

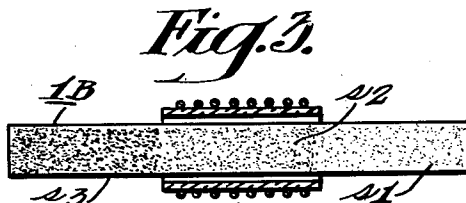
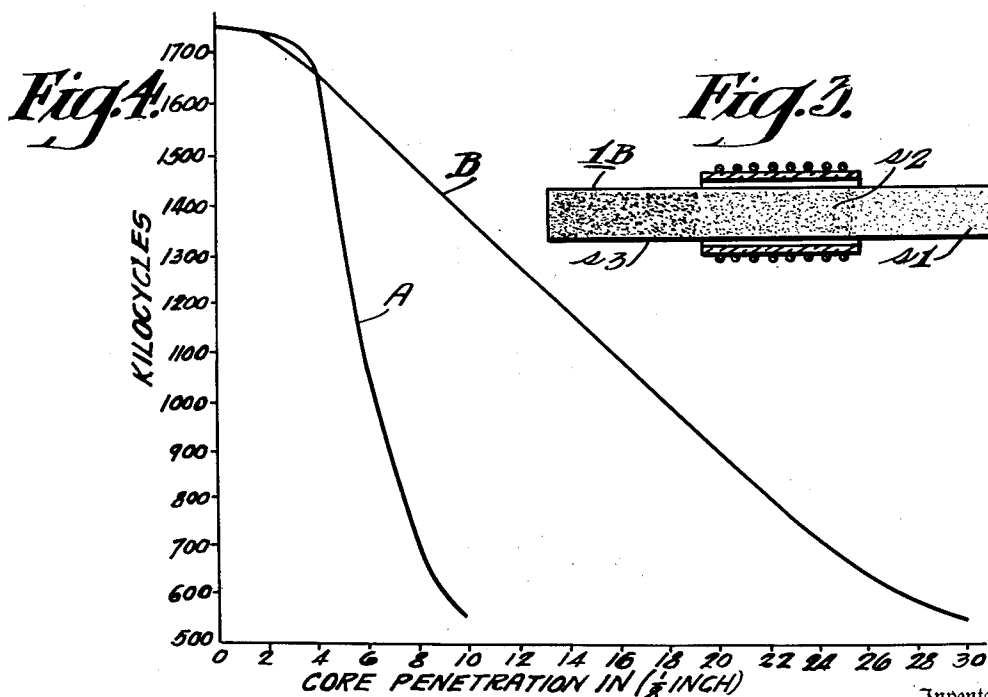
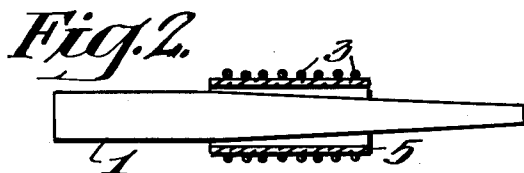
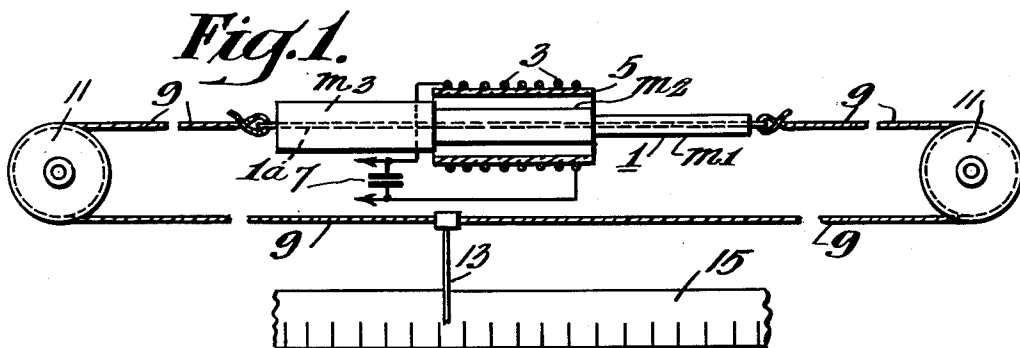
March 6, 1945.

W. L. CARLSON

2,370,714

VARIABLE PERMEABILITY TUNING DEVICE

Filed Sept. 30, 1942



Inventor
Wendell L. Carlson
 By **C. D. Tuska**
 Attorney

UNITED STATES PATENT OFFICE

2,370,714

VARIABLE PERMEABILITY TUNING DEVICE

Wendell L. Carlson, Haddon Heights, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application September 30, 1942, Serial No. 460,303

6 Claims. (Cl. 250—40)

My present invention relates to improvements in variable permeability tuning devices for use in radio and analogous systems for the communication of intelligence.

In the present day broadcast receivers of the type employing variable permeability tuners the total tuning movement or "stroke" of the magnetic core required to tune the receiver over the entire broadcast band (of from 550 kc. to 1600 kc.) corresponds to the length of the tuning coil. Usually, the coil length, and hence the stroke is about one and three-eighths of an inch. Since, in the interests of legibility, the associated scale-bearing surface on the dial usually has a span considerably greater than one and three-eighths of an inch, it has heretofore been necessary to employ a gear train, or the like, intermediate the turning knob and the dial in order to correlate the stroke of the variable inductor with that of the tuning index or pointer. This practice not only complicates the construction and adds to the cost of the set but, further, may introduce "backlash" and other inaccuracies in the tuning indication or operation.

Accordingly, the principal object of my present invention is to provide an improved variable permeability tuning device and one wherein the foregoing and other less apparent disadvantages of present day variable permeability tuning devices are obviated.

A more specific object of my invention is to provide an improved variable permeability tuner, incorporating an indicator of sufficient span to be readily readable, and one wherein the pointer or other indexing device is coupled directly instead of indirectly to the core drive-rod, wire or other adjusting mechanism.

Another and important object of my invention is to provide a simple, accurate, inexpensive and trouble-free variable permeability tuner.

The foregoing and other objects are achieved in accordance with my invention by the provision of an elongated magnetic core of tapered construction which is adapted to be entered within and withdrawn from an open ended inductance coil of conventional (short) length and of uniform diameter. As will hereinafter more fully appear, the core may be "tapered" either mechanically or magnetically. This permits the use of an elongated and hence easily readable tuning indicator having an indexing element which is coupled directly instead of indirectly to the core driving mechanism.

Certain preferred details of construction, together with other objects and advantages, will

be apparent and the invention itself will be best understood by reference to the following specification and to the accompanying drawing wherein:

Figure 1 is a plan view of a variable permeability tuning system embodying my invention.

Figure 2 is a longitudinal sectional view of a coil and core and showing another form of tapered core within the invention.

Figure 3 is a similar view of a coil and core and wherein the core is of uniform diameter but of variable magnetic density, and

Figure 4 is a chart showing the performance of a variable permeability tuning system constructed in accordance with my invention as compared to that of an analogous prior art tuner.

Fig. 1 shows a variable permeability tuner within the invention and comprising an elongated magnetic core 1 of non-uniform diameter mounted for movement within and with respect to the inductor 3 which is of standard length and which may comprise Litzendraht or any suitable wire wound upon an open ended form 5 of uniform diameter. Coil 3 is electrically connected to a fixed capacitor 7. The core 1 is shown as driven by a cord 9 which extends around a pair of pulleys 11 and carries a pointer 13 which cooperates with a suitably calibrated dial scale 15. Movement of the core 1, and hence of the pointer 13, may be effected as by means of the tuning knob (not shown) mounted on one of the pulley shafts.

It will be observed upon inspection of Fig. 1 that the length of the magnetic core 1 corresponds substantially to the length of the tuning scale 15 and is of a length substantially three times that of the coil 3. In carrying my invention into practical effect, it was found that a tuning scale having a span of three or four inches provided sufficient space for a readily readable broadcast scale. Accordingly, the magnetic core was made three and three-quarter inches long. This is used with a conventional coil approximately one and one quarters inches long and having an inside diameter of approximately one-quarter of an inch. These relative dimensions are not critical, provided (a) that the dial is of sufficient length to accommodate a readily readable, i. e., "uncrowded" scale, and (b) that the core is at least, say, twice the length of the coil.

The core 1 may be tapered as shown in Fig. 2 or it may be of stepped construction as shown in Fig. 1. In the latter case the core may comprise a number (in this case, three) of discrete sections assembled upon a non-magnetic axial support 1a, the inner or trailing section m^3 being of a diameter corresponding substantially to the inner di-

iameter of the coil form 5 and the leading sections m^2 and m^1 being each of a diameter smaller than its trailing section. In either event the core parts m are preferably, though not necessarily, of uniform permeability throughout their length and may be constituted of a ferromagnetic compound such for example as the one described in U. S. Patent 1,274,952 to Speed.

Instead of being of the "stepped" or mechanically tapered construction shown in Figs. 1 and 2, the core may be "magnetically tapered." That is to say, as shown in Fig. 3, the core which is here designated 1B may be of the same uniform diameter as the coil 3 but of variable magnetic density. In this case the leading section s^1 of the core (i. e., the end allotted to the high frequency end of the scale) must be of lower permeability than the intermediate and trailing core sections s^2 and s^3 , respectively. It is possible to employ a high permeability and low or high loss core section in combination with a low permeability low or high loss core section so as to alter the selectivity of the resonant circuit as well as its frequency during the tuning operation.

As previously mentioned, it has heretofore been necessary to employ a gear train or the like in order to achieve a readily discernible indication of the dial setting of a conventional permeability tuner. This is brought out by the chart of Fig. 4 wherein the curve A shows that in the absence of a gear train (or equivalent "step-up" drive system) a conventional short core of uniform diameter need be moved but three-quarters of an inch to tune its associated coil over a range of from say .550 to 1600 kilocycles. Obviously, it would be impractical to crowd scale markings indicative of this tuning range onto a dial of such a short span. The curve B shows that my present invention may more than triple the tuning stroke and hence permits the use of a dial scale capable of accommodating relatively widely spaced indicia, and this too without the use of a gear train, or the like, in the drive mechanism.

I am aware that others have previously proposed the use of a tapered core of ordinary length in a permeability tuner (see by way of example, "Proceedings of The Institute of Radio Engineers," vol. 21, No. 5, May 1933, pp. 690-709, esp. p. 699) and for a different purpose but, as far as I am aware, have not suggested the use of an elongated tapered core in the manner and for the purpose herein described.

What is claimed is:

1. A variable permeability tuning device adapted in normal use to be varied intermittently, comprising a circuit tunable through a predetermined frequency range and which includes as an element thereof an inductance coil of a certain length, and a compressed comminuted ferro-magnetic core of a length at least twice the length

of the coil so constructed and arranged that, upon axial movement of the core within the coil from a position at which the core is fully withdrawn from the coil to a position at which the trailing portion of the core is fully entered therein, the tuning of the circuit through said predetermined frequency range is gradually effected throughout said core movement.

2. The invention as set forth in claim 1 and wherein said magnetic core is of tapered construction, the maximum diameter of said core corresponding substantially to the inner diameter of said coil.

3. The invention as set forth in claim 1 and wherein said magnetic core comprises a plurality of sections of different diameters.

4. The invention as set forth in claim 1 and wherein said magnetic core is of variable magnetic density, the leading portion of said core being of lower permeability than the intermediate and trailing portions thereof.

5. A variable permeability tuning device comprising a circuit tunable through a predetermined frequency range and which includes as an element thereof an inductance coil of a certain length, and a compressed comminuted ferro-magnetic core of a length at least twice the length of the coil adapted to be moved within the coil for tuning the circuit over said predetermined frequency range, said core being so constructed and arranged that, as compared with a permeability tuning device tunable over the same frequency range and having substantially equal core and coil lengths, for equal movements of the cores of the respective devices, the former effects a more gradual change in circuit tuning so that for the same tuning range a tuning indicator scale is required for the first device that is at least twice the size of the scale used with the second device.

6. A variable permeability tuning device comprising a circuit tunable through a predetermined frequency range and which includes as an element thereof an inductance coil of a certain length, a compressed comminuted ferro-magnetic core having a length at least twice the length of the coil disposed for axial movement within the coil, means for moving said core with respect to the coil, a pointer attached to said core moving means so as to have the same travel as the core, and a scale along which the pointer is caused to move indicative of the frequency of the tunable circuit, the arrangement being such that the core travel is at least twice as great as compared to a permeability tuner in which the core and coil are of equal lengths and the core travel is equal to the coil length, thereby enabling the use of a larger scale to cover substantially the same frequency range.

WENDELL L. CARLSON.