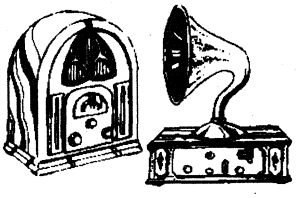
Vintage Radio

by PETER LANKSHEAR



The excellence of Hammarlund

Scandinavia has produced its share of notable pioneering radio engineers, the two best known being the Swedish born Ernst Alexanderson and from Denmark, Valdimar Poulsen. Also from Sweden came the subject of our attention this month, component and receiver manufacturer Oscar Hammarlund.

Very early in the history of radio, it was realised that there had to be better ways of generating RF than by means of high voltage spark discharges — best described as brutal inefficient and spectrum hungry. The aim was to generate a continuous single frequency or continuous wave (CW), something that spark could never do.

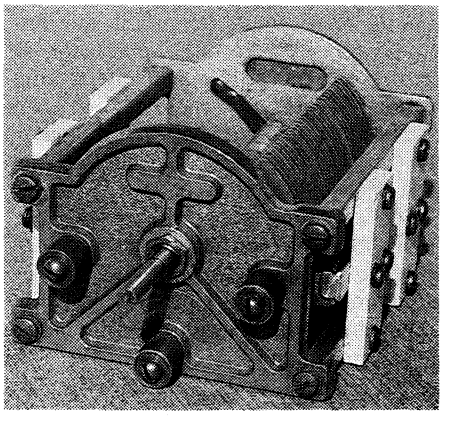
By the 1920's, high powered valve transmitters had become available, but prior to this there was the high frequency alternator which directly and efficiently generated as much as 100kW at frequencies up to 100kHz. Much of the development of these remarkable machines is due to Alexanderson, who went on to become the first chief engineer of RCA. During his long life, (he died in 1975 at the age of 97) he was awarded 344 patents, ranging from electric locomotives to television.

Poulsen was another leader in high powered RF generation, but his work was with arc transmitters. Alternators were understandably very expensive and very large, and consequently relatively few were built. Much more common was the arc transmitter, which generated remarkably pure waveforms by means of an electric arc working in a hydrocarbon atmosphere. By 1919, arc transmitters rated at one megawatt were in use. Incidentally, a graduate Australian electrical engineer, Cyril F. Elwell introduced the Poulsen arc to America in 1908 and subsequently played a large part in its development by the Federal Telegraph Company.

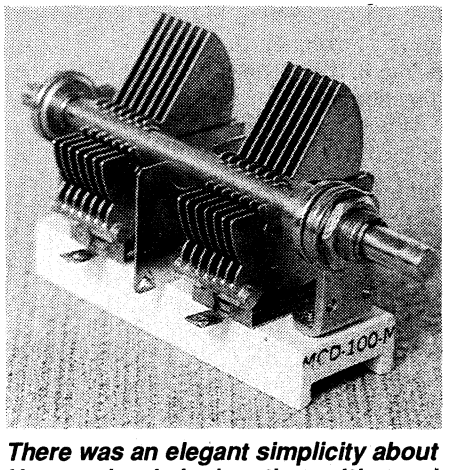
Important as Poulsen's contribution to radio transmission was, his most significant invention, through the lack of a means of amplification, was to remain undeveloped for a generation. But it is difficult to imagine modern technology without it — for it was, of course, none other than magnetic recording.

A third Scandinavian pioneering electronics engineer, Oscar Hammarlund, is rarely credited with his best known invention, the eversharp propelling pencil.

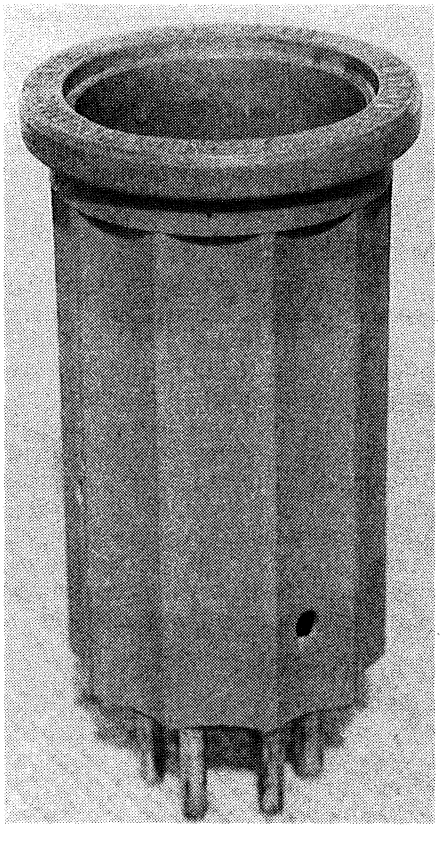
He was born in 1861 in Stockholm, and although his contributions to electronics were perhaps not as spectacular as those of Alexanderson or Poulsen, he was nevertheless a very inventive and skilled engineer, and the firm he founded set for the electronic in-



Hammarlund components made extensive use of Isolantite insulation and finely finished die castings. The splendid TCD split stator transmitter tuning capacitors were an established design by 1932, and the range remained in the catalogs for many years.



There was an elegant simplicity about Hammarlund design that withstood fashion changes. Although this dual 100pF MC-D-100-M variable capacitor is over 50 years old, it would not look out of place in modern equipment.



For generations of hams and shortwave enthusiasts, the Hammarlund Micalex plug-in ribbed former was the ultimate for small coil construction.

dustry, high standards of excellence in component design and quality.

Moved to America

Hammarlund completed his education with a distinguished academic record and, already demonstrating considerable engineering ability, he joined the well known Swedish firm of L.M. Ericsson Co. as a special tool designer and inspector of electrical instruments. However, it was not long before he was invited to go to America to do similar work for the Elgin Watch Company. This he did, in 1882.

Oscar Hammarlund's work with Elgin was noted by Western Electric and in 1886 he was appointed Superintendent of the W.E. plant in Chicago, a considerable responsibility for a 25 year old. Six years later, he went to the Gray Telautograph Co.

It is not always realised that Bell applied for the patents of the telephone only narrowly ahead of Elisha Gray. Gray was a capable engineer and in 1892 was developing the Telautograph, an instrument for transmitting writing electrically and therefore a forerunner of the fax machine.

It was in the process of investigating stylus problems for Gray that the automatic lead pencil was invented by Hammarlund.

Given his technical and engineering talents, it is not at all surprising that Oscar Hammarlund took a keen interest in the new technology of wireless telegraphy. In 1910 he founded a company to develop his ideas.

As the radio industry expanded, the outstanding quality of Hammarlund Manufacturing components made them up-market standard setters. But as well as producing fine components, the Hammarlund Company achieved an number of important 'firsts', including the first commercially produced shortwave superheterodyne communications receiver, the ancestor of a long lived line which were the finest of their type available.

Although catering for a different market from that of the budget conscious broadcast listener, the Hammarlund company had competition — one worthy rival being the National company under the able leadership of James Millen.

It will be recalled that in our November 1994 column, we described the very successful 1924 Browning Drake receiver and how it came to be closely associated with the National company, who produced a long series of very popular receivers, including in 1934 the landmark HRO.

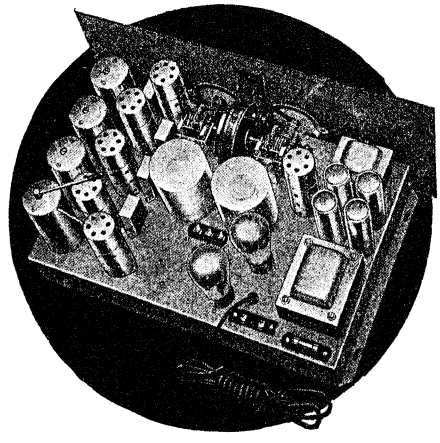
Competing with National

National's success with the Browning Drake did not go unchallenged, and in 1925 Hammarlund responded with the Hammarlund-Roberts kitset receiver. Like the Browning Drake, the Hammarlund-Roberts comprised a neutralised RF stage, a regenerative detector and two audio stages; but there were significant differences. The Hammarlund RF amplifier was simpler to neutralise, and regeneration was controlled not by the 'regenaformer' variometer, but the superior, and more accurately adjustable variable capacitor method.

Like the Browning Drake, the Hammarlund was a simple but efficient design, and many old timers insist that it was superior to the Browning Drake. However, the audio power output of the early radios was never very great and the Hammarlund-Roberts receiver was soon upgraded to a five valve set with push pull output.

VALUE • AND • ECONOMY

The Lowest Priced COMPLETE Short-Wave Superheterodyne



REMEMBER when spare tires, bumpers, horns, etc. were automobile *accessories* — purchased *separately?*

Today, you expect them as *standard equipment.* You would resent being compelled to pay extra for them.

Just so with radios. To own a short-wave receiver comparable in any way with the COMET "PRO" — in quality, range and performance, you must buy or build a perfect tuner, an adequate power supply, a complete set of coils, special transformers, etc. These will make your receiver cost more, in the end, than if you bought the COMET "PRO" *complete,* with all "accessories" *built-in* and scientifically matched to the receiver.

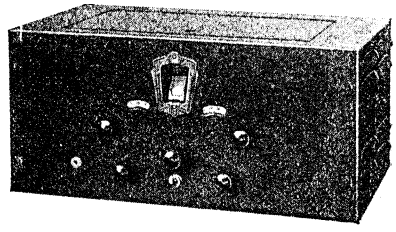
The list price of the COMET "PRO" is $150 (*less tubes*). *But it won't cost you that much!* As a recognized amateur, you are entitled to a discount of 40 and 2 percent, which reduces the price to $88.20 plus a small Federal Excise Tax. That price includes not only a tuner, world-famous for its sensitivity and selectivity, but also a built-in power-pack, air-tuned transformers, and all coils needed to cover a range of 15 to 250 meters, with *band-spread tuning at all frequencies.*

Besides, your dealer can probably arrange easy payments, if you request it.

Think it over, and you'll buy the COMET "PRO" — not only on the basis of its unexcelled *performance,* but also for its unequalled *value* and *economy.*

COMET "PRO"

PROFESSIONAL RECEIVER



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424 W. 33rd St., New York

— Check here for General Catalog. — Check here for folder on new Air-Tuned I.F. Transformers. — Check here for new booklet describing the "PRO" in detail.

Name .....

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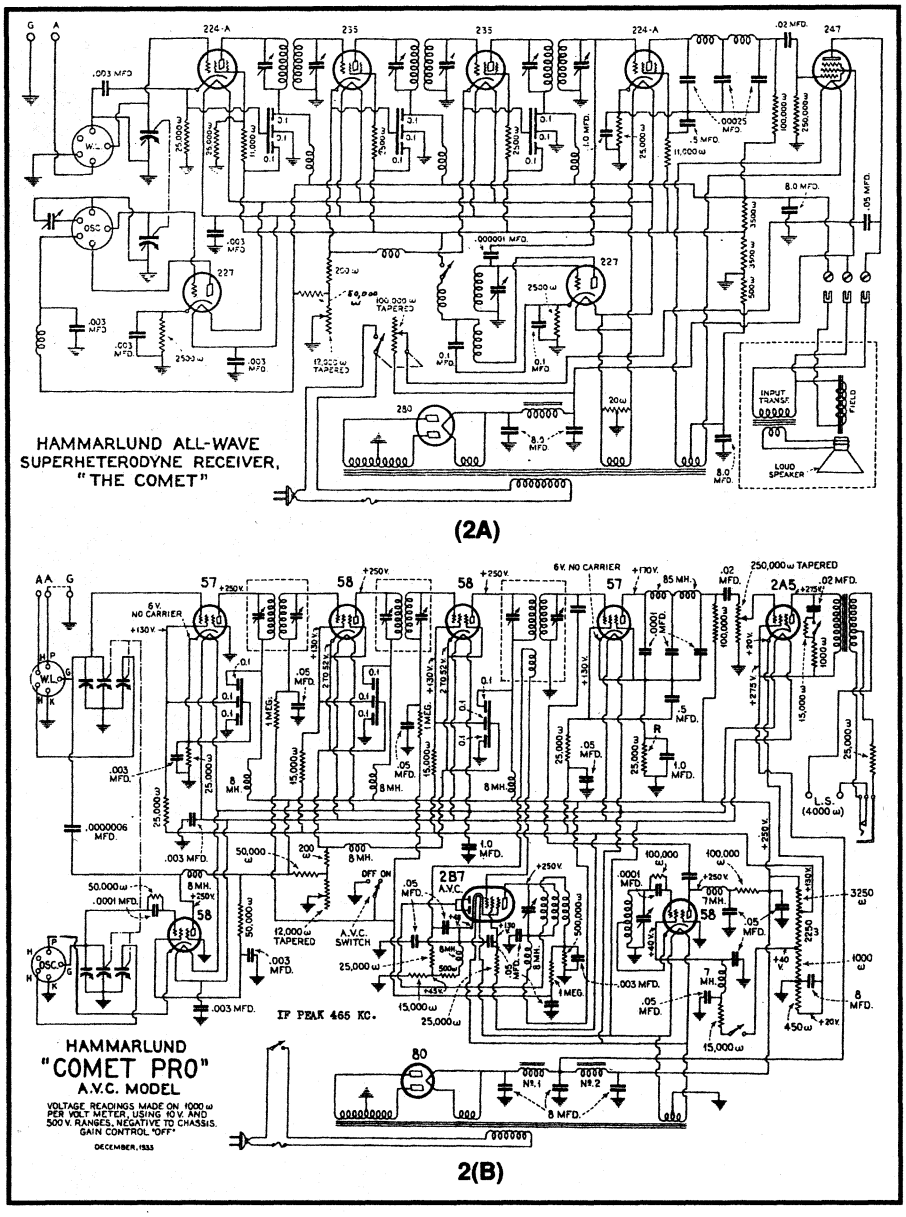
Say You Saw It in *QST* — It Identifies You and Helps *QST*

This advertisement appeared in QST for August 1933. The comments about purchasing a complete radio (but still less tubes!), was aimed at National, who kept the basic price of their FB7 competitive by selling coils and power supplies as optional extras.



The rapid development of the Comet series is evident from these circuits, with the original Comet (2A) introduced at the beginning of 1932 and the first Comet PRO available in April. By November 1933, less than two years later, the final version of the Comet PRO (2B) had appeared.

Following these successes, Hammarlund Roberts Incorporated as the firm was now called, produced more or less annually a series of receivers, optionally as kitsets or assembled and in cabinets. They tuned only the broadcast band and their circuits were typical of current practice. Most models had the prefix Hi-Q — referring no doubt to Hammarlund's highly efficient coils — and they naturally incorporated the company's premium quality components.

The first model was the 1926 'Hi-Q', a fairly conventional neutralised TRF with two RF stages, detector and two transformer coupled audio stages. The second two tuning capacitors were ganged. It was followed in 1927 by the 'Hi-Q Six', a similar set but with an additional RF stage and using grid resistors for stabilisation of the RF valves.

During 1928 there were at least six 'Hi-Q 29' models, by now using the new screen grid RF amplifier valves with either two or three stages, and with a choice of transformer or resistance coupled audio stages.

Several versions were fitted with mains power supplies. One, the 'Junior' was a hybrid, requiring a lead-acid battery for the valve filaments, but the AC models used the newly introduced indirectly heated valves.

Two Hi-Q 29's had the unusual and short lived Arcturus indirectly heated valves with 15 volt carbon heaters! One distinguishing feature of some of these models was the tuning of both windings of the RF coils, providing band pass coupling.

Last of the HI-Q line

For the 1930 season there were — surprise — the three 'Hi-Q 30' models, including AC and DC mains powered and a battery powered chassis. With six ganged tuning capacitors controlling preselector tuning and three tetrode RF stages, they were examples of the ultimate development of TRF technology. About the only significant feature absent was automatic gain control, but this was rarely seen in TRF receivers anyway. It is obvious from the illustration that these receivers were by now so complex that only experienced builders could tackle the kitsets.

The situation was now changing significantly. During 1930, RCA were obliged to release the superheterodyne patents and it was apparent that radical changes in the radio industry were taking place. At the same time, the Great Depression was paralysing commerce, so that in some respects 1931 was a year in limbo.

Hammarlund made some nominal changes to the Hi-Q 30, to produce the single model AC powered 'Hi-Q 31'. This was to be their last TRF, and the end of the Hi-Q series. Some years later there was a revival of the name in their HQ family of budget priced receivers, which were popular with amateurs worldwide.

There was, however, one field where the TRF was still practically unchallenged. Conventional superhets were considered to have serious shortcomings for shortwave work. Inadequate mixer and oscillator design meant that they were noisy and difficult to tune, and with the commonly used 175kHz intermediate frequency there were serious image problems. Converters were receiving some acceptance by shortwave broadcast listeners, but for amateur and communications work, the standard receiver remained the TRF with a tuned RF stage, regenerative detector and simple audio amplifier.

As has been mentioned in previous

columns, these simple receivers should not be underestimated. For CW (Morse code) reception, the oscillating detector is remarkably efficient. As late as the outbreak of World War II, Pan American Airways were still using similar receivers on their prestigious China Clipper flying boats operating on the San Francisco — Manilla — Hong Kong route.

Theoretically, there was nothing inherently wrong with the superheterodyne that proper design could not overcome. Wisely avoiding the temptation to produce yet another broadcast band only receiver in an over supplied market, Hammarlund in 1931 went to work instead on a shortwave superheterodyne.

Meanwhile in Chicago, during that same year, New Zealander E.H. Scott had produced his massive 12-valve 'All Wave Superheterodyne'.

Probably the first commercially made shortwave receiver, the beautifully made Scott did not have ganged tuning or double tuned IF transformers, features which were included in the new Hammarlund design.

The Comet

Called the 'Comet', Hammarlund's new receiver was announced at the end of 1931, and now there was no kitset option. Using 'in house' components made with Hammarlund precision, the Comet's quality was of the highest order, and with the extensive use of Isolantite insulation, efficiency and stability were good. Images were reduced by the use of what was then a high frequency IF of 465kHz.

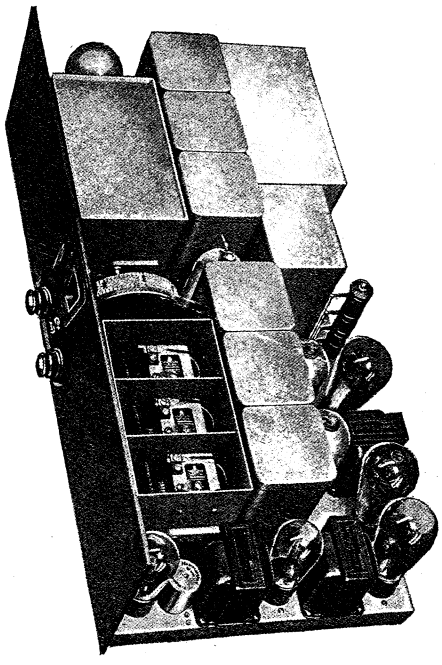
The circuit consisted of a 24A screen grid mixer, inductively coupled to a type 27 triode oscillator. There were five pairs of plug-in coils to cover the range from 550kHz to 21MHz. Tuning was assisted by means of an oscillator bandspread capacitor.

There were two IF amplifier stages using the new variable-mu type 35 tetrodes, and another 24A operating as a biased detector drove the recently introduced type 47 output pentode. One significant feature was what was called the 'IF oscillator' — known better today as a beat-frequency oscillator (BFO).

First of the 'pros'

The Comet was an instant success. Its performance was a revelation, and it was adopted by several large national and international organisations.

Inevitably its communications potential became apparent and by April 1932, the Comet had been adapted for communications work. Not that many modifications were needed.



The Hi-Q 30 was far more complex than most kitset TRF receivers. In this picture from 'Radio News' for December 1929, one of the shield covers has been removed to show how two three-gang tuning capacitors were coupled together as part of the complex tuning system.

Extra tuning capacitors were added and a metal front panel fitted. The main tuning capacitors were used for band setting and were no longer ganged but tuned independently, enabling the oscillator to be operated either above or below the signal frequency. To simplify operation, there was now ganged bandspreading for the aerial tuning and oscillator.

Finally, the audio stage was changed to an indirectly-heated type 27 general purpose triode. This developed less hum than the directly heated 47, and the reduced output was considered adequate for headphones or moving-iron loudspeakers.

If more audio was required, a self-powered unit containing a power pentode and moving coil loudspeaker was available, intended to be driven from the headphone socket.

Called the 'Comet PRO (for Professional)' the new improved receiver continued the success of the Comet. The company must at this time have severed its Roberts interests, as the name was now the Hammarlund Manufacturing Company.

Improvements were steadily made. By December 1932, the RF tetrodes and the triode oscillators had been replaced by the new 57 and 58 RF pentodes, and in the output stage, the 47 pentode was reinstated. The coils were now shielded and the oscillator was capacitively coupled to the mixer.

Throughout 1933, improvements continued, and by the end of the year, the top of the line PRO had a crystal filter, variable BFO, air tuned IF trimmers, an indirectly heated output pentode and automatic gain control.

Other manufacturers had understandably not taken the Hammarlund success lying down. Significant competition came from arch-rival National's superheterodynes. Their very expensive AGS was available within three months of the release of the Comet PRO, and at the beginning of 1933, amateurs could buy the economy priced National FB7 with an equivalent specification to the PRO.

The communications receiver had come a long way in two years, but time was running out for the Comet — because, as related in our November 1990 column, National's HRO was introduced at the end of 1934. Although expensive, the HRO was an instant favourite and so advanced that all competition, including the Comet PRO, was immediately obsolete.

The Comet was still a fine receiver, with thousands in daily use, but its days were numbered. Hammarlund set about developing the PRO into a line of superlative receivers, which remained in production for over 30 years and which became a benchmark for performance. But that story will have to wait until next month. ❖

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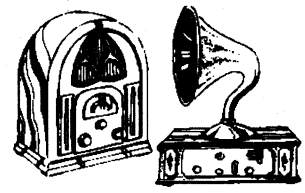


The Hammarlund Super Pro Receivers

Last month we saw how, early in 1932, the Danish born Oscar Hammarlund's New York manufacturing company proved that not only was the shortwave superheterodyne communications receiver a practical proposition, but also it had a superior performance to the then-standard shortwave regenerative TRF receiver.

Domestic shortwave superhets were also appearing, and although they had some features in common with receivers intended for communications work, two quite different classes of equipment developed — and with few external resemblances. Whereas domestic radios were intended to look like furniture, communications receivers had metal front panels, more controls, and usually metal cabinets, were often without internal speakers and no attempt was made to disguise their technical appearance.

There were essential characteristics that defined the classic communications receiver. High quality domestic sets could meet some of these requirements, but by and large the specifications were too stringent for, or were absent from run of the mill receivers. Summarising, these were:

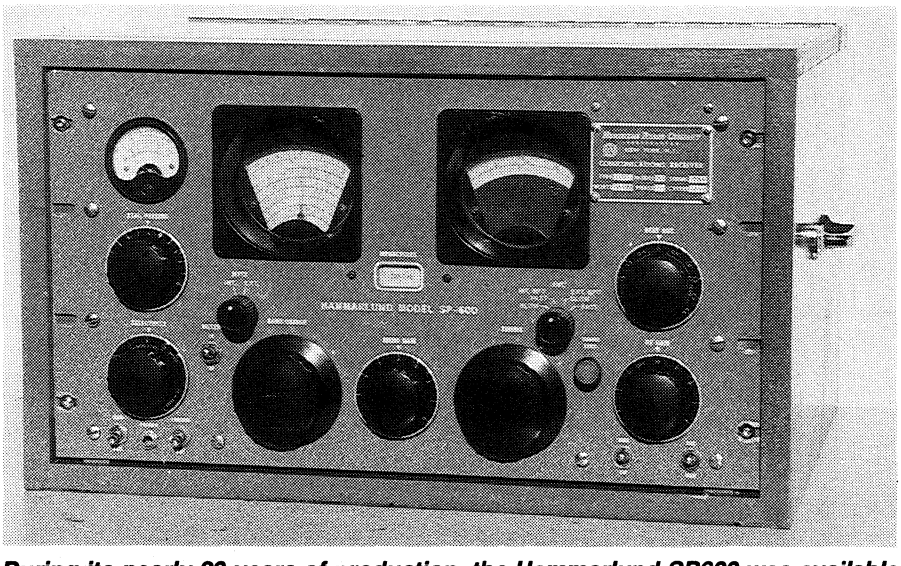
1. High sensitivity, with a good signal to noise ratio together with the ability to handle a wide range of signals without overloading.
2. Good selectivity, preferably variable, with high rejection of adjacent signals.
3. A minimum of images and spurious responses or self-generated signals.
4. Mechanically and electrically very stable. This demanded sturdy and solid construction.
5. Tuning systems had to have easily read dials and accurate resetability to a given frequency, coupled with low tuning ratios to provide accurate tuning of all kinds of signals.
6. An internal beat frequency oscillator was essential.

The Hammarlund 'Comet Pro', described last month, and generally considered to be the first true communications superhet, was able to meet these specifications, with one exception. Lack of an RF stage in front of the mixer created a problem with images. These, at twice the IF frequency, were nearly 1MHz removed from the fundamental, but strong signals could still break through at the higher frequencies. Initially this would not have been a major problem, but as the popularity of the shortwave bands increased, so too did the nuisance factor of images, which have the annoying habit of appearing right on top of a wanted signal.

There are two ways of reducing images in conventional superheterodynes. One is to raise the intermediate frequency; but in practice, for general coverage receivers, there is an upper limit of about 500kHz. (Receivers without broadcast band coverage sometimes had an IF of around 1600kHz, but selectivity then became a problem).

The other approach is to improve rejection before the frequency converter, by providing extra tuning for the incoming signal, usually in the form of one or more RF stages. As frequency converters tend to be very noisy, RF stages also have the important benefit of improving the signal to noise ratio.

Although band changing would become more complicated, the obvious way to improve the Comet would have been the addition of an RF stage.

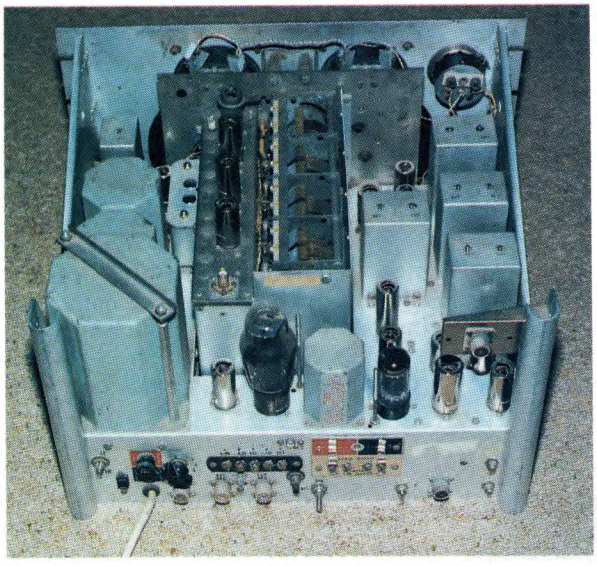


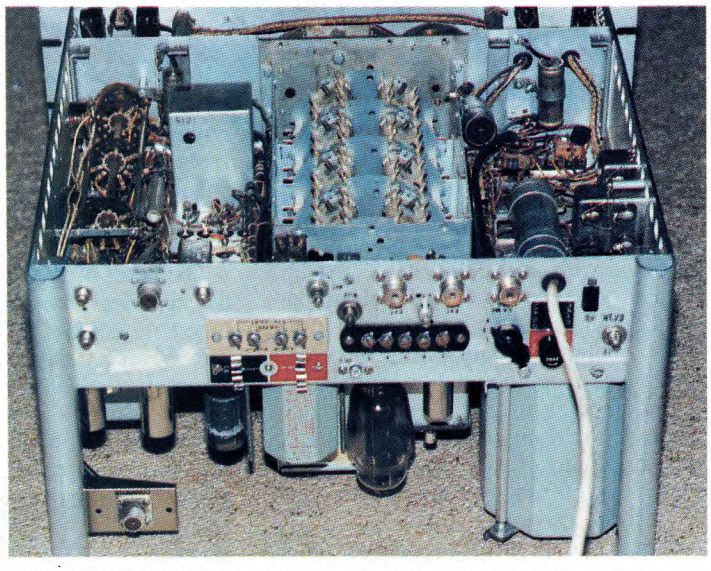
During its nearly 20 years of production, the Hammarlund SP600 was available in several versions. The set above has a home made wooden cabinet and was originally one of a dual diversity pair in a northern radio company's frequency shift telegraph terminal.

A new generation

Meanwhile, the competition had been busy, and by 1935 the new generation of communications receivers had appeared, led by the legendary National HRO fitted with an unprecedented *two* RF stages. Good as it had been, Hammarlund's Comet Pro was no match for these new models.

Of course, as any progressive manufacturer would have done, Hammarlund foresaw the eventual obsolescence of the Comet and had been developing an improved model. Mid-1935, they announced a new receiver to





Left: The rear view, with the tuning capacitor cover removed, revealing the four split stator and rotor sections. Note the massive cast case for the power transformer and chokes. Right: With the underside covers removed, the turret, heart of the tuning system can be seen to dominate the interior of the chassis. Note the silver plate contact pegs projecting from each module base. Between each group of pegs are the air spaced trimmer and slug adjusting screws. The wafer switch to the left is the variable selectivity control.

be called their 'Super Pro'; but it was March 1936 before the first examples were released.

Just as 18 months previously, the National HRO had revolutionised receiver performance, so the Super Pro in its turn set still higher standards. Its appearance and specification were impressive. Like the HRO, there were two RF stages, but the Super Pro, with five switched bands covering from 550kHz to 20MHz had a directly calibrated main dial and a second dial for the mechanical bandspread, together with precision geared drive. One considerable advance was efficient bandswitching.

The front panel was the standard width for rack mounting, as an alternative option to a metal cabinet, and the large, tightly packed chassis was practically square. Fig.1, reproduced from a 1936 advertisement in *QST*, shows some of the outstanding features.

Much of the success was due to the quality of the mechanical construction, and generally, the electrical design of the Super Pro was conservative and conventional. A unique feature was fitting the aerial coils with Faraday electrostatic shields, made from woven thread and wire, to reduce the transfer of man-made noise from the aerial.

Four IF stages

Although by 1936 metal valves were fashionable, all 16 valves in the Super Pro were, like those in National's HRO, the older and proven glass types. In the front end, two type 6D6 were used as RF amplifiers, and a 6A7 was paired with an electron-coupled 6C6 oscillator for frequency conversion. There followed an optional crystal filter and an unprecedented *four* 465kHz IF stages, with continuously variable selectivity, the spacing of the windings being adjusted by means of cams controllable from the front panel.

Four IF stages were not necessary to obtain sufficient amplification. The prime reason was to obtain an IF bandpass response with very steep sides, and by running each stage conservatively, this was achieved with considerable stability. The IF amplifier valves used were three 6D6's and a 6B7 diode- pentode, which served also as a diode detector. There was yet a further IF stage using a 6B7 as a separate AGC amplifier and rectifier. In all, the original Super Pro had no fewer than *seven* IF transformers! Another sharp cutoff 6C6 was used as an electron-coupled BFO.

High power audio

The audio amplifier had an element of overkill! A type 76 general purpose triode fed a triode-connected standard 42 output pentode.

This combination would have been adequate for most communications work. But Hammarlund obviously considered this to be unworthy of a premium receiver, and fitted an extra transformer coupled push-pull triode connected pair of class AB 42's, capable of a nominal 15 watts! This configuration, by the way, had been used a couple of years previously by Philco in some of their very popular cathedral and console receivers.

There was a separate cabinet for the power supply, with dimensions in keeping with the massive receiver. A 5Z3 was used for the HT rectifier, and a type 1V for the bias rectifier.

The Super Pro lived up to its promise of providing a superior performance. It was primarily a professional receiver, as the name implied. The price put it out of reach of all but the most affluent amateurs and shortwave enthusiasts. Major users were government and large commercial organisations, and military versions were soon being made.

Amateurs were not denied possession of Hammarlund receivers, however. In 1938 the HQ120 became available, a top performing model, but only half the price of a Super Pro and with calibrated amateur bandspread and reviving the HQ prefix.

By now, the SP100 had replaced the original Super Pro, but the only change was the substitution of half the valve complement with their octal-based metal equivalents.

The Super Pro 200 series followed. These were basically the original model, but with 18 octal valves and with a noise limiter as a new feature — but now with only three IF stages.

With the outbreak of World War II, there was a huge and initially unsatisfied demand for communications receivers, and in the USA large numbers were made, including the National HRO, the RCA AR-77 and AR-88 and of course, the Hammarlund SP200.

Hammarlund design and quality came to the fore during this period. It has been claimed that their 'APC' variable capacitors were at one stage being produced by 10 different manufacturers, at the rate of one million a month!

It was with an SP200 that I first had 'hands on' experience with a Hammarlund Super Pro. This was in 1950 at the New Zealand Broadcasting Service's shortwave receiving station, situated on a remote area of the hills 300 metres above Cook Straight and with a DXer's dream aerial 'farm' populated with numerous 600-metre long rhombic and V aerials, covering all points of the compass and all on 20 metre high poles.

There was a wide choice of top-line receivers, including Eddystone, STC, Canadian Marconi, HRO clones and RCA models. But when reception conditions were bad, a Hammarlund SP200 was unquestionably the best performer, and the universal favourite. It says much for Hammarlund engineering that this was in spite of the receiver being basically the 1936 design, with the RF stages using the already obsolete 6K7 valve.

At the conclusion of hostilities in 1946, Hammarlund were able to put into production the SP400. Basically, it was the proven old SP200, but with some minor valve changes.

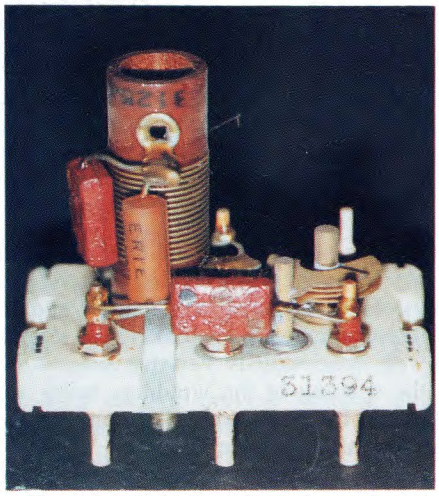
Meanwhile, however, significant developments were under way. A new Super Pro was taking shape. Using their experience of a decade of Super Pro production and wartime developments, Hammarlund's SP600 receiver was a completely new design, but it was not until 1952 that it was finally released.

An historic anomaly

It is here that one of those situations occurred that can mislead historians. Four years earlier, the 1948 *Radio Amateur's Handbook* had included a full-page Hammarlund advertisement with technical details and even a drawing of the SP600. The problem is that it bore little resemblance to the production model SP600.

The real SP600, with no fewer than 20 valves, was certainly worth waiting for. Oscar Hammarlund, who died in 1945, would have approved. It bristled with interesting features, and has been referred to by several writers as the finest conventional superheterodyne communications receiver ever made — capable of holding its own even with later specialist receivers, including the Wadley-Loop Racal RA17. Frequency coverage of the standard model was from 540kHz to a remarkably high 54MHz, in six bands. A low frequency version, the SP600-LF, covered from 15kHz to 540kHz.

The heart of the front end, and key to the superior performance, was the coil turret — a large rotary drum divided into 24 compartments, each for a coil assembly with its associated capacitors mounted on an isolantite base. These bases had silver plated pegs which, as the drum was turned, mated with silver plated spring contacts located between the tuning capacitor and the associated RF and oscillator valve sockets.



Individual coil modules are complete sub-assemblies and are readily unclipped from the turret. This is the oscillator coil unit for the 7.4 to 14.8MHz band.

There was therefore no wavechange switch, and lead lengths were sufficiently short for efficient 50MHz operation. The turret effectively combined the efficiency of the HRO coil boxes with the convenience of the wavechange switch. Some years later, Philips used a turret successfully for their TV tuners.

Ceramic shaft

The split-stator four gang tuning capacitor can be seen in Photo 2. What may not be obvious from the photo is that the brass vanes are gold plated and to minimise coupling between stages, the shaft is made not of metal, but Isolantite!

The manufacture of a component like this demands extreme precision and skill. Ceramics such as Steatite and Isolantite shrink considerably during firing, and cannot be turned to an exact size afterwards. Isolantite manufacture was a Hammarlund specialty and their standard insulation, and their receivers have little of the usual bakelite and fibre used extensively in conventional radios.

The SP600 circuit is significantly more complex than that of the earlier Super Pros. As an indication, the parts list specifies 129 resistors and 184 capacitors. Many domestic receivers would have had only one-tenth this number.

The RF stages are choke/resistor coupled, with the circuit constants chosen to provide increased gain at the higher frequencies, where it is most needed. As was standard communications receiver practice, the high frequency oscillator was a separate valve, and in the set illustrated, which was half of a pair for diversity reception, it is a double triode arranged so that, if required, an external master oscillator can be used.

Then follows the first mixer, a standard pentagrid 6BE6, the anode of which is connected to a double frequency IF transformer T1. Some models had the option for fixed frequency operation using V3 with up to six switched crystals.

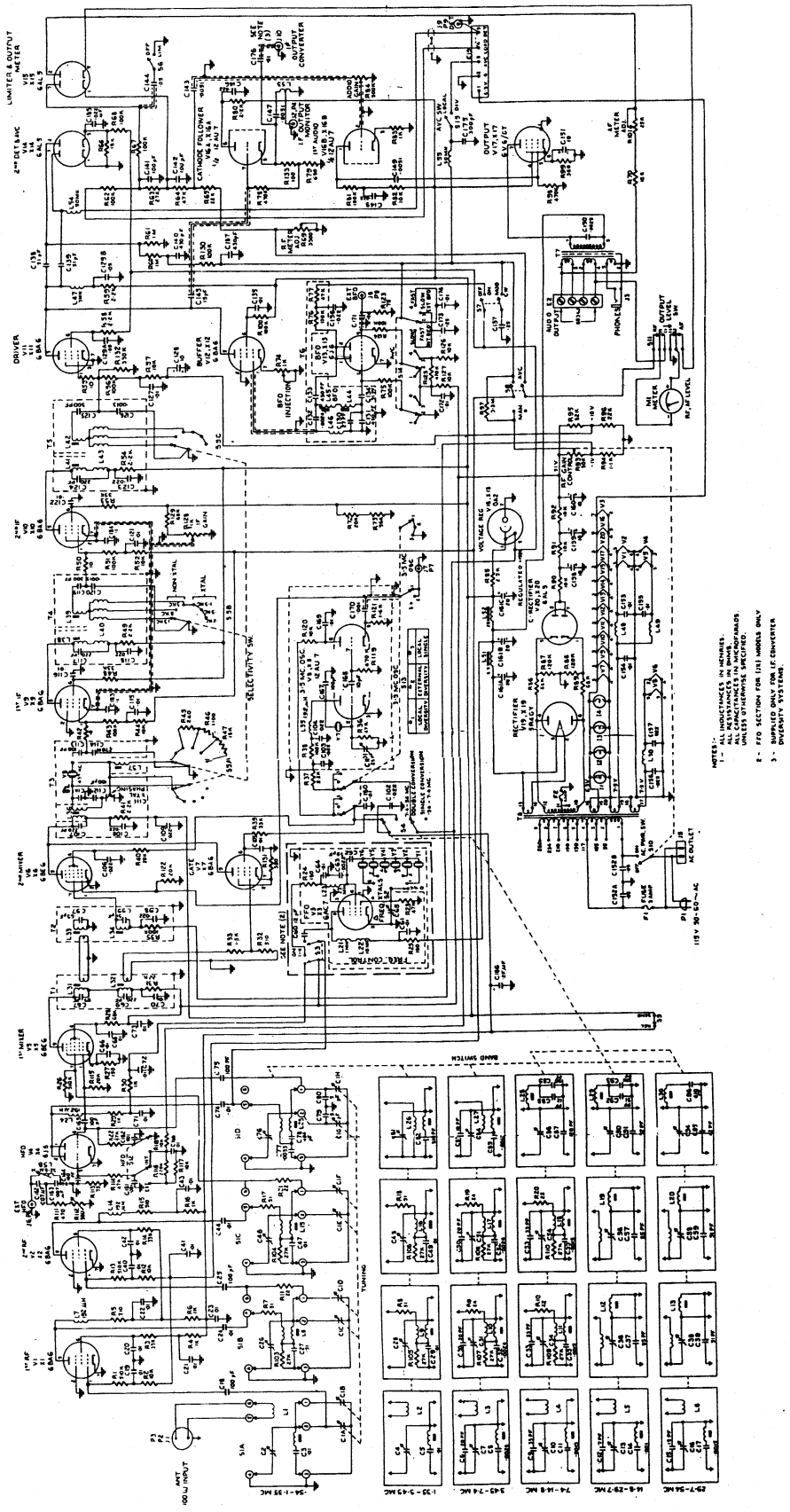
Double conversion

At the highest frequencies covered by the SP600, with the standard 455kHz IF necessary for good selectivity, and despite the use of two RF amplifiers, images would be a problem. The ingenious solution adopted by Hammarlund was to use double conversion for the top three bands.

These signals were first converted to an IF of 3955kHz before being coupled via T2 to the second mixer V6, another 6BE6. Here signals were mixed with the output of the 3.5MHz crystal oscillator V8 to produce the main IF signal of 455kHz.

Signals for the three lower bands left the first mixer already converted to 455kHz, and were automatically directed to a straight amplifier V7, called a 'gate', operating in parallel with the second mixer. All IF signals appeared at the anodes of the V6 and V7 to be passed on to the crystal filter and the IF system with six switched positions, rather than the continuously variable selectivity of the earlier models.

Valves 9, 10 and 11 comprised the traditional three-stage IF amplifier, providing considerable amplification and drive to the AGC and detector



The circuit of the SP600 is well worth tracing out as it reveals many innovations and unusual features. There were several variations of the receiver for specialist applications, this version being adapted for diversity reception using two receivers connected to widely spaced aerials and with inter-connected oscillators and AGC systems.

diodes V14. There was actually sufficient detector current for direct reading by the signal strength meter, calibrated in dB above one microvolt.

With several volts of audio from the detector, minimal amplification was needed from V16B before the signal passed on to the single 6V6GT audio output stage. In contrast with the earlier Super Pro powerhouse audio systems, the SP600 provided only a couple of watts at 600 ohms, primarily intended for feeding an audio line which can be monitored by the signal strength meter.

Associated with the detector are two unusual facilities. V16A is a cathode follower, providing an output of the IF signal for connection to external equipment. To ensure complete stability and eliminate any possibility of 'pulling', the BFO (V13) had a buffer amplifier, V12.

A high tension and a bias rectifier, together with a voltage regulator are needed for the power supply. The power and audio transformers and filter chokes are in keeping with the rest of the engineering of the SP600, being sealed in octagonal cast cases with ceramic terminals.

The SP600 is a handsome receiver, with the controls located in just the right places for prolonged periods of operation. Naturally, accuracy and resetability of dials was paramount. Each band had 6000 readable divisions with very precise drives and no backlash. As one old time 'sparkie' commented after a session with mine, "That is an operator's receiver!"

One development that caught up with

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the SP600 after it went into production was the increase in single sideband traffic. While the stable and flexible BFO is ideal for CW and RTTY transmissions, there is insufficient injection and the diode detector is not suitable for single sideband operation. Hammarlund overcame this problem with the SPC-10 SSB converter, which can be driven from the SP600 IF cathode follower.

If space permitted, there are still more details of interest that could be mentioned; but I think that sufficient has already been written to show that the SP600 is quite a receiver. It is only recently that solid state technology has been able to match the performance of the great communications receivers of the valve era. The Super Pro 600 was specified to resolve a 1uV CW signal with a 10dB signal to noise ratio.

The major advance in modern receivers has probably been frequency synthesis, eliminating the huge dials and the need for the complexity and precision of the drive mechanisms of the classic receivers.

At one stage, the US military released a large number of SP600 receivers for sale to the public, and examples regularly appear in the American amateur and vintage radio magazines 'for sale' columns at reasonable prices, and to make a purchase is a practical proposition. There is one catch however — although the major metalwork is aluminium, the weight with cabinet is over 40 kilos. Hardly 'carry on board' luggage!

The SP600 was the last of the Super Pro line, and remained in production until at least 1970. For a receiver to remain in production for 18 years without major modification, it had to be an outstanding design.

Odd spot

By far the most frequently used valve of the 1920's was the 201A, and it was the subject of this column for April 1991. Nine years ago, the US-based Antique Wireless Association reported on a project initiated by renowned valve historian Bro. Patrick Dowd, identifying just how many different brands of 201A could be identified.

In their May 1995 Bulletin is an update, listing a staggering 513 brands, including Australia's AWA. No wonder the '01A is claimed to be the most popular and duplicated valve of all time! ❖