

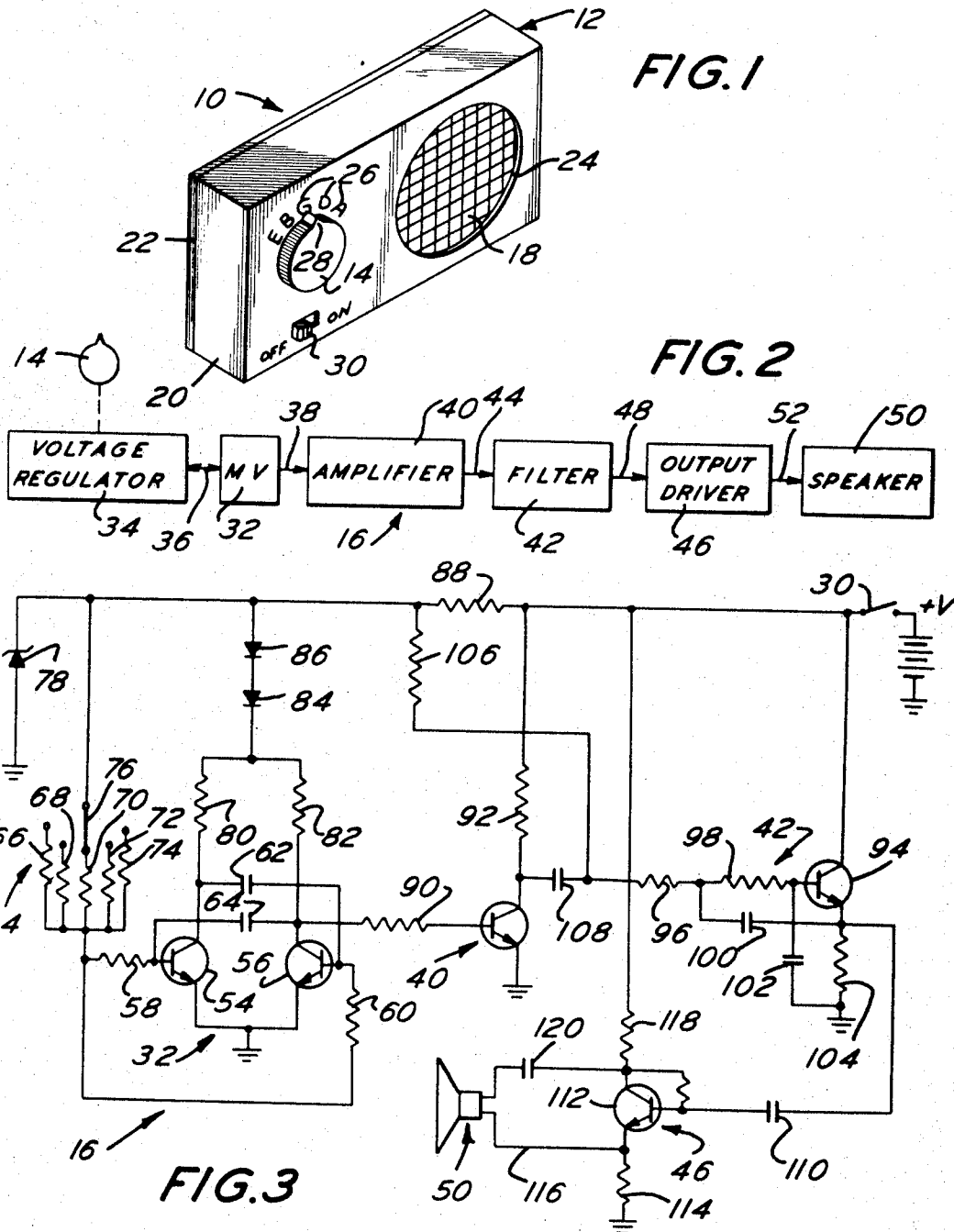
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D. G. ALTHOFF

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TUNING DEVICE

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INVENTOR
DONALD G. ALTHOFF
BY

Caesar, Rivise, Bernstein & Cohen
ATTORNEYS.

1

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TUNING DEVICE

Donald G. Althoff, 1135 Thomas St.,
Chester, Pa. 19013

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ABSTRACT OF THE DISCLOSURE

A tuning device for a musical instrument having a plurality of members each of which requires tuning to a different predetermined pitch to enable use of the instrument. The tuning device comprises means for generating a plurality of frequencies, each of the frequencies corresponding to one of the predetermined pitches of the members requiring tuning. A selection member cooperates with the means for generating for selecting one of the plurality of frequencies at a time. The selection member is adapted to select the frequency corresponding to the pitch of the member of the instrument requiring tuning. Reproduction means are provided connected to the means for generating so that the tuning device produces a sound similar to that which is produced by the member of the instrument requiring tuning when properly tuned.

This invention relates generally to tuning devices and more particularly to a tuning device for stringed instruments.

Presently available tuning devices for musical instruments in general and stringed instruments in particular are normally usable only by professionals. That is, the sophisticated electronic tuners which are available provide only a standard pitch which is tuned to a single string, from which each of the additional strings of the instrument must be tuned. However, to tune the remaining strings requires a trained ear. Therefore, a tuning device for a piano would generate the standard A above middle C which has a fundamental vibrating frequency of 440 beats per second. In order to tune the remainder of the strings in the instrument, it requires a highly trained professional tuner who can readily discern the difference in pitch produced by each of the other strings. There are still further sophisticated tuning devices which use comparing means for comparing each of the fundamental frequencies with the frequencies produced by the strings of the instrument. However, these tuning devices require very extensive circuitry and are normally priced far out of the reach of an amateur musician.

The devices available for amateurs are the standard pitch pipe and the tuning devices comprising a plurality of pitch pipes which produce, when blown, the pitch of each of the strings of the instrument to be tuned. Thus, for the guitar, such a tuning device comprises six pitch pipes which may be blown to produce the pitch of each of the six strings in the guitar. However, these are inadequate in that it is very difficult for the amateur to compare the pitch produced by these horns to the pitch produced by the string being tuned because it is difficult to hear the tone when the student is blowing the horn and compare it with the sound produced by the string. Also, because the tone produced by the pitch pipe is raspy and not similar to the sound produced by the string, it is diffi-

2

cult to compare the melodious tones produced by the string of the instrument to the pitch pipe.

It is, therefore, an object of this invention to overcome the aforementioned disadvantages.

Another object of the invention is to provide a new and improved tuning device which generates a sound like that of the instrument when tuned properly.

Another object of the invention is to provide a new and improved electronic generator for producing the standard frequencies of an instrument to be tuned.

Yet, another object of the invention is to provide a new and improved tuning device which is easy to carry, compact and produces sounds like each of the strings of a stringed instrument.

Another object of the invention is to provide a new and improved tuning device which is inexpensive to produce and which greatly facilitates tuning of a stringed instrument by an amateur.

These and other objects of the invention are achieved by providing a tuning device for a musical instrument having a plurality of members each of which require tuning to a different predetermined pitch to enable use of said instrument, said tuning device comprising means for generating a plurality of frequencies, each of said frequencies corresponding to one of said predetermined pitches of said members requiring tuning, a selection member cooperating with said means for generating for selecting one of said plurality of frequencies at a time, said selection member adapted to select the frequency corresponding to the pitch of the member of said instrument requiring tuning, and reproduction means connected to said means for generating so that the tuning device produces a sound that is similar to that produced by said member of said instrument requiring tuning when properly tuned.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of the tuning device embodying the invention per se;

FIG. 2 is a schematic block diagram illustrating the operation of the circuitry in the tuning device embodying the invention; and

FIG. 3 is a detailed schematic diagram of the circuitry of the tuning device embodying the invention.

Referring now in greater detail to the various figures of the drawings wherein similar reference characters refer to similar parts, a tuning device embodying the invention is generally shown at 10 in FIG. 1.

The tuning device basically comprises a rectangular casing 12, a selection knob 14, a tone generator 16, shown in FIGS. 2 and 3, and a speaker 18 for reproducing the tone. Case 12 includes a front portion 20 for housing the tone generator and speaker 18 and a rear plate 22 which is removable and which provides access to the circuitry when servicing the same or for replacement of batteries.

The front portion 20 of the case 12 includes an elliptical opening 24 against which is mounted the speaker 18. The front portion 20 of the case 12 also includes an opening through which the selection knob 14 may communicate with the electrical circuitry housed within the front portion. The outer surface of case 12 also in-

cludes selection indicia 26 which is placed on the outer surface of the case adjacent selection knob 14.

The selection indicia 26 in a preferred embodiment are the letters "E," "G," "B," "D" and "A" which, as will hereinafter be seen, correspond to the notes produced by the strings of a guitar. The selection knob 14 is generally cylindrical and includes a triangularly shaped projection 28 which acts as a pointer when selecting the particular tone the generator will produce in accordance with the particular letter of the indicia pointed to by projection 28. In the preferred embodiment shown in FIG. 1, E, B, G, D and A are the notes that would be played by the first five guitar strings of a six string guitar. Since the sixth string of a guitar is also the note E but an octave lower, the tone generated for the higher E may also be used to tune the sixth string E, as will hereinafter be seen. The six strings of a six string guitar should be tuned to the following frequencies:

	Cycles per second
1st string (E) -----	329.6
2nd string (B) -----	246.9
3rd string (G) -----	195.9
4th string (D) -----	146.8
5th string (A) -----	110.0
5th string (E) -----	82.3

The first string E and the sixth string E are separated from each other by a single octave and although of different frequencies sound alike. Therefore, the production of the higher frequency E which is produced by the first string may also be used to tune the sixth string.

The tuning device also includes an on-off switch 30 to selectively initiate operation of the tuning device. When switch 30 is placed in the on position, the tone produced at speaker 18 is the tone which is represented by the letter at which the projection 28 is pointed. Thus, when projection 28 is pointed at the letter E, the tone E at 329.6 cycles per second (hereinafter referred to as c.p.s.) is reproduced by the speaker 18. Similarly, when the projection 28 is pointed at the letter B, the speaker 18 reproduces the tone of the B string at 246.9 c.p.s. and so on through the remainder of the strings of the guitar. Each of the tones reproduced by speaker 18 is not only produced at the same frequency as the string of the guitar, but also sounds similar to the tone actually produced when the string is picked because of the novel circuitry used.

The circuitry used in the tuning device 10 is wholly solid state. Thus, the size of the entire tuning device is comparable to that of a package of cigarettes. A compact tuning device is therefore provided which produces the same tones as those produced by picking the strings of a guitar. The device is easily usable in that an individual may tune the guitar by comparing the sounds produced by the tuning device with the sounds produced by picking the corresponding strings of the guitar. As will hereinafter be seen, the circuitry used is simple and inexpensive. The tuning device is thus easily purchased by students and amateur musicians as an addition to their musical equipment.

The tone generator 16 is shown in schematic block diagram form in FIG. 2. The tone generator basically comprises a multivibrator 32 which generates a square wave at each of a predetermined plurality of frequencies which are the same as the basic frequency of the desired tones. The frequency generated by the multivibrator is determined by the voltage regulator 34 which is connected to the multivibrator via lines 36. The voltage regulator is associated with the selection knob 14 and regulates the voltage supplied to multivibrator 32 in accordance with the position of the knob 14. The output of multivibrator 32 is fed via line 38 to an amplifier 40 which amplifies and shapes the output of the multivibrator. The amplifier produces a square wave output which is fed to a filter 42 via line 44. Filter 42 elimi-

nates a large portion of the second and third harmonics of the square wave produced by the amplifier 40 to more closely produce a wave similar to that produced by the string of a musical instrument. An output driver 46 receives this filtered signal from the filter via line 48. The output driver 46 is connected to speaker 50 via output line 52. Speaker 50 converts the signal on line 52 to a tone of the same frequency. This tone is very similar to the tone produced by the strings of the musical instrument because the signal to the speaker contains not only the prime frequency of the tone but is also rich in harmonics.

In operation, the selection knob 14 is positioned in accordance with the indicia on the case 12 of the tuning device. The voltage regulator is adjusted in accordance with the position of the selection knob to provide the appropriate voltage to multivibrator 32 which responds to the voltage to produce a square wave of a predetermined frequency. It is amplified by amplifier 40 and transmitted to filter 42 which filters out the undesired harmonics and produces a signal which is closer to the wave shape of a tone produced by the string of an instrument. The output driver 46 amplifies the output signal of filter 42 to drive speaker 50 which converts the signal to an output tone.

FIG. 3 is a detailed schematic diagram of the circuitry comprising the tuning device 10. The multivibrator 32 is preferably comprised of a pair of N-P-N type transistors 54 and 56. The emitters of transistors 54 and 56 are connected to ground. The bases of the transistors 54 and 56 are connected together via serially connected resistors 58 and 60, respectively. The collector of transistor 54 is connected to the base of transistor 56 via a coupling capacitor 62. Similarly, the collector of transistor 56 is connected to the base of transistor 54 via a coupling capacitor 64.

The multivibrator 32 is connected to the voltage regulator 34. The voltage regulator 34 is comprised of five resistors 66, 68, 70, 72 and 74 and a wiper arm 76 which is mechanically connected to the selection knob 14. The resistors 66 through 74 are connected together at one end and are connected to the base of transistor 54 via resistor 58 and to the base of transistor 56 via resistor 60. Wiper arm 76 is adapted to be connected to one of resistors 66 through 74 at a time. A Zener diode 78 is connected at one end to ground and across the voltage regulator 34 and multivibrator 32. The collectors of transistors 54 and 56 are connected via collector resistors 80 and 82 and serially connected diodes 84 and 86 to the wiper arm 76 and to Zener diode 78. The diode 86, wiper arm 76 and Zener diode 78 are connected to a positive source of voltage (+V) via a current limiting resistor 88 and on-off switch 30. The collector of transistor 56 of the multivibrator 32 is connected to the base of amplifier 40 via an isolation resistor 90. The amplifier 40 is preferably comprised of an N-P-N transistor which is connected as a grounded emitter and which is selectively driven into saturation by the collector of transistor 56 in order to produce a square wave. The emitter of amplifier 40 is connected to ground. The collector of amplifier 40 is connected via a load resistor 92 and on-off switch 30 to a source of 60 voltage.

The filter 42 is comprised of transistor 94, resistors 96 and 98 and capacitors 100 and 102. The base of transistor 94 is connected to ground via capacitor 102. The base is also connected via resistor 98 and capacitor 100 to the emitter of transistor 94. The emitter of transistor 94 is connected to ground via resistor 104. The collector of transistor 94 is connected directly to the positive source of voltage via on-off switch 30. Biasing potential is applied to filter 42 via resistor 106 which is connected to resistor 96 at one end and is connected via resistor 88 and on-off switch 30 to the positive source of voltage.

The collector of amplifier 40 is coupled to the resistor 96 of the filter 42 via coupling capacitor 108. The emitter of transistor 94 of filter 42 is coupled to the output driver 46 via a coupling capacitor 110.

The output driver 46 is basically comprised of a power transistor 112 which is preferably of the N-P-N type. The emitter of transistor 112 is connected to ground via resistor 114 and to the speaker 50 via line 116. The collector of the transistor 112 is connected via resistor 118 and on-off switch 30 to the positive source of voltage (+V). The collector of transistor 112 is also connected to the speaker 50 via capacitor 120.

In operation, switch 30 is closed so that positive potential is applied to the multivibrator 32 via resistor 88, diodes 84 and 86 and via one of the resistors of voltage regulator 34. As a positive potential is applied to the multivibrator 32, the transistors 54 and 56 alternately conduct. The output of the transistor 56 of multivibrator 32 is fed to the amplifier 40 which is driven to saturation each time the output on the collector of transistor 56 goes positive.

The amplifier 40, therefore, produces at its collector a square wave as a result of being driven into saturation and being cut off when the positive voltage at the collector decreases as the transistor 56 goes conductive. The square wave is fed to the filter 42 which deletes the majority of the second harmonic which is present and also deletes the majority of the third harmonic of the square wave produced by amplified 40. Since the output signal of the amplifier 40 is very close to a square wave, the amount of second harmonic present is small. The filter, therefore, filters mostly third harmonics from the signal produced by amplifier 40. The resulting signal produced by filter 42 has a basic frequency equal to one of the tones of a corresponding string of an instrument. The output signal of filter 42 is very rich in harmonics and is, therefore, very similar to the structure of the sound waves that are produced by the string of an instrument.

The output filter 42 is then fed to the output driver 46 which drives the output speaker 50 in a push-pull fashion. Capacitor 120 prevents D.C. current flow from the driver 46 to the speaker 50.

The frequency of the square wave produced by the multivibrator and amplifier 40 is determined by the amount of positive voltage fed to the multivibrator via the voltage regulator 34. The resistance values of resistors 66, 68, 70, 72 and 74 determine the voltage fed to multivibrator 32. The values of resistors 66 through 74 thus each correspond to the frequency of a tone desired. Therefore, the higher frequencies are developed by connecting wiper arm 76 to the resistors of lower resistance. Conversely, the lower frequencies are produced by connecting wiper arm 76 of the voltage regulator to the resistors of higher resistance.

The voltage source (+V) is preferably a conventional 9 volt dry cell. Diodes 84 and 86, which are interposed between the voltage source and the multivibrator 32, control the stability of the circuit even in variable temperatures. As the temperature increases, the resistance of the diodes decreases and therefore higher voltage is applied via resistors 80 and 82 to the collectors of multivibrator 32. The increased voltage to the collectors prevents the multivibrator 32 from speeding up as is its normal tendency when the temperature increases. The Zener diode 78 is connected across the multivibrator and voltage regulator in order to insure a constant voltage thereacross. The Zener diode breaks down at approximately 6 volts so that there is always a constant potential applied to the multivibrator.

It can therefore be seen that an extremely reliable and inexpensive tuning device has been provided. Due to the use of a Zener diode across the frequency generator, when the 9 volt D.C. battery which is connected to on-off switch 30 runs down, the Zener diode prevents a change of frequency by breaking down at a voltage much lower than the normal voltage of the battery. In this manner, the only circuitry affected by a run-down battery is the output speaker which will not receive as much current to drive

it. Therefore, only the volume of the sound emitted by the tuning device is affected.

Amplifier 40 prevents overloading of the multivibrator by acting as a buffer which also provides a low impedance path to drive the filter 42. As hereinbefore mentioned, the filter is a low pass active filter which eliminates much of the third harmonic of the multivibrator square wave. Since the output of the multivibrator is very close to a square wave, the filter removes the harshness of the output sound. In this manner, the harshness of the output sound is removed and the sound is very similar to that produced by the string of the stringed instrument. The device is simple to operate in that the on-off switch need only be switched to the "on" position and the selection knob rotated to the indicia corresponding to the tone desired on the string which is to be tuned. An amateur can thus easily tune his instrument by comparing the sounds produced by output speaker 18 with the sound being produced by the strings of his instrument. Thus, for a guitar it is necessary only to compare each of the five sounds with the first five strings of the guitar and to compare the sound produced by the E with the sixth string and make the sixth string an octave lower.

Without further elaboration, the foregoing will so fully illustrate my invention, that others may, by applying current or future knowledge, readily adapt the same for use under various conditions of service.

What is claimed as the invention is:

1. A tuning device for a musical instrument having a plurality of members each of which requires tuning to a different predetermined pitch to enable use of said instrument, said tuning device comprising, means for generating a plurality of frequencies, each of said frequencies corresponding to one of said predetermined pitches of said members requiring tuning, said means for generating a plurality of frequencies comprising a multivibrator and a voltage regulator, a selection member for selecting one of said plurality of frequencies at a time, said voltage regulator being associated with said selection member to provide a different voltage to said multivibrator for each of the frequencies generated by said multivibrator, said multivibrator being connected to a filter, said filter adapted to remove frequency harmonics in the output signal of the multivibrator that are not present in the sounds of the notes produced by said instrument, said selection member adapted to select the frequency corresponding to the pitch of the member of said instrument requiring tuning, and reproduction means connected to said filter so that the tuning device produces a sound similar to that which is produced by said member of said instrument requiring tuning when properly tuned.

2. The invention of claim 1 wherein said multivibrator is connected to said filter via a buffer amplifier.

3. The invention of claim 1 wherein a Zener diode is provided across said multivibrator and said voltage regulator so that said multivibrator frequencies remain constant.

4. The invention of claim 1 wherein said filter is connected to an output speaker via an output driver which is connected to said speaker in push-pull fashion.

5. The invention of claim 1 wherein said multivibrator is connected to a constant source of voltage via a temperature compensating device which enables the multivibrator to produce constant frequencies notwithstanding changes in temperature.

6. The invention of claim 1 wherein said musical instrument is a guitar, and said tunable members comprise strings, said tuning device further including indicia adjacent said selection member, said indicia corresponding to the strings of said guitar so that tuning of said guitar is facilitated.

7. The invention of claim 1 wherein said tuning device includes a rectangular housing, said housing being pocket

7

sized and including a removable rear wall for access to said means for generating a plurality of frequencies and for replacement of a power source for said means for generating, the front wall of said housing including an opening for said reproduction means and an opening to accommodate said selection member whereby said tuning device is both portable and easy to use.

8. The invention of claim 5 wherein said temperature compensation device is comprised of a pair of serially connected diodes.

5

10

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RICHARD B. WILKINSON, *Primary Examiner*.
LAWRENCE R. FRANKLIN, *Assistant Examiner*.

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8

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