the game in the reverse of the usual manner, as he started in from the mathematical end, took up receiving, and since the convention has sworn to put in a transmitter.

The Third issued at the banquet a formal invitation to the Fourth District to take part in the convention to be held at Washington on Feb. 22 and 23d next, on the ground that the 4th is in the same radio inspection district and is also geographically related to them. The invitation was accepted for the Fourth by 4XC.

Well, we had Quite
Some
Time!

Some New Apparatus at the Conventions

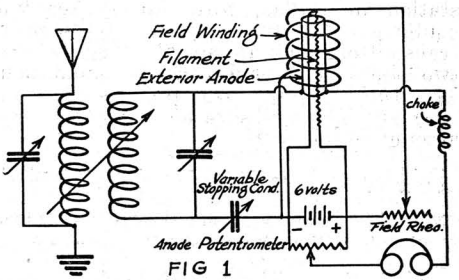
IT isn't very hard to imagine that before many years slip by we will be having radio shows every year at which the "new fall styles" in amateur apparatus will make their debut. Something of the sort was evident at the 1921 convention, several exceptionally interesting pieces of equipment having their premiere on that occasion.

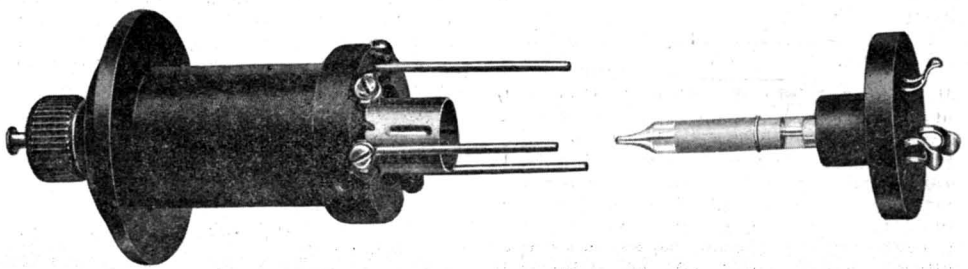
The Connecticut Tube

The talk of the show, we believe, was the new Connecticut detector tube. Here for once is something new under the sun; something radically different and intriguing. It has been our good fortune to be invited to the laboratory of the inventor, Mr. Harold P. Donle, chief engineer of the Connecticut Telephone & Electric Co., of Meriden, Conn., where the tube was studied in actual operation and data gathered for this description—the first information made public on a device that holds much interest for the amateur.

In introducing the subject we would call the attention of our readers to an article appearing on page 22 of QST for October, 1919, describing a Connecticut tube of earlier model. This was an elongated three-element tube in which the anode was a silver plating on the *outside* of the glass wall, the space current freely passing thru the glass by an electrolytic action when the walls were properly warmed by the filament.

We must digress a moment to say that the Connecticut Telephone & Electric Co. is an old long-established firm, perhaps best known as the manufacturers of "Connecticut" ignition systems for automobiles. They have entered the radio field slowly, but with both feet. The present tube is the result of over four years of real research, over 1600 experimental tubes having been made and a careful log kept of their performance. Mr. E. C. Wilcox, president of the firm, estimates that about $100,000 has been spent in its development. These points are of interest in letting us know that the tube is not the result of hit-or-miss experiments, and that it is backed by a two million-dollar firm of repute.

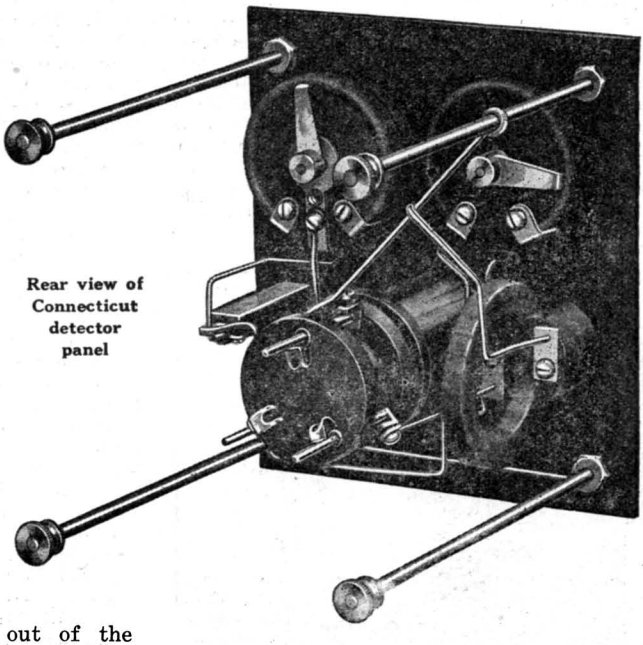




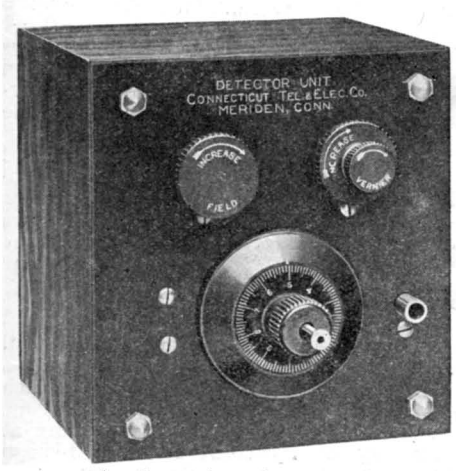
The Connecticut Tube and its Field Coil

The several illustrations herewith will give a good idea of the appearance of the tube and its appurtenances. Briefly, it is a small elongated tube containing only a filament within its exhausted interior but bearing a deposited silver anode on its *outside* wall, the whole placed within a magnetic field. Figure 1 shows the connections, with a simple spider-web tuning

system. There is no grid, no B battery, no tickler coil or plate loader—it is a two-element tube. In this case the magnetic field is obtained from a solenoid winding, and the position of the tube in the field is adjustable. A single 6-volt battery is used and this performs three functions: it heats the filament; it excites the field winding, controllable by a series rheostat; and it provides a plate potential, adjustable by a potentiometer across the battery. In the plate circuit are included 'phones and a r.f. choke. The input is connected across the anode and the negative terminal of the battery, thru a variable stopping condenser. In the photograph of the detector panel front, the upper left-hand knob is the field rheostat which is used for coarse adjustments, fine adjustments being had by moving the tube in and out of the solenoid, which movement is controlled by the large knob with dial in the lower center. The anode potentiometer is in the upper right-hand corner, and is equipped with a vernier for very fine adjustment. There is no control for the filament, it being directly connected to a 6-volt battery and operating equally satisfactorily whether the battery is fully charged or almost exhausted. The filament is metallic, neither coated nor tungsten, and operates at a bright red. Of course such a filament at so low a temperature would not ordinarily emit sufficient electrons for satisfactory action but in Mr. Donle's tube with exterior anode another factor enters in the form of electrolytic action on the warmed glass. It is probable that the sodium in the glass is ionized, a copious supply of electrons resulting, probably a hundred times what would be available for an interior anode which did not get the benefit of the chemical action in the glass.



Rear view of Connecticut detector panel

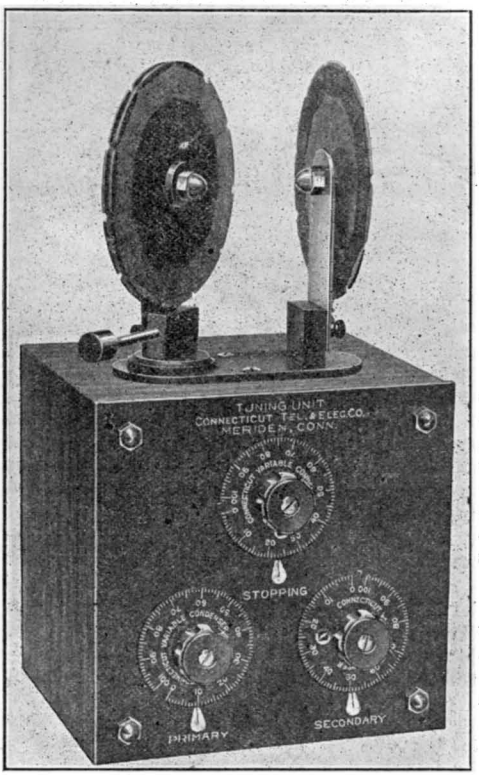


The Connecticut detector unit

So much for the arrangement. The performance is even more interesting, but likewise more complex. The tube will detect, regenerate, oscillate, heterodyne—and so may be used for either spark or C.W. reception. The main point about its adjustment is that *the tube must be tuned to the desired signal.* This is something we haven't heard of before—*tuning* a tube—yet it is just what takes place in this one. The adjustments are exceptionally critical but result in exceptional selectivity and a similar decrease in QRN. Increasing either the field intensity or the anode potential or drawing the tube further into the solenoid raises the frequency—reduces the wave length. It covers from 50 to 2500 meters.

It is hard to say just what is going on within the tube. It will "oscillate", or whatever it is, at any desired wave length, *entirely without any inductance-capacity* connected in, the frequency determined solely by the "tube-tuning". (The best action of course is when it is resonated with the tuning system.) It will be noted in Figure 1 that if the tuning circuit is

disconnected the only path from anode to filament is thru the phones and choke, where radio frequency current can not pass. What, then, is it that "oscillates"? Mr. Donle says that *inside the tube there is a certain phenomenon going on continually which gives a sinusoidal variation of the internal impedance.* More than that deponent saith not, and we hesitate to venture any guesses as to what the phenomenon is. Of course it is not due to a radio-frequency variation of the field intensity—a permanent magnet will do quite as well.



The Connecticut tuning unit

The exterior anode, by the way, is essential, and is different from the Fleming patent in that the latter specifies two electrodes within a vacuum whereas the Connecticut tube contains only a filament inside.

The detector action of the tube is somewhat similar to the action of a gaseous tube on one of the kinks in its characteristic curve, with the added advantage that in the Connecticut tube the location of the "kink" and its "steepness" can be regulated—it makes its own kinks. Furthermore, at a given setting of field strength, variation of anode potential gives a certain *change* of wave length, while another value of field will give a different change for the same anode potential range.

In practical operation it is necessary to tune the tube the same as the receiving set, and this adds very much to the complexity of getting signals. Furthermore, the adjustments are very critical but smooth-running verniers make nice control easy. Mr. Donle tells us that, when once adjusted say for 225 meters, a leeway of 25 meters up or down is possible with good efficiency by merely varying the location of the tube within the solenoid, and that C.W. signals may be nicely heterodyned. We witnessed a comparison of this tube with a picked three-element detector of above average performance, hooked up to a three-circuit regenerator. On 600 meters the signals on the Connecticut tube, when once it was adjusted, were considerably louder than on the extra-good standard detector—we estimated they were 1.5 to 2.0 times as loud. The tube works with very loose coupling and this, combined with the tuning of the tube itself, results in a most pleasing selectivity and a remarkable diminution of interference from strays as well. Mr. Donle claims for it a signal 2 to 2½ times as loud as obtained from other tubes, provided the peak adjustment is secured. Tests made this same night on amateur wave lengths were unfortunately negative, it being one of New England's dead nights and no sparks could be picked up at the hour of tests on either set, so that no comparison could be made. We expect to witness tests on 200 meters in the near future and will take pleasure in announcing the results.

A GREAT diversity of receiving tuners were on exhibit at the Convention and there was something to suit anyone's pocketbook. Among the better grade of regenerative tuners there was a noticeable trend towards better construction and ease of adjustment that would facilitate C.W. reception. This tendency we might say was evidenced in three particulars which were embodied in several sets shown: vernier adjustments, shielding, and rear connections for batteries, etc.

The Grebe CR-8

Standing head and shoulders above all the other receivers was the model CR-8 of Messrs. A. H. Grebe & Co., of which we present several photographs. No one could see this tuner without marvelling at the beauty of its construction. It is a work of art. The consensus of opinion was "the best-looking set I have ever seen in my life." It is all of that. Mr. Grebe states that it has been especially brought out for the critical demands of A.R.R.L. relay work.

The circuit used, shown in Figure 2, presents no deviation from the original