

March 2, 1937.

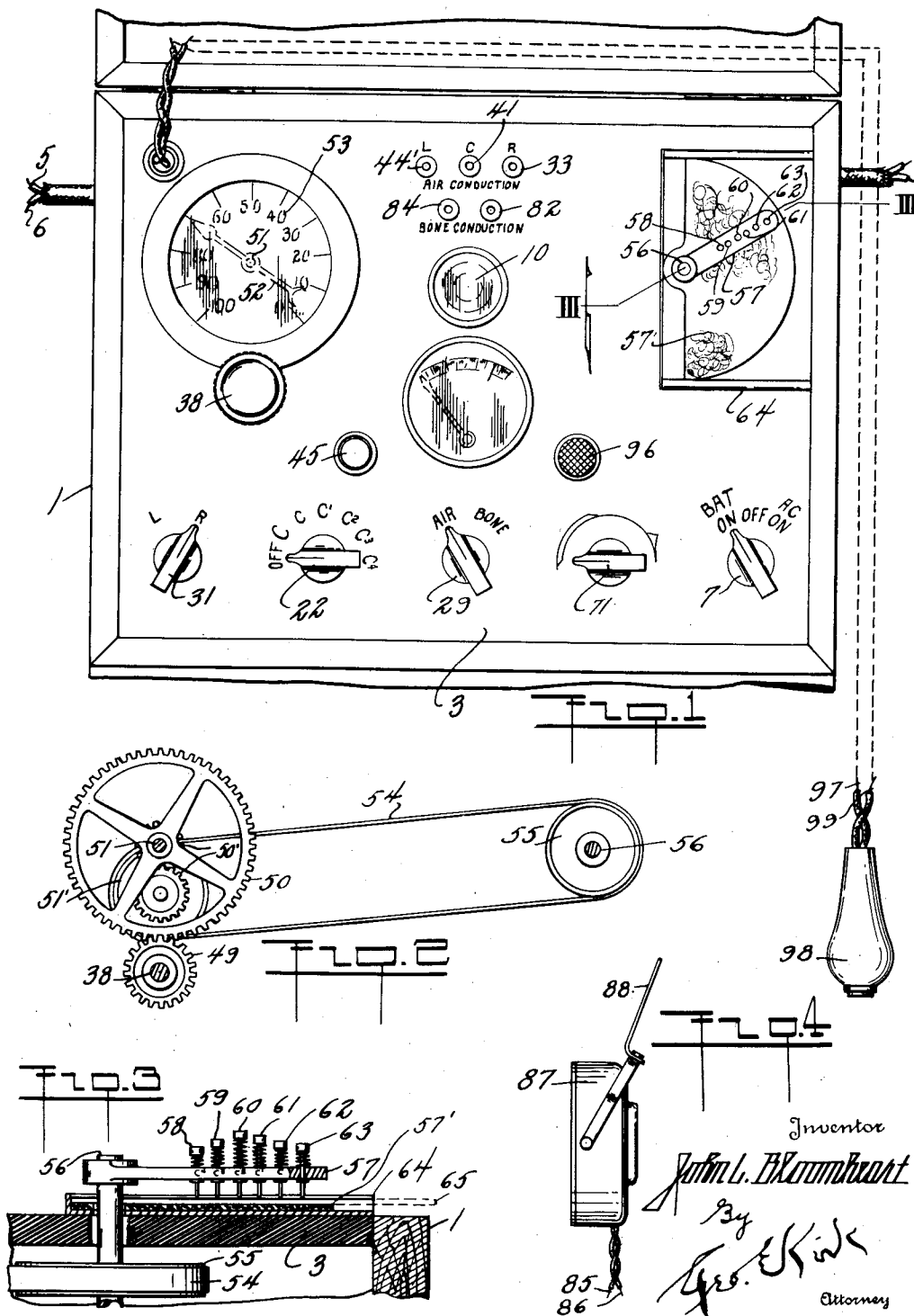
J. L. BLOOMHEART

2,072,705

HEARING TESTING

Filed July 17, 1935

2 Sheets-Sheet 1



March 2, 1937.

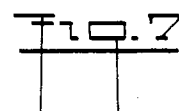
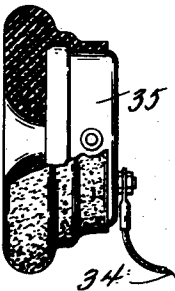
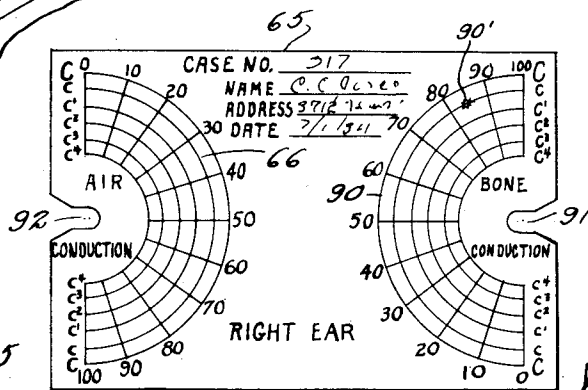
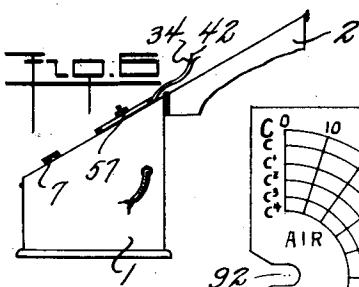
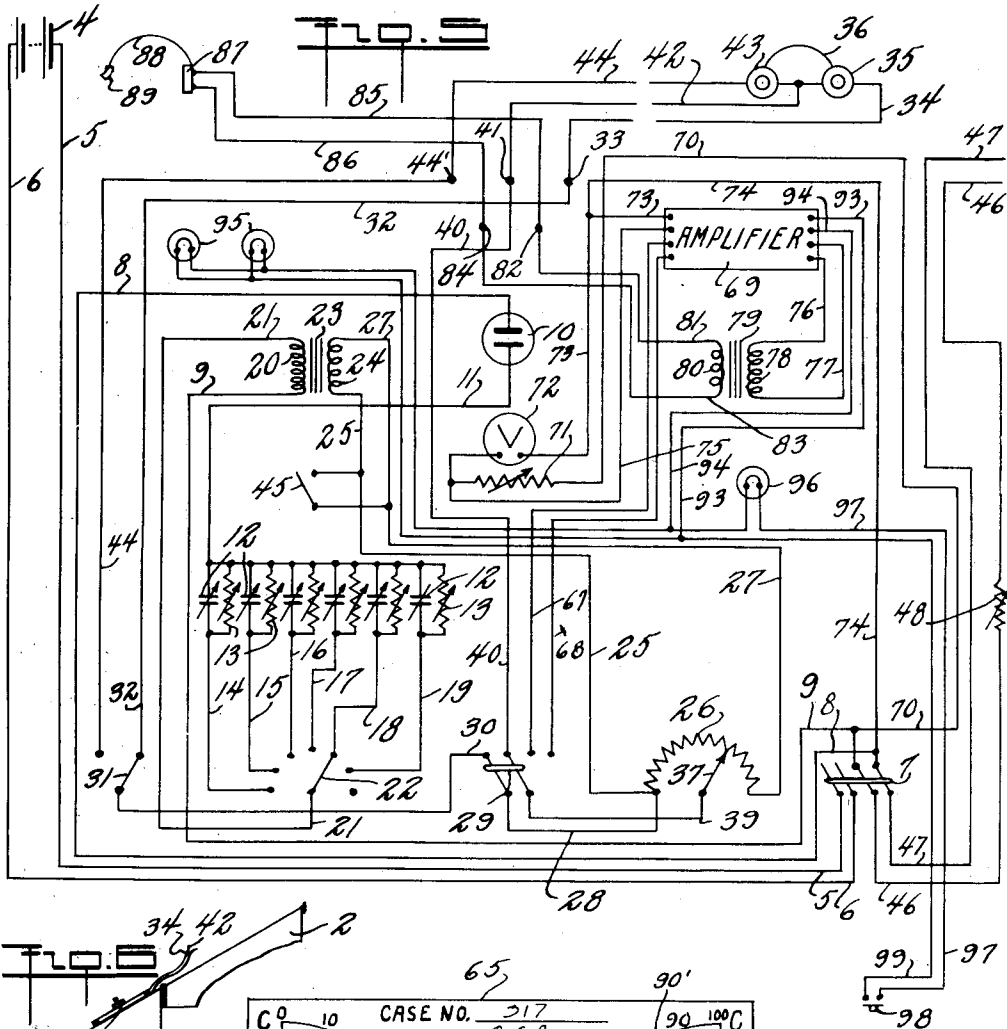
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,072,705

HEARING TESTING

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5 Claims. (Cl. 179-1)

This invention relates to sound equipment or audiometric devices or apparatus.

This invention has utility in audibly and controllably generating tones, especially in testing and checking hearing of individuals on definite frequency and volume.

Referring to the drawings:

Fig. 1 is a plan view of a panel for an embodiment of the sound testing device under the invention herein;

Fig. 2 is a detail view of the drive from the intensity indicator to the record-effecting indicator in the device of Fig. 1;

Fig. 3 is a section on the line III—III, Fig. 1;

Fig. 4 is a detail view of the receiver as adapted to transmit bone conduction to the user;

Fig. 5 is a wiring diagram of electrical features of the device of which the panel is shown in Fig. 1;

Fig. 6 is a side elevation of the device in the cabinet;

Fig. 7 is a view of a side of a record as adapted to be developed at the indicator; and

Fig. 8 is a detail view of the receiver as adapted to the ear.

Cabinet 1 is shown provided with closure 2 beneath which is panel 3 as an instrument board. In carrying out the invention herein, such for ear or so-called air conduction, may have, as energy source, dry cells 4 say to 90 volts. It is convenient for this purpose to adopt battery set-up such as used in radio work. Lines 6, 5, from the dry cell 4 may be effective through switch 7 for connecting these lines respectively to lines 8, 9. Line 8 is connected through gas-providing gap or neon oscillating lamp or tube 10 with line 11, connected by variable condensers 12 and variable resistances 13 to lines 14, 15, 16, 17, 18, 19.

The circuit to these lines from the predetermined variable condensers 12, 13, has its frequency controlled due to the cooperation of the tube 10. The circuit is completed with the line 9 through primary winding 20 of transformer and line 21 to frequency selector switch 22.

In determining these values for frequency when the check-up is for the human ear, the tones may be of frequency for a succession of notes C on the scale. For instance, the line 14 when connected to the line 21 may be for C as 64 vibration frequency per second. The line 15 may be to note C thereabove, say 126 vibration frequency per second, and so on through the scale of these predetermined frequencies.

From this primary 20 of the transformer, induction is effective through iron core 23 of this transformer to secondary winding 24. From the secondary 24, line 25 may extend to potentiometer 26. From the opposite side of this winding 24 line 27 extends to the opposite side of this po-

tentiometer 26. From the line 25 to the potentiometer 26, there is line 28 to switch 29, thence by line 30 to switch 31. From the switch 31 extends line 32 to terminal 33 on the cabinet and thence by line 34 to receiver 35 of head set 36.

At the potentiometer 26 there is adjustment 37 for intensity control of the frequency operable by rotating handle 38 (Fig. 1). This adjustment 37 at the potentiometer has line connection 39 to the switch 29, and thence by line 40 to terminal 41 on the panel. From this terminal 41 extends line 42 as a common lead not only to the right receiver 35 of the head set 36 but to left receiver 43. From this receiver 43 extends line 44 to terminal 44' on the panel, and thence to the switch 31. This switch 31 is thus a selector for the receiver 35 at the right ear or the receiver 43 for the left ear. In the diagnosis the switch 22 may be adjusted for frequency change and the switch 37 for intensity control. These receivers are cushioned.

In checking up with the patient as to whether or not there may be head noises or other disturbances interfering, the operator may close push button switch 45 and thus short-circuit between the lines 25, 27, from the secondary 24. This will render ineffective the frequency selection and potentiometer so that the receiver 35 or 43 will be idle or quiet.

The switch 7 is shown with three positions. As shifted counter-clockwise in the extreme position, the battery 4 is on in supplying energy source for checking through the head set 36. Upon a turning to the right of the switch 7 to mid-position, such is off as to the battery 4 and in fact off as to energy source, whether battery or line current. Further shifting to the right brings the switch 7 to connect in alternating current power lines for this instrument. Lines 46, 47, to this switch 7 connect in this throwing of the switch 7 to the lines 9, 8, while lines 5 and 6 are out of circuit. In the line 46 is adjustable resistance 48 controllable to render this power supply such as may properly function in conjunction with the condensers, resistances, and transformers, as well as potentiometer, thereby providing a generator frequency source in the electric current supply responsive in the checking or testing of hearing for the user or patient as effective through the receivers 35, 43. Rotation of the handle 38 in controlling the intensity is connected through gearing 49/50 (Fig. 2) to rotate shaft 51 and thereby locate pointer 52 on scale 53 as a visible indicator of the adjustment obtained at the potentiometer by operating the switch 37.

Differential gearing 50' controlled by shaft 51 operates wheel 51' from which is connected metal tape 54 extending to wheel 55 on shaft 56. This 60

tape 54 is fixed with the wheels 51', 55, and thus provides positive rotation means in each direction for the shaft 56 having fixed thereon arm 57 (Figs. 1, 8). This arm 57 has thereon series of plungers 58, 59, 60, 61, 62, 63, in similar number and noted value as for the frequencies determined by the adjustment of the switch 22.

Adjacent this arm 57, as movable over felt cushion 57', is guide 64 for notation receiving card 65 having chart 66 thereon with arcs corresponding to the notations for the adjustments of the frequencies 22. Radial lines on this chart 66 correspond to the notations on the dial 53 as disclosed by the pointer 52. It thus follows that, as the switch 37 is adjusted by the knob or handle 38, the intensity as disclosed at the dial 53 is that followed by the arm 57, and it is only necessary that the operator depress the particular plunger corresponding to the notation at the arm 22, thereby punching the chart 66, giving a simultaneous reading of frequency and intensity as found for the air conduction say for the right ear. This chart may be similarly printed on the reverse side for the left ear and be moved and inserted in the guides 64 when the switch 31 is turned for checking the patient as to hearing to be investigated in connection with the left ear.

This operation for diagnosis may be as to air or ear and for bone conduction. The equipment is shown in a cabinet and is a compact, simple device. It may be used with the electric power from a battery or power current supply.

To this end, with the switch 7 connected to the power supply lines 46, 47, the switch 29 may be shifted clockwise, thereby connecting lines 28, 39, to lines 67, 68, and amplifier 69. This amplifier 69 is of a type adapted to radio work and effective to increase the intensity over that as used for the head set to make the energy source adaptable herein for bone conduction testing. The switch 7 connects the line 46 through line 70 and variable resistance 71 with volt meter 72, thence by line 73 to the amplifier 69. Line 74 from the switch 7 is connected through the line 73 to this amplifier 69. From the variable resistance 71 there is line 75 connected to the amplifier 69. Lines 76, 77, from this amplifier extend to primary 78 of output transformer having iron core 79 and secondary 80. From this secondary 80, line 81 extends to terminal 82 on the panel 3, and line 83 extends to terminal 84 on the panel 3. From the terminal 82 extends line 85 and from the terminal 84 extends line 86. These lines 85, 86, extend to bone conduction receiver 87 from which extends spring arm 88 to rubber cushion 89, making it convenient yieldably to place this bone-faced receiver 87 on a cheek bone beneath the eye, against the skull back of the ear, upon the forehead or such other desired position as it may be in order to check up in the diagnosis.

In diagnosis there may be occasion for exploration near the right and left ears. Bone conduction diagnosis is assisted by the use of the potentiometer in the range available by the amplifier 69. There is assistance in the frequency control. Accordingly, chart 90 on the card 65 provides a convenient set-up of scale relations showing recording punch 90' located not only for the frequency but for intensity.

This bone conduction chart 90 is disposed with

the chart 66 for the right ear. Accordingly, bone conduction may be taken at the same time as the air or ear conduction for the same side of the head. In placing the card 65 in position for the bone conduction, it will be with opening 91 inserted to embrace the stem or shaft 56 instead of opening 92. With this right ear side up, this means the lower right hand corner of the card is placed in the upper left hand position. For the reverse or left side reading, the printing on the opposite side of the card 65 is available, for the action of the punches clearly shows the side upon which the punch is effective.

Lines 93, 94, from the amplifier 69 may be taken off as desirable to supply current of say 2 volts and thus allow the operator readily to observe the dial 53 as illuminated by bulbs 95. Additionally, from these lines 93, 94, there may be pilot lamp 96 from the line 94 in line 97 to switch 98, which as closed completes circuit by way of line 99 to the line 93. This pilot lamp or jewel 96 at the panel is a signal or indication means from the patient as to whether or not the machine is functioning from a current source of supply, and if so functioning, the operator may control the cut-out in supplementally checking to be effective through the push button 45 in this bone testing as readily as heretofore discussed in connection with the ear or air testing conduction. Cut-out may also be had at "off" position for the switch 22 (Fig. 1).

What is claimed and it is desired to secure by United States Letters Patent is:

1. Hearing testing apparatus comprising a source of variable frequency electric current, means for controlling the frequency of said current, volume control means for said current, an indicator associated therewith, and rotary record-effecting means coupled to said indicator.

2. In an electric audiometric device having a source of testing current and a volume control, and an indicator therefor, the combination therewith of a record making device positively driven thereby, said record making device comprising a punch bearing arm rotatably mounted over a suitable record card.

3. An audiometric device comprising a generator of variable frequency testing current, an air conductor applicator, a bone conductor applicator, circuit means for energizing either applicator, volume control means, and volume recording means associated with said circuit means, said recording means enabling a card punch record to be made of desired volume observations.

4. Hearing testing apparatus comprising a source of variable frequency electric current, means for controlling the frequency of said current, volume control means for said current, an indicator associated therewith, and rotary record-producing mechanism connected to said indicator and including means responsive to manual actuation.

5. Hearing testing apparatus comprising a source of variable frequency electric current, means for controlling the frequency of said current, volume control means for said current, an indicator associated therewith, and record-producing mechanism embodying a rotary arm shiftable in response to volume control and manually actuable means connected to said arm and responsive to record frequency.

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