

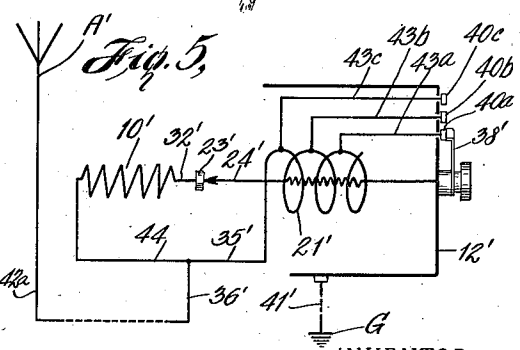
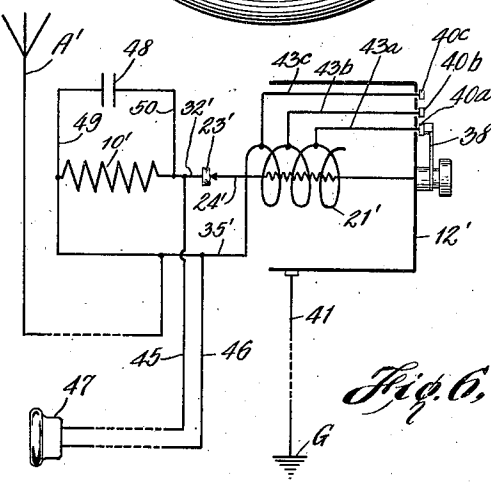
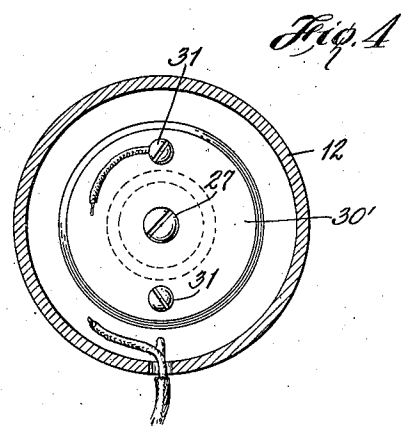
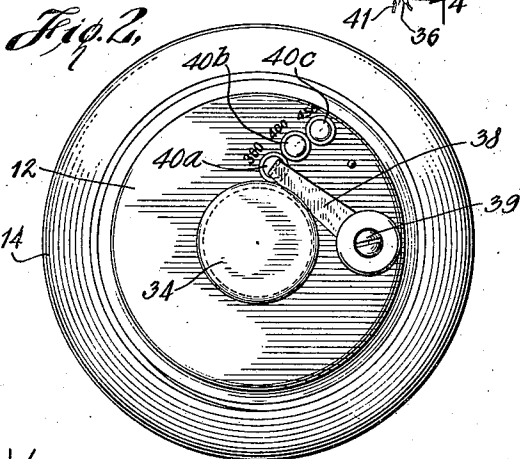
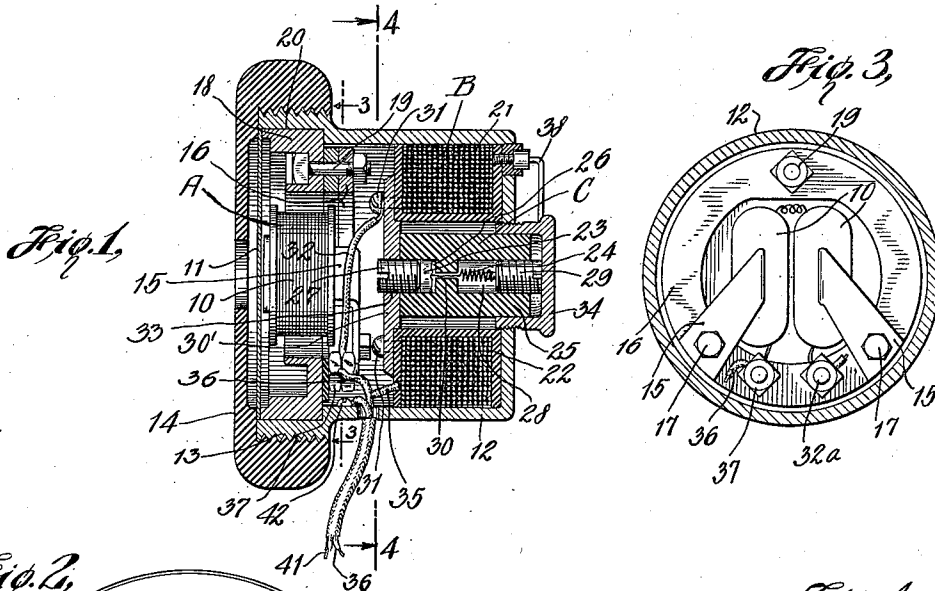
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H. CSANYI

PORTABLE RADIO RECEIVING SET

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INVENTOR  
HENRY CSANYI  
BY  
Meyers, Cavanaugh & Whitehead  
ATTORNEYS

## UNITED STATES PATENT OFFICE.

HENRY CSANYI, OF NEW YORK, N. Y.

PORTABLE RADIO RECEIVING SET.

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This invention relates to a radio receiving apparatus, and more particularly to a hand-portable radio receiver unit especially designed for broadcasting reception; and has special reference to the provision of a combined unitary radio receiving set and telephone receiver.

A principal object of my present invention comprehends the provision of a radio receiving apparatus built into a compact and unitary organization on the style of the ordinary telephone receiver and operable when connected to an antenna for efficiently receiving radio telephonic energy.

In the construction and design of a complete radio receiving outfit adapted to be carried in the hand and applied to the ear after the fashion of the ordinary telephone receiver, a number of problems present themselves for consideration, upon the successful solution of which largely depend the workability and efficiency of the radio receiving unit. The receiver unit in being hand-portable and of a size comparable with the common telephone receiver, must comprise but a few parts compactly organized and efficiently coordinated. To minimize bulk, it is desirable to avoid the use of all energy sources in the receiving set such as batteries, and the parts of the radio outfit must be so selected and arranged as to permit of efficient reception of incoming radio impulses, with the production of strong audible impulses without the use of such energy at the incoming station. It is also highly desirable to overcome such disturbing influences as the proximity of grounded bodies such as the presence of the user's hand in holding the receiver unit or the user's head to which it is applied. Other desiderata in the production of an apparatus of this nature are the provision of a unit which is substantially free from accidental derangement or setting disturbance, which is rugged so as to withstand rough usage, and which is constructed in a manner to be quickly disassembled for purposes of replacement and repair, with parts standardized to permit rapid and inexpensive replacement. My present invention comprehends the provision of a portable and unitary receiving set in which these features are present in a high degree and are combined in an efficient manner to effect a workable apparatus capable of efficient radio reception.

To provide a compact hand-carried set, I have found it desirable to combine with a telephone receiver such radio receiving parts as a tuning coil, a detector, and if desired a condenser, all connected in a simplified circuit. A common objection to a simplified receiving set of this nature is that the set is not sensitive enough for receiving the relatively weak impulses intercepted by an antenna. I have found after extensive experimentation that this objection may be successfully overcome, and that the receiver parts may be so co-ordinated and relatively associated as to produce a unit which sensitively responds to incoming radio impulses such as are transmitted from radio broadcasting stations; and one of the principal objects of my invention comprehends the provision of a receiving apparatus which is effectively responsive to relatively weak radio frequency energy for producing strong audible impulses.

It is well known that the tuning of a radio set is greatly influenced by proximate grounded bodies, and is detrimentally disturbed by the change in position or location of such grounded bodies, the tuning being largely influenced, for example, by the movement of such objects as the hand or body of the operator. This is especially the case where the entire set is carried in the hand of the operator, and for the successful operation of a hand-carried radio receiver the effect of ground bodies must be largely eliminated. The provision of an apparatus of this nature which is substantially free from ground influences of this kind is another principal object of my present invention.

The more specific objects of my present invention may be said to include, besides the provision of a unitary hand-portable apparatus having the characteristics above referred to the further provision of a hand-carried radio receiving unit in which the telephone coil, the tuning coil and the detector are coaxially arranged with the detector disposed within the tuning coil and arranged so as to be influenced uniformly by the magnetic field thereof; the further provision of a unit of this nature in which all the parts of the receiver are contained in a casing, this casing functioning as an electrostatic shield for the parts of the apparatus contained therein; the further pro-

vision of a unit of this nature in which the parts are so electrically connected together and to the said casing as to eliminate the disturbing influence of proximate grounded bodies; the still further provision of a unit in which the detector comprises a crystal detector so constructed as to prevent accidental derangement; the still further provision of a crystal detector unit constructed so as to permit quick detachment and replaceability thereof; the further provision of a novel crystal detector plug; and the general provision of a receiving outfit comprising few parts combined in a simple way to produce a unit manufacturable at a low cost and saleable at a moderate figure.

Another object is the provision of a construction wherein the detector contact or cat's whisker is so arranged and of a character such that the magnet acts upon the contact in the manner of an interrupter.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in the elements and their relation one to the other, as hereinafter particularly described and sought to be defined in the claims, reference being had to the accompanying drawings showing preferred embodiments of my invention, and in which:

Fig. 1 is a cross-sectional view of the complete radio receiving unit.

Fig. 2 is a rear elevational view thereof,

Fig. 3 is a cross-sectional view taken on the line 3—3, Fig. 1,

Fig. 4 is a cross-sectional view thereof on the line 4—4, Fig. 1,

Fig. 5 is a wiring diagrammatic view showing the electrical connection of the parts and the manner of connecting the same for radio energy reception, and

Fig. 6 is a wiring diagrammatic view showing a modification thereof.

Referring now more in detail to the drawings, the radio receiving unit of my invention preferably comprises a telephone receiver A which may include a plurality of telephone coils 10 and a diaphragm 11, a tuning coil B, and a detector such as a crystal detector C, all carried by and housed within a casing 12, the telephone receiver A being located at one end of the casing and the tuning coil B and detector C being located within and at the opposite end of the said casing, the casing 12 being externally threaded at one end, as at 13, for receiving the correspondingly threaded cap 14 of the type commonly employed with telephone receivers.

The telephone receiver A in the preferred construction includes the plurality of receiving coils 10 carried by the core pieces 15 which are secured to the arcuate members 16 by the securing means such as 17, these arcuate members being attached to an annu-

lar member 18 by the securing element 19, the said annular member being receivable by an annular recess 20 provided in the front end of the casing 12, and these parts are so interfitted as to permit the positioning of the diaphragm 11 adjacent the pole faces of the cores of the telephone receiver, with the parts clamped in position by the mounting of the cap 14 on the casing 12.

As heretofore mentioned, I have found after considerable experimentation that the parts of the receiving set may be so correlated as to produce a unit which sensitively responds to incoming radio frequency impulses such as are transmitted from radio broadcasting stations. More specifically, I have found that the tuning coil B and the detector C may be so relatively disposed within the casing 12 as to effect the strengthening of the audible impulses produced, this result being achieved by the disposing of the detector C longitudinally within the tuning coil B and influenced by the magnetic field thereof, these parts being preferably co-axially arranged at the rear end of the casing 12. In the preferred construction the tuning coil B comprises a multi-layer coil 21 as clearly shown in Fig. 1 of the drawings, wound upon a spool body 22 of insulating material, detector C being disposed longitudinally within the magnetic field of said coil and being arranged coaxially therewith so as to form the core thereof. Desirably the tuning coil B and the detector C are arranged coaxially with the telephone receiving coils 10, as is clearly shown in the drawings. By the provision of this arrangement, it has been found that the sound impulses may be materially strengthened so as to effect a more sensitively responding receiving unit.

The detector C in the preferred construction comprises a crystal detector providing a crystal such as 23, which may for example be a crystal of iron pyrites, and a detector contact or point 24 cooperating therewith, the crystal and point being so co-ordinated as to minimize the possibility of accidental displacement of the parts after the same have been set in a given position in the assembling thereof. In the assembling of the crystal parts, a point of the crystal is selected which yields the best results, and a desideratum of the present invention includes the provision of a construction in which the accidental relative displacement of the detector parts is effectively prevented so that the selected point will remain substantially the same under all conditions of service to which the receiving unit is subjected. A further desired end in the construction of the crystal detector is the provision of a detector unit which besides being free from mishandling, is capable of quick detachment from the receiving unit

for purposes of repair or replacement. To these ends, the crystal detector of my invention comprises a separable plug including an insulating plug body 25 provided at one end with a recess 26 housing the crystal 23, the said recess being closed by a threaded member 27 contacting the crystal 23, and provided at the other end with a recess 28 housing the flexible part of the contact 24, the said recess being closed by a threaded member 29 to which the said contact 24 is electrically connected, the said plug body being further provided with a constricted opening 30' connecting the two recesses 26 and 28, the constricted opening being designed to minimize any vibration of the contact 24 so as to prevent displacement thereof and derangement of the contact point selected, while permitting an initial setting in the assembling thereof. The plug body 25 and the end threaded members 27 and 29 comprise a housing for the detector parts, the whole forming a plug unit which is quickly separable and replaceable in the receiver unit, as will appear more in detail hereinafter.

As heretofore mentioned, for the purpose of preventing any interference with the tuning of the receiving set such as results from the change in position of proximate grounded bodies, my invention includes the provision of means for electrostatically shielding the parts of the receiving unit so that the unit may be carried in the hand of the user and may be tuned without ground disturbances. To this end the casing 12 comprises a metallic casing, and the parts of the unit are so connected to the metallic casing as to be electrostatically shielded thereby. This may be accomplished as shown in the drawings by making the casing 12 the ground terminal of the receiving set and appropriately connecting the parts of the set thereto. For connecting the parts as desired, I provide a metallic plate 30 which is connected to the insulating coil body 22 by means of the securing elements such as 31, the said metallic plate being electrically connected to one terminal of the telephone coils 10 by means of a conductor 32 connecting a securing means 31 to a binding post 32<sup>a</sup> insulatably fixed on the annular member 18 carrying the telephone coils, to which binding post one of the terminals of the coils 10 is connected as shown in Fig. 3 of the drawings. The metallic plate 30 forms one terminal of the crystal detector C, the threaded member 27 being to this end threadedly received by a central tapped bore 33 in the said plate. The other terminal of the crystal detector C is electrically connected to the metallic casing 12 by means of the cap 34 which is threadedly received by the casing 12 and which contacts the threaded terminal 29 of the detector plug. The multi-layer tun-

ing coil 21 is similarly connected in circuit to the ground casing 12, one end of the tuning coil being connected by means of a conductor 35 to a conductor 36 connected to the binding post 37 which in turn is connected to the receiver coils 10, the other end of the tuning coil 21 being connected to the casing 12 by means of a movable arm 38 electrically connected at its pivot 39 to the metallic casing 12 and movable over a plurality of insulated taps 40<sup>a</sup>, 40<sup>b</sup> and 40<sup>c</sup>, connected to spaced points of the coil 21 as will be described diagrammatically hereinafter, the plurality of taps being provided for tuning purposes, the winding of the coil and the arrangement of the taps being so designed as to permit adjustment for the wave lengths of 360, 400 and 450 meters usually employed in broadcasting transmission.

For connecting the set for radio reception, the conductor 36 leading from the binding post 37 is connected to an aerial, and a conductor 41 which is electrically connected to the casing 12 by means, for example, of the screw 42, is connected to some suitable ground.

The electrical connections between the receiver parts and the connection of the same to the antenna and ground are diagrammatically illustrated in Fig. 5 of the drawings. Referring to Fig. 5 the antenna A' is shown connected by means of a conductor 42<sup>a</sup> to the tuning coil 21' by means of the conductors 36' and 35', spaced points of said tuning coil being connected as by means of conductors 43<sup>a</sup>, 43<sup>b</sup> and 43<sup>c</sup>, to the insulated buttons or taps 40<sup>a</sup>, 40<sup>b</sup> and 40<sup>c</sup>, the taps being selectively connected to the casing 12' by means of the movable arm 38', the said casing being connected to ground G by means of the conductor 41'. It will be further seen by reference to this figure that the telephone coil and the crystal detector are connected in series across the antenna and ground terminals, the coil 10' being connected by means of the conductor 44 to the antenna conductor 36', and by means of the conductor 32' to the crystal 23', the crystal contact 24' of which is electrically connected to the casing 12'.

For the purpose of connecting another telephone receiver in circuit with the radio receiving set, I may provide additional conductors connected across the telephone coil 10 of the radio receiver, the conductors being adapted for connection to an auxiliary telephone receiver. This is diagrammatically shown in Fig. 6 of the drawing, and having reference to this figure which diagrammatically shows the receiver parts connected to the antenna A' and ground G in a manner similar to the diagrammatic showing of Fig. 5, I show the provision of the conductors or leads 45 and 46 connected to the conductors 32' and 35' respectively, the

said conductors being attachable to an auxiliary telephone receiver such as 47. If desired, a condenser such as 48 may be connected across the terminals of the coil 10' by means of the conductors 49 and 50.

In addition to providing a compact portable arrangement, the placing of the detector contact in the magnetic field in the manner specified provides that the induction from the magnet will act in the manner of an interrupter, giving a polarization on the same principle as the coherer. As shown, the detector contact has a coil, which is at the axis of the magnet. This coil is a secondary with the magnet coil as a primary, and the magnetic induction provides vibration. While this vibration is very fine, detectable only with a milli-ampere meter it produces a higher rectification curve, and a steady rectification on the same point, so that it is not necessary to change the crystal point.

Referring to Figures 1, 5 and 6, it will be noticed that the coil in the detector contact is at the axis of the magnet coil.

The manner of making and using my portable radio receiving set will in the main be apparent from the above detailed description thereof. In the assembling of the parts the tuning coil and its mounting B carrying the plate 30 is inserted into the casing 12 and positioned at the inner end thereof, after which the telephone receiver A and its mounting with the terminals of the telephone coil appropriately electrically connected to the plate 30 and the tuning coil 21 is fitted into the front end of the casing 12 and clamped in position by the mounting of the cap 14 on the said casing. The detector plug C may then be inserted from the rear of the casing 12 by rotating the same, the threaded member 27 thereof being received by the plate 30, after which the cap 34 is threadedly inserted in the rear wall of the casing 12 into contacting position with the detector plug. The apparatus may then be connected to an antenna and ground as shown in Fig. 5 of the drawings, and may be adjusted within the range of broadcasting transmission by operation of the arm 38. If the detector plug is desired to be removed for repair or replacement, the cap 34 may be unscrewed and the plug C removed as a unit from the plate 30. The telephone receiver coils and the tuning coil may be likewise removed with facility by unscrewing

the front cap 14 for any desired repair or replacement.

While I have shown my device in the preferred forms, it will be obvious that many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention, defined in the following claims.

I claim:

1. A unitary and hand portable radio receiving set, comprising a telephone receiver with its coil and diaphragm, a tuning coil disposed adjacent the receiver coil, and a fixed crystal detector including a crystal and a detector contact cooperating therewith and arranged at the axis of the tuning coil.

2. A unitary and hand portable radio receiving set, comprising a telephone receiver with its coil and diaphragm, a tuning coil disposed adjacent the receiver coil, and a fixed crystal detector including a crystal and a detector contact cooperating therewith and arranged at the axis of the tuning coil, the detector contact having a coil in the length thereof.

3. A unitary and hand portable radio receiving set, comprising a telephone receiver with its coil and diaphragm, a tuning coil disposed adjacent the receiver coil, and a fixed crystal detector including a crystal and a detector contact cooperating therewith and arranged at the axis of the tuning coil, the detector contact having a coil in the length thereof, and a metallic casing housing the parts, the detector having one terminal electrically connected to the receiver coil and the other to the casing, the casing forming a connection for ground and an electrostatic shield for the receiving set.

4. A unitary and hand portable radio receiving set, comprising a telephone receiver with its coil and diaphragm, a tuning coil disposed adjacent the receiver coil, and a fixed crystal detector including a crystal and a detector contact cooperating therewith and arranged at the axis of the tuning coil, the detector contact having a coil in the length thereof, the plug having a restricted passage through which the end of the contact between the tuning coil and the crystal extends to limit vibration and prevent displacement of the contact point.

Signed at New York city in the county of New York and State of New York this 29th day of November A. D. 1922.

HENRY CSANYI.