Feb. 8, 1966 R. R. CHAPMAN 3,233,362

TOY SATELLITE WITH RADIO SIGNAL GENERATING MEANS

Filed Dec. 19, 1961

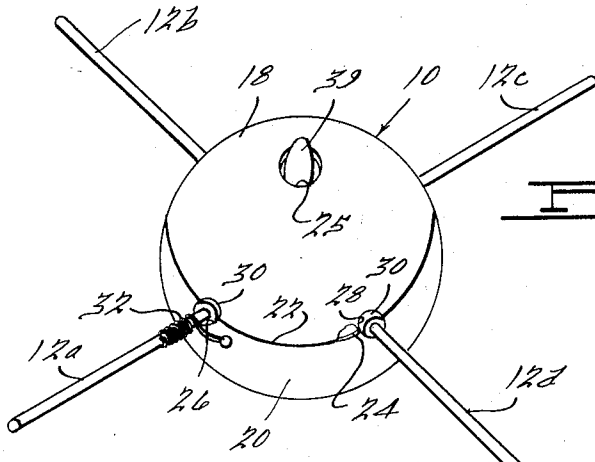


FIG. 1.

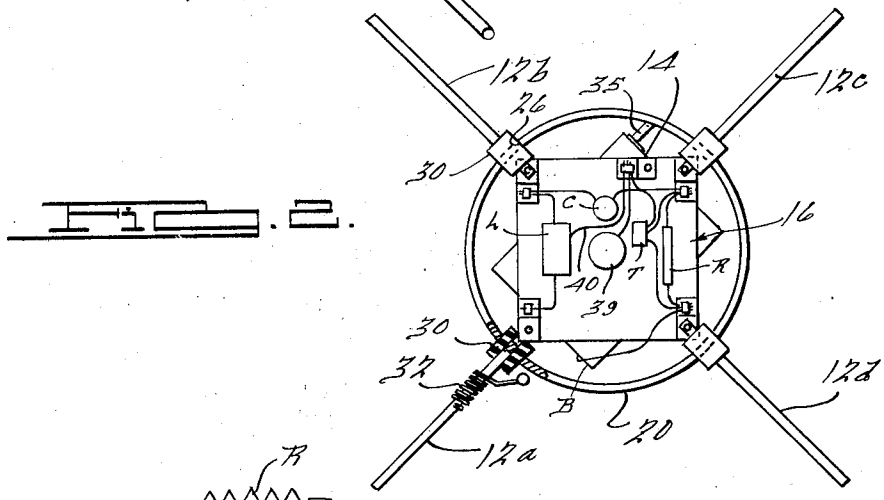


FIG. 2.

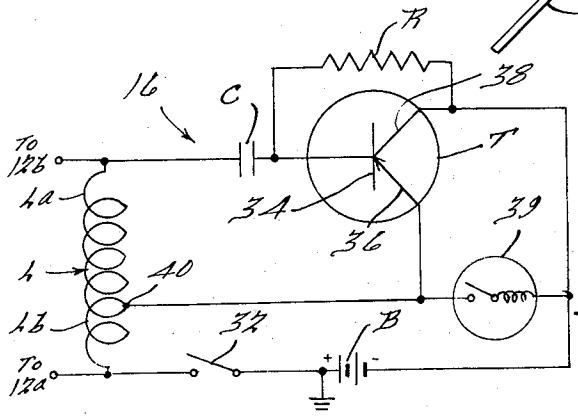


FIG. 3.

INVENTOR.
Ralph R. Chapman
BY
Harness, Dickey & Pierce
ATTORNEYS.

United States Patent Office 3,233,362 Patented Feb. 8, 1966



3,233,362

# TOY SATELLITE WITH RADIO SIGNAL GENERATING MEANS

Ralph R. Chapman, Lansing, Mich., assignor of one-half to Robert D. Chapman, Standish, Mich.

Filed Dec. 19, 1961, Ser. No. 160,477
5 Claims. (Cl. 46—227)

This invention relates to toys and more particularly to an educational toy satellite.

Real satellites are provided with transmitters for transmitting signals back to earth carrying various information. It is an object of this invention to provide a toy satellite having radio transmitter means for sending out a signal which can be detected by a conventional home or car radio.

While many toys provide little or no educational value, the toy of this invention provides means whereby radio transmission phenomena can be studied and observed. It is another object of this invention to provide a toy satellite having an educational value as well as an intrinsic value as a toy.

While many toys provide little or no educational value, the toy satellite of this invention has an educational feature in that it is simple in construction and be provided in an educational "do-it-yourself" kit form. Therefore, it is another object of this invention to provide a toy satellite having a transmitter therein which is of a simple construction and readily adaptable to a "do-it-yourself kit form.

Other objects, features, and advantages of the present invention will become apparent from the subsequent description and the appended claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a pictorial view of the toy satellite of this invention in an assembled condition;

FIGURE 2 is a top elevational view of the toy satellite of this invention in which the upper shell member has been removed and in which some of the electrical components have been shown pictorially; and

FIGURE 3 is a schematic diagram of an oscillator circuit utilized in the toy satellite shown in FIGURES 1 and 2.

In general, the toy satellite comprises an outer shell assembly **10** having disposed therein and extending radially therefrom a plurality of antennas **12***a*, **12***b*, **12***c*, and **12***d* which are in turn secured to a mounting board **14** to which is attached an oscillator circuit **16**. Looking now to FIGURE 1, the outer shell assembly **10** comprises upper and lower hemispherically shaped shell members **18** and **20**, respectively, having interfitting or overlapping portions **22** and **24**, respectively, matably retained together by a press or interference fit. The upper shell member **18** has a centrally disposed aperture **25** extending therethrough for purposes to be described. The interfifitting portions **22** and **24** each are provided with a plurality of notches **26** and **28**, respectively, which, upon assembly of the shell members **18** and **20**, define apertures extending into the outer shell assembly **10**. While the shell assembly **10** is shown to be spherical in form, any substantially enclosed housing of any shape, approximating the shape of a satellite, nose cone, etc., could be utilized. Note that, while the shell assembly **10** can be made of any suitable material, in the preferred embodiment it is made of aluminum or some other metal which is a conductor of electricity for a purpose to be described.

The plurality of apertures defined by the notches **26** and **28** are disposed circumferentially equidistantly and provide means whereby the plurality of antennas **12***a*–**12***d* can be extended internally from within the outer shell assembly **10** and thence radially outwardly beyond



the outer shell assembly **10**. In the preferred embodiment the plurality of antennas **12***a*–**12***d* are made of a metal which is a conductor of electricity. The antennas **12***a*–**12***d* are insulated from the upper and lower shell members **18** and **20** in the region of the nothces **26** and **28** by means of tubular insulating members **30**.

Looking now to FIGURE 2, the plurality of antennas **12***a*–**12***d* are each secured to one corner of the mounting board **14** and hence maintain the mounting board **14** suspended within the interior of the shell assembly **10**. The mounting board **14** is made of an insulating material, such as "Bakelite" in order that electrical components can be mounted thereupon. While the four antennas **12***a*–**12***d* are shown, only two are utilized for the transmission of the electrical signals and in the preferred embodiment adjacent antennas **12***a* ad **12***b* are selected for a purpose to be described.

Disposed upo the antenna **12***a* is a spring switch member **32** which serves a purpose to be described.

Looking now to FIGURES 2 and 3, the oscillator circuit **16** is disposed upon the mounting board **14** and comprises a transistor T of a p-n-p type having a base **34**, an emitter **36** and a collecor **38**. The collector **38** is electrically connected to the base **34** via a biasing resistor R and is also serially connected to the negative side of a battery B which has its positive side grounded. The base **34** is serially connected to a capactor C and thence to a coil L and to ground via switch **32**. The coil L has connected thereto a tap **40** which divides the coil L into coil portions $L_a$ and $L_b$. The emitter **36** is connected to the tap **40** of the coil L. The battery B is grounded to the shell assembly **10** via a spring clip **35**. The antennas **12***a* and **12***b* are connected to opposite ends of the coil L and are, of course, insulated from the shell assembly **10** by virtue of the insulating members **30**. The switch **32** is a spring-like member which is slidably disposed upon the antenna **12***a* in electrical contact therewith; the switch **32** can be either moved into stationary contact with the shell assembly **10** or can be located proximate the shell assembly **10** and moved into contact intermittently with the shell assembly **10** by hand. In either situation, engagement of the switch **32** with the shell assembly **10** completes the circuit to the battery B and energizes the oscillator circuit **16**.

Upon closing the switch **32**, a small amount of current is caused to flow between the collector **38** and the base **34** and hence to the tank circuit comprising the coil portion $L_a$ of the coil L and the capacitor C. This causes oscillations to occur, resulting in an amplified oscillating current flowing in the collector-emitter circuit and thence through the other coil portion $L_b$ of the coil L. Since the portions of the coil $L_a$ and $L_b$ are wound on the same form and are thus inductively coupled, an auto-transformer action causes the voltage drop across the coil portion $L_b$ ot induce or feedback a voltage in the coil portion $L_a$, hence causing a regenerative effect whereby the amplitude is increased. This regenerative effect continues until the oscillator circuit **16** reaches a point of saturation. Since in the preferred embodiment the output signal is to be picked up by a conventional AM receiver, the output signal should has a radio frequency carrier component and an audio component. In the circuit of FIGURE 3, the initial buildup of current flowing through the transistor induces a positive voltage in the coil L via the coil portion $L_b$, which voltage is coupled through the capacitor C to the base **34** of the transistor T. As previously discussed, the polarity is such that this voltage buildup results in an increase in current through the collector **38**. The regenerative action continues until the transistor T is saturated and the collector current buildup is stopped as determined by the

gain limitations of the transistor T. With no change in current flowing through the coil L, the potential drop across coil L drops, thus causing a reduced potential to appear at the base **34** of the transistor T and causing the current through the collector **38** to decay. The inductive action of the coil L tends to maintain the current flow therethrough and hence the decay of current through collector **38** results in a negative voltage on the coil L, and hence on the base **34**, which in turn tends to aid the decay of current flow through the transistor T. This degenerative action causes the current through the collector **38** to become zero, at which time the transistor T is turned off and the sequence is then repeated. During the self-quenching sequence described, on successive cycles a charge is gradually built up on the capacitor C through the low resistance path of the base **34** and emitter **38** circuit. Eventually the charge on the capacitor C reaches a level sufficient to place the transistor T in an off condition. With the transistor T turned off, the capacitor C then discharges through the bias resistor R, which has a high value of resistance in comparison to the resistance of the base **34** emitter **36** circuit. This discharge occurs until the base **34** of the transistor T is once again at a potential such that the transistor T is in condition to conduct and the sequence starts again. Note, then, that actually two types of oscillation are caused to occur. The first oscillation which has a frequency determined by the tank circuit comprised of the capacitor C and the coil portion $L_a$ causes a high frequency oscillation to occur. At the same time, the charge and discharge effect of the capacitor C, which turns the transistor T on and off, causes a lower frequency oscillation to occur. By properly selecting the values of the parameters of the circuit, the high frequency oscillation can be selected to be an R-F frequency and can serve as a carrier wave while the low frequency oscillation can be selected as an audio signal. In the preferred embodiment the audio frequency was chosen to be approximately 1000 cycles per second. This frequency can be changed by varying either the value of the capacitor C or the value of the biasing resistor R. The carrier or high frequency wave, because of the gradual change in charge condition of the capacitor C, varies in frequency and, in the preferred embodiment, has a frequency variation in the range of from approximately 400 kc. to 1 mc. The range of carrier frequency can be changed by varying the values of the capacitor C or of the inductance $L_a$. Thus, while the audio signal is a substantially constant tone, the carrier wave varies considerably over the R-F band. This variation in carrier frequency has a particular utility in the toy of this invention, since it allows the output signal from the toy to be picked up over a relatively broad band of tuning on a conventional AM tuner.

A thermal light **39** is connected between the emitter **36** and the collector **38** and operates such that when it is inserted into the circuit it initially short-circuits the collector **38** to the emitter **36** and hence prevents the transistor T from conducting; hence the circuit **16** from oscillating. Upon reaching a given temperature, the current to light **39** is interrupted internally in the light **39** by means well known in the art, thus allowing the transistor T to conduct and to go into oscillation. In the preferred embodiment, the thermal light **39** is selectively connectible into the circuit such that the oscillator circuit **16** can be used either in a continuous oscillating condition or in a situation in which, with the light **39** in the circuit, the oscillations are interrupted each time the light **39** is on or in a closed circuit condition. The light **39** could be placed in a different portion of the oscillator circuit **16** such that the circuit **16** would be in a condition of oscillation when the light **39** was on. While the transistor T is shown to be of p-n-p type, an n-p-n type could be used by simply reversing the connections to the battery B.

The antennas **12***a* and **12***b*, which are connected across the coil L, transmit the output signal occurring across the coil L. Note that the transmitting antennas **12***a* and **12***b* are at an angle less than 180° and hence provide a means whereby transmission of the output signal therefrom is somewhat directional.

The switch **32** is of a spring type and can be operated by hand to selectively open or close the circuit to the transistor T and hence be used to send a signal, i.e., such as the Morse code, etc. In the preferred embodiment the resistor R was 150K., the capacitor C was .004 mfd., and the coil L was an air core coil wound on a ⅛-inch diameter form and was composed of 350 turns of #28 wire having a tap at approximately 50 turns (i.e. $L_b$ would then be 50 turns). The output signal therefrom was capable of being detected by a conventional home receiver over a selectively wide frequency range of tuning on the receiver.

From the above description it can be seen that the toy satellite as described has many educational features. In the first place, it is simple in construction, and can be provided in a "do-it-yourself" type kit, thereby giving the user experience in constructing transistorized circuits. Also note that, with the antennas **12***a* and **12***b* at an angle less than 180°, the output signal is directional, thereby allowing observation of the directional effects of radio transmission, i.e. by aiming the antennas **12***a* and **12***b* away from the radio receiver, the tone out of the receiver is diminished in amplitude. Also, the toy satellite as described allows a user to gain knowledge in the transmission of coded signals via the use of the switch **32**. Another educational value of the toy is in the demonstration of the transmission of radio waves through various materials, i.e. paper, etc., and the absorption of radio waves in other materials, i.e. lead, as by merely placing a sheet of such material in front of the transmitting antennas **12***a* and **12***b*. Another educational feature of the top satellite is the teaching of the range of radio transmission since, by merely moving the satellite towards or away from the radio receiver, the audio signal output from the radio will correspondingly increase or decrease in amplitude. The above are only a few of the educational advantages to be gained from a toy as shown and described and serve to enhance the intrinsic value thereof, which is simply as a toy.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

**1.** A toy satellite comprising a hollow housing and radio transmitter means for transmitting a radio signal including oscillator circuit means disposed within said housing for generating said signal, said oscillator circuit means comprising a transistor having a base, a collector, and an emitter electrode, a source of potential connected to said collector electrode having one end connected to said collector electrode, a coil having one end connected to the opposite end of said source of potential, a capacitor connecting the other end of said coil to said base electrode, a biasing resistor connected between said collector electrode and said base electrode, and a tap electrically connecting said emitter electrode to a portion of said coil, and a thermal light connected between said emitter electrode and said collector electrode for intermittently opening and closing the circuit between said emitter electrode and said collector electrode responsively to current flowing from said source of potential to said thermal light, said housing having an opening through which the light from said thermal light is transmitted.

**2.** A toy satellite comprising a pair of members having interfitting portions and defining a hollow housing upon assembly of said pair of members at said interfitting portions, each of said interfitting portions having a plurality of slots similarly peripherally disposed for defining upon

assembly of said pair of members a like plurality of apertures, and radio transmitting means for transmitting a radio signal including oscillator circuit means disposed within said housing for generating said signal and a plurality of antennas extending radially outwardly from said hollow housing through said plurality of apertures with said oscillator circuit means being connected to at least two of said plurality of antennas, said pair of members being made of an electrically conductive material and with said plurality of antennas insulated from said pair of members and with said oscillator circuit means including said pair of members, and a switch member in electrical contact with one of said at least two antennas and selectively engageable with one of said pair of members for closing a circuit of said oscillator circuit means upon contact with one of said pair of members for turning said oscillator circuit means on.

3. The apparatus of claim 2 further including a thermal light connected to said oscillator circuit means and extending outwardly and emanating light through an aperture in one of said pair of members and being operatively associated with said oscillator circuit means for providing an open and closed circuit thereacross responsively to current flowing to said thermal light.

4. A toy satellite comprising a hollow housing and radio transmitter means for transmitting a radio signal including oscillator circuit means disposed within said housing for generating said signal and electrical circuit means connected to said oscillator circuit means and being actuable to opened and closed conditions for interrupting the transmission of said radio signal when in one of said conditions, said electrical circuit means including a thermal light member actuable for opening and closing said electrical circuit means responsively to current flow therethrough,



said housing having an opening through which the light from said thermal light is transmitted.

5. A toy satellite comprising a pair of members having interfitting portions and defining a hollow housing upon assembly of said pair of members at said interfitting portions, and radio transmitter means for transmitting a radio signal including oscillator circuit means disposed within said housing for transmitting said signal, an antenna extending radially outwardly from said hollow housing and electrically connected to said oscillator circuit, a thermal light, and circuit means connecting said thermal light to said oscillator circuit means for providing an open and closed circuit across said oscillator circuit means responsively to current flowing through said thermal light for interrupting said oscillator circuit means when closed when said thermal light is energized, said housing having an opening through which the light from said thermal light is transmitted.


**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,771,584 | 11/1956 | Thomas | 332—29 |
| 2,835,548 | 5/1958 | Baumann | 315—352 |
| 2,977,418 | 3/1961 | Haas | 331—112 X |
| 3,021,451 | 2/1962 | Lundahl | 331—112 X |
| 3,056,930 | 10/1962 | Berg | 331—75 |
| 3,063,048 | 11/1962 | Lehan et al. | 325—4 X |

OTHER REFERENCES

Popular Electronics, September 1958, pp. 75, 76.
Radio & Television News, December 1956, pg. 62.



DELBERT B. LOWE, *Primary Examiner.*

JAMES W. LOVE, RICHARD C. PINKHAM,
*Examiners.*