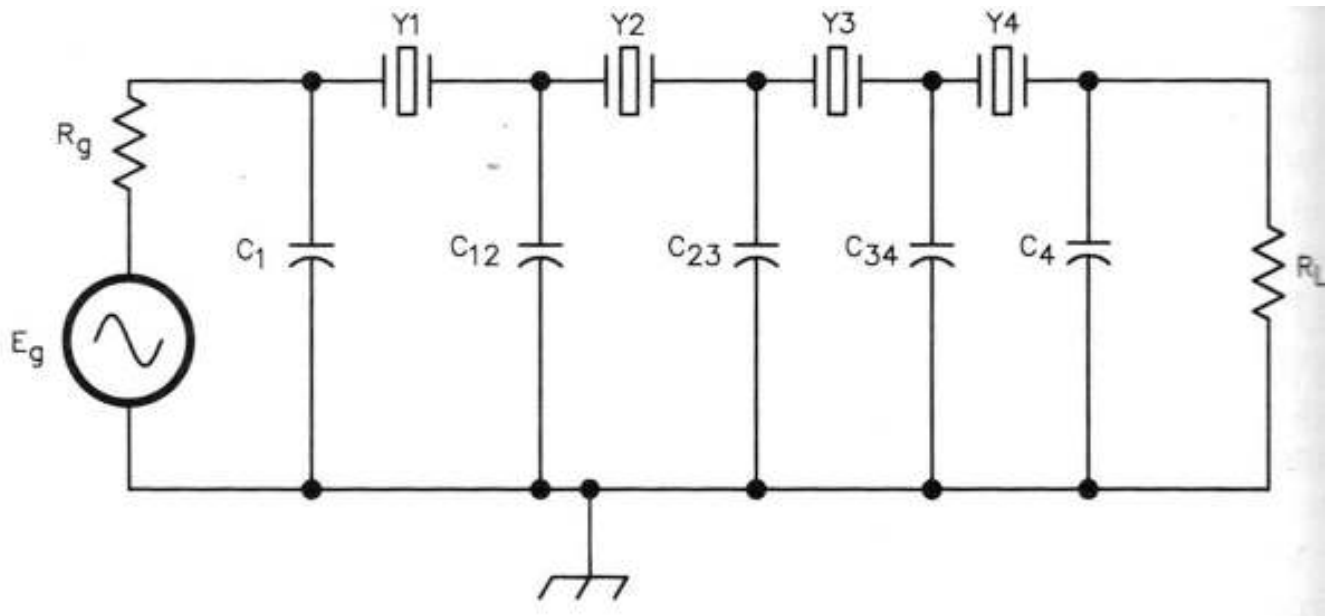
CERAMIC, CRYSTAL

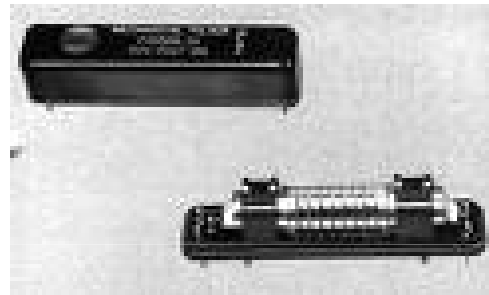
DIGITAL





(B)





FILTERING OUT UNWANTED **SIGNALS**

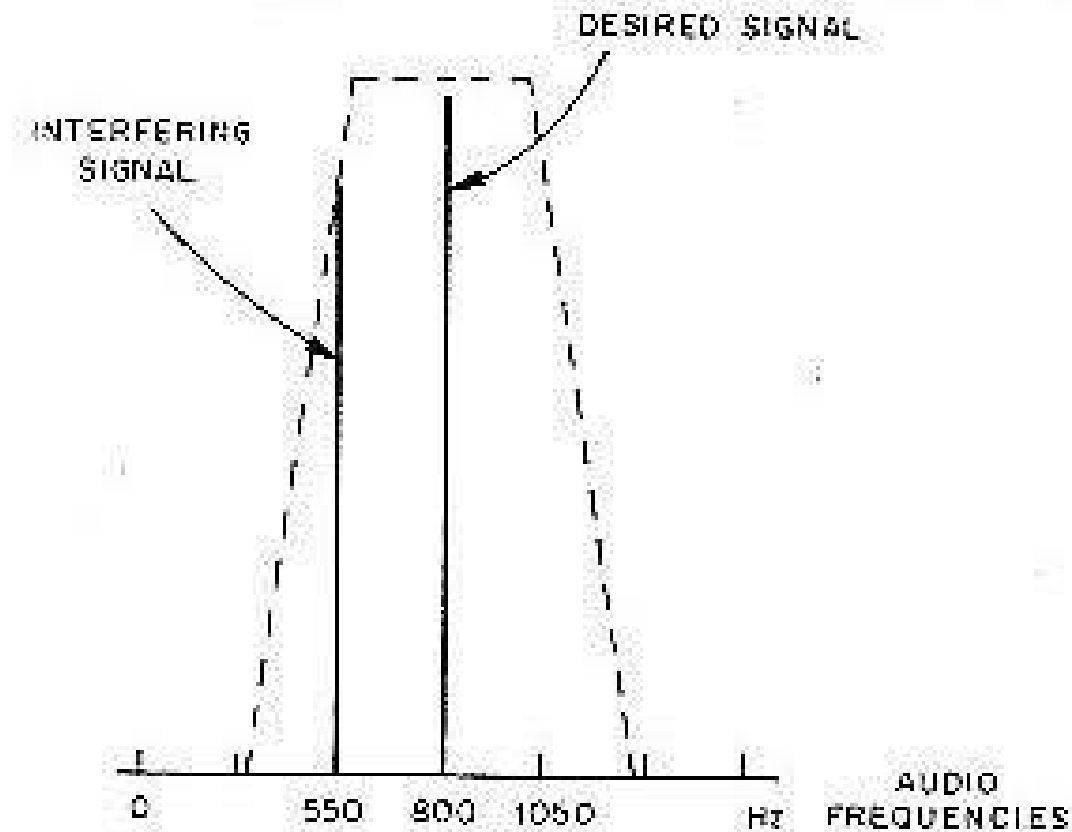
BAND PASS vs BAND REJECT FILTERS

IF SHIFTING

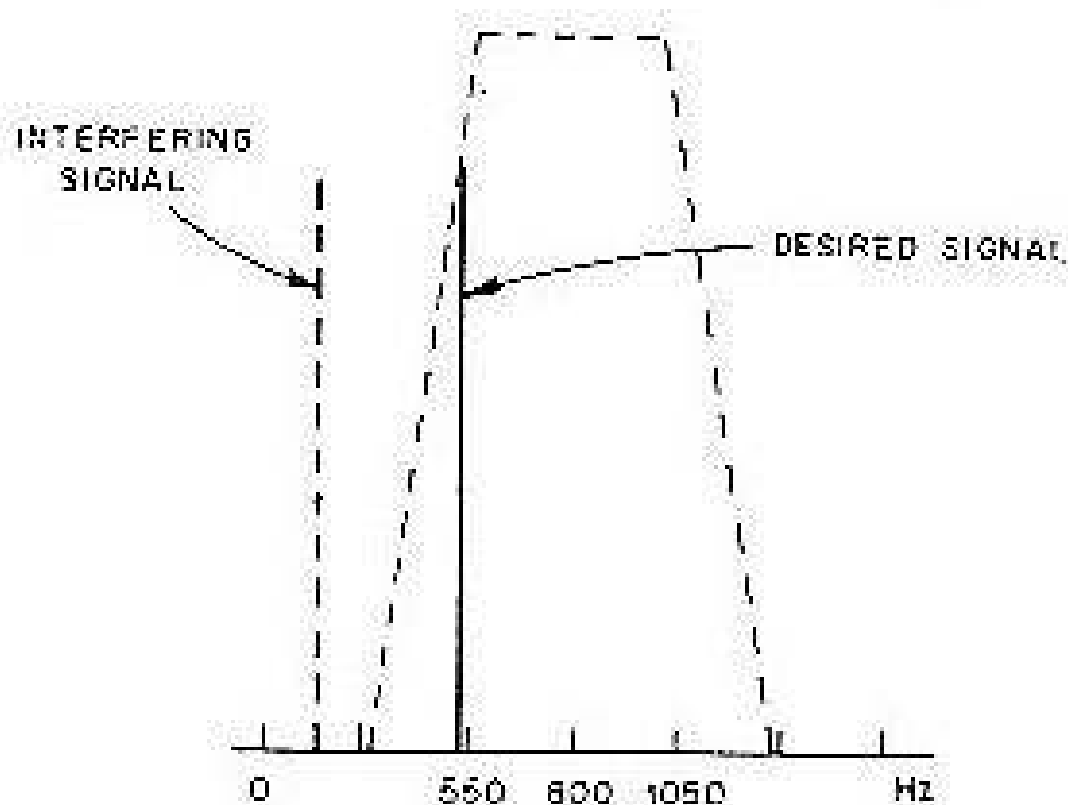
FILTER “SHAPE”

COMMON FILTERING WIDTHS

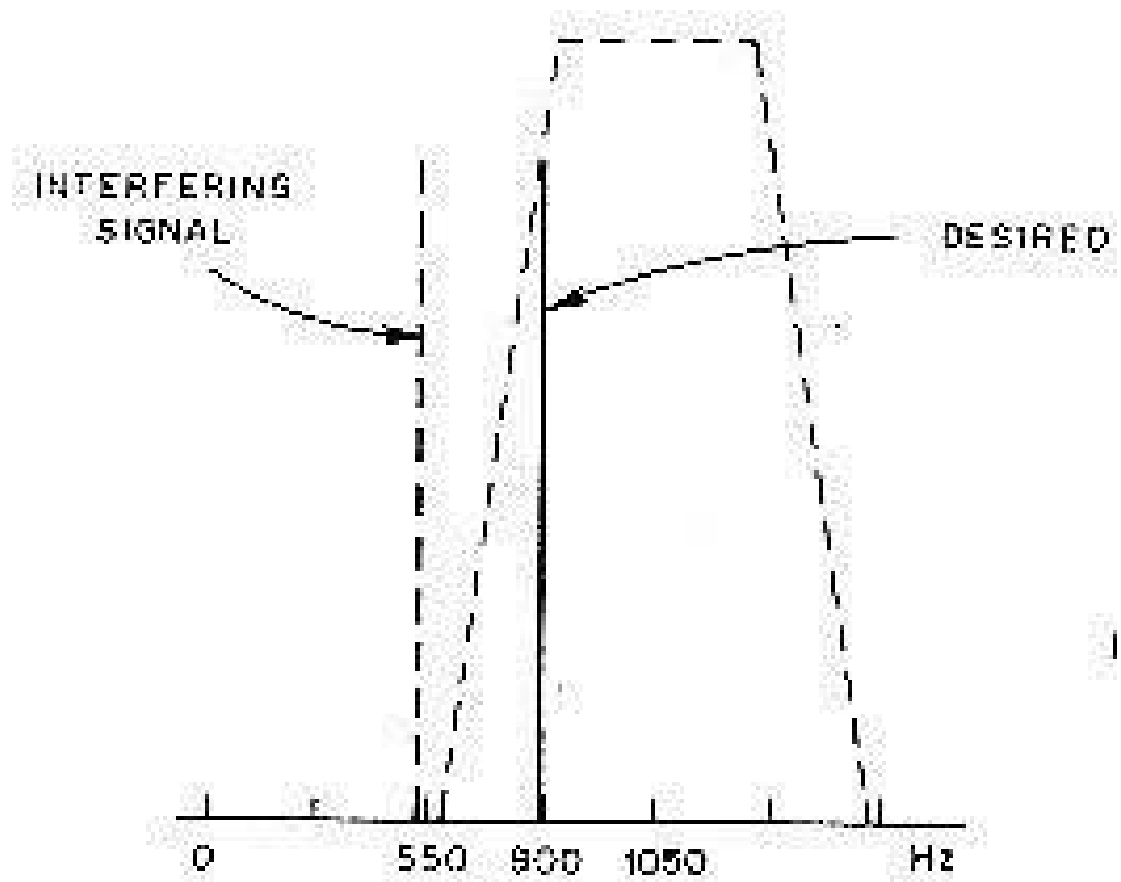
ELIMINATING an INTERFERING SIGNAL



**SIGNAL IS TUNED IN THE CENTRE OF THE PASSBAND
OF A 500 HZ CW FILTER**



**INTERFERING SIGNAL HAS BEEN “REMOVED” BY
TUNING THE RECEIVER 250 HZ HIGHER IN
FREQUENCY. BUT DESIRED SIGNAL WILL NOW HAVE
AN AUDIO PITCH 250 HZ LOWER**



SHIFTING THE IF MAKES IT POSSIBLE TO MOVE THE INTERFERING SIGNAL OUTSIDE THE PASSBAND WITHOUT CHANGING THE NOTE OF THE DESIRED SIGNAL

THE “NEW AGE”: SOFTWARE-DEFINED RADIOS



\$649

STRUCTURE

VERSATILITY

COST



\$40

