June 3, 1952 R. D. REED 2,599,126

HELICAL LINEAR REACTANCE

Filed Feb. 26, 1948 3 Sheets-Sheet 1

Fig. 1.

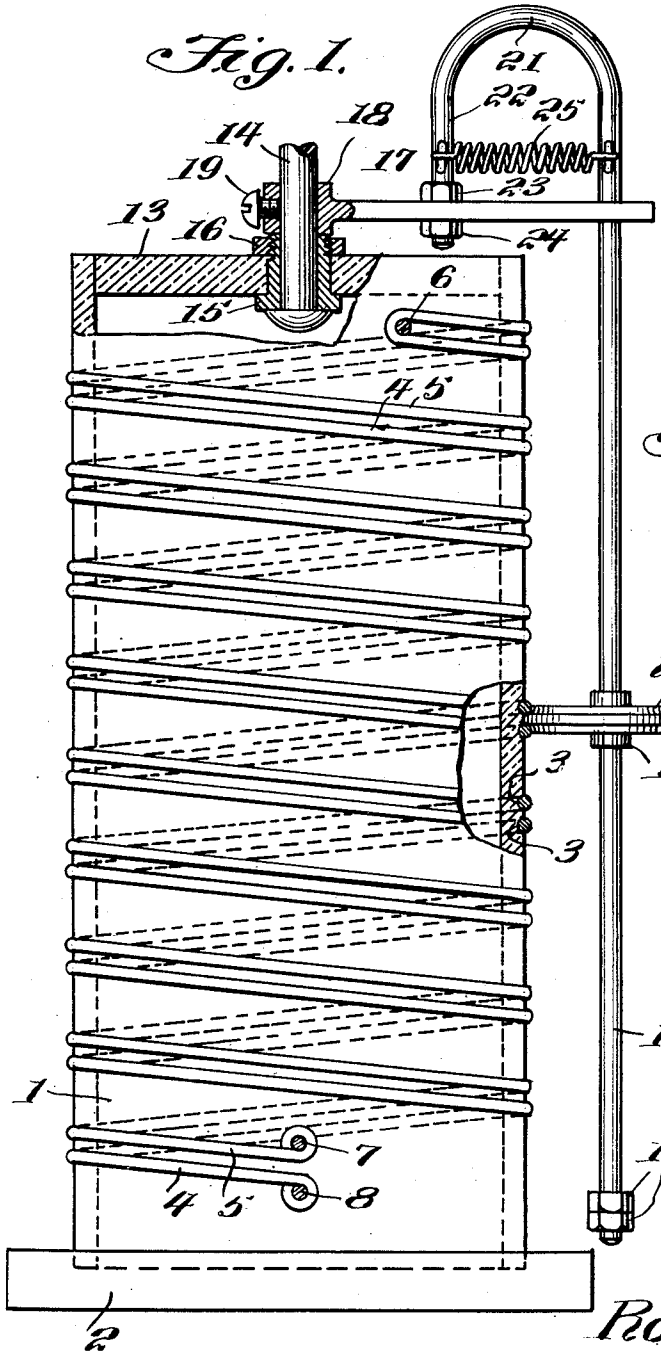


Fig. 3.

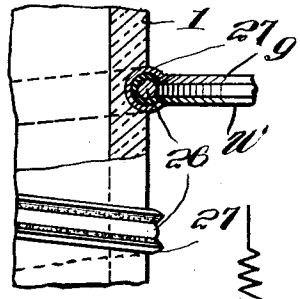
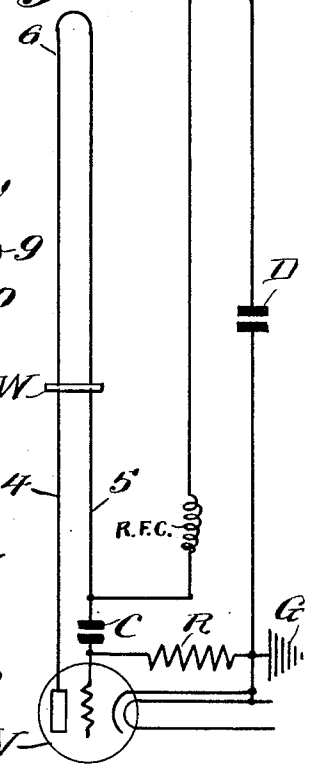


Fig. 12.



INVENTOR.

Roland D. Reed,

BY Victor J. Evans & Co.

ATTORNEYS

June 3, 1952 R. D. REED 2,599,126

HELICAL LINEAR REACTANCE

Filed Feb. 26, 1948 3 Sheets-Sheet 2

Fig. 2.

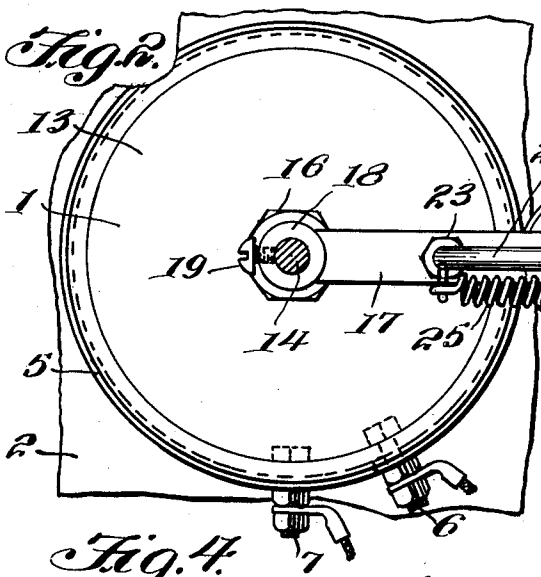


Fig. 4.

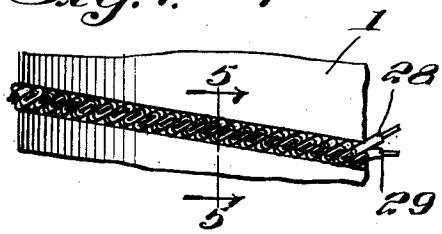


Fig. 5.

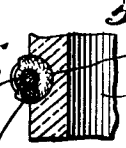


Fig. 8.

Fig. 7.

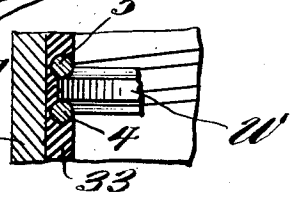
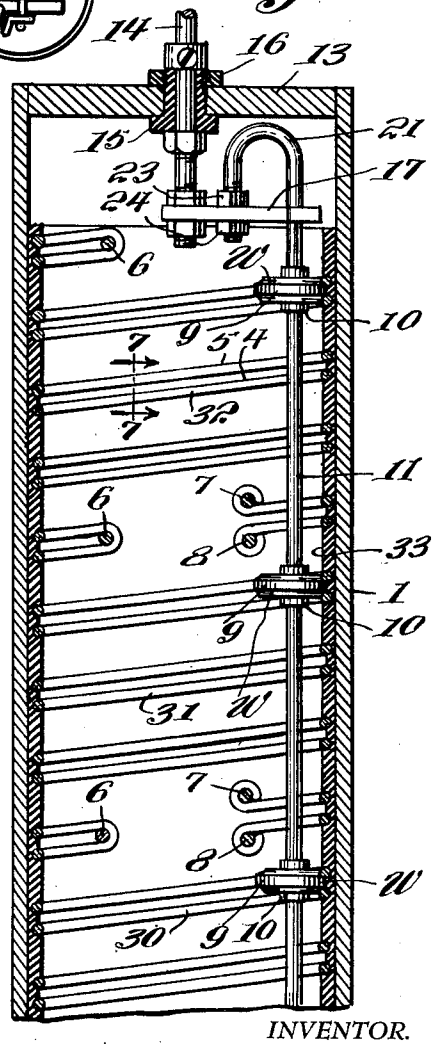


Fig. 6.



INVENTOR.

Roland D. Reed,

BY Victor J. Evans & Co.

ATTORNEYS

June 3, 1952 R. D. REED 2,599,126

HELICAL LINEAR REACTANCE

Filed Feb. 26, 1948 3 Sheets-Sheet 3

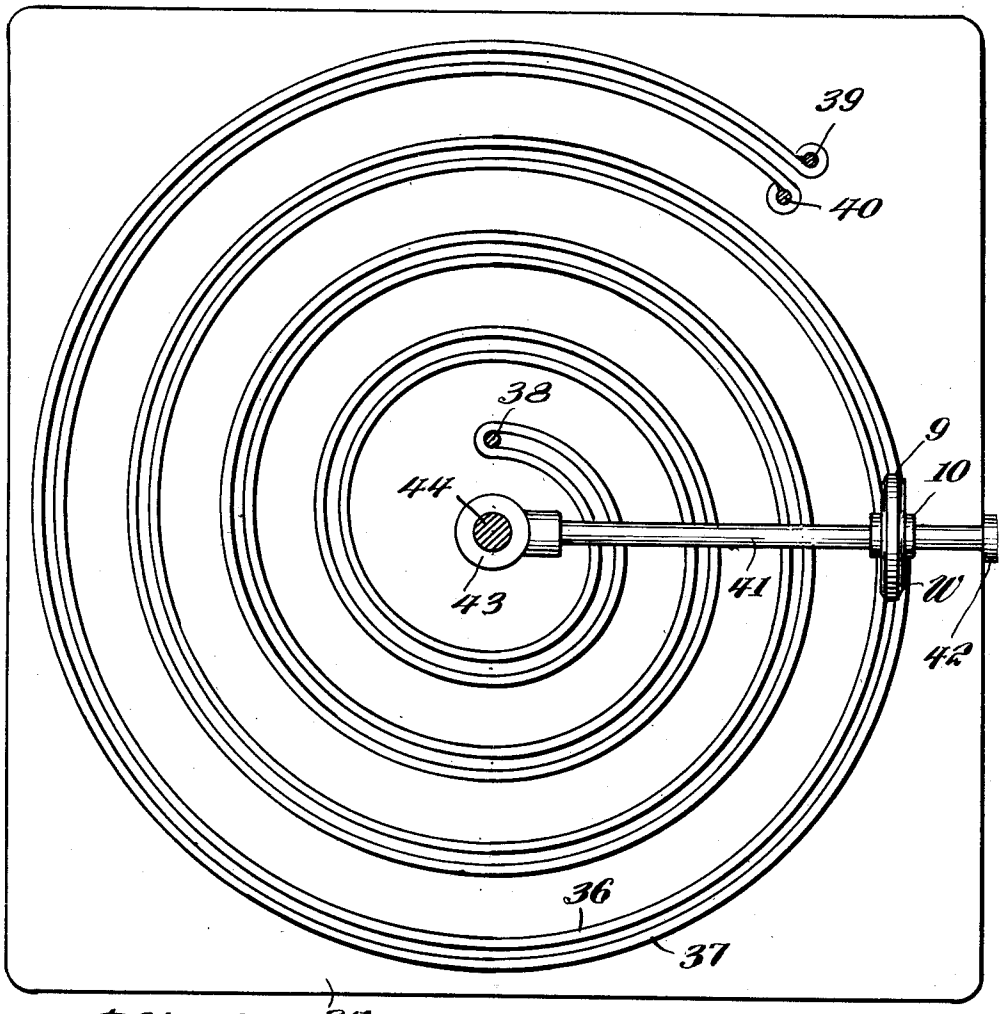


Fig. 9.

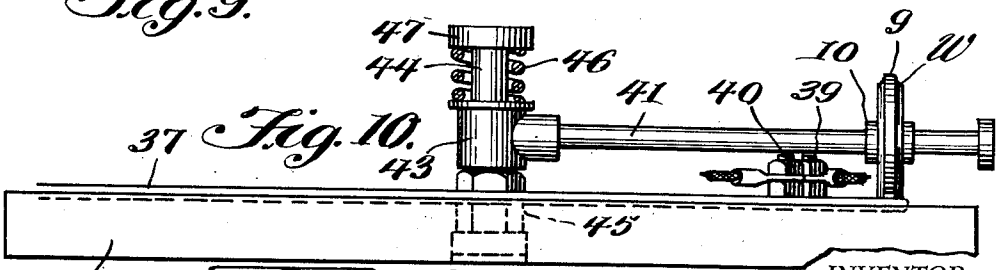


Fig. 10.

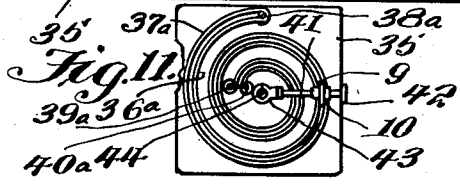


Fig. 11.

INVENTOR.

Roland D. Reed,

BY Victor J. Evans & Co.

ATTORNEYS

Patented June 3, 1952

2,599,126

UNITED STATES PATENT OFFICE

2,599,126

HELICAL LINEAR REACTANCE

Roland D. Reed, Hamilton Square, N. J.

Application February 26, 1948, Serial No. 11,280

3 Claims. (Cl. 336—138)

1

The present invention relates generally to electrical regulators of the alternating inductive resistance type, and more specifically to an improved helical linear reactance or reactor, which, while adapted for regulating various electrical devices, is especially designed for use as an indicator, a testing appliance, or metering appliance for vacuum tubes in an oscillatory circuit by causing the tube to oscillate at its resonant frequency. By the utilization of my improved reactor in an oscillatory circuit I am enabled to regulate various electrical appliances and devices within wide limits of a comparatively extended frequency range, and the results are determined by mutual inductance in the parallel helical conductors of a spirally arranged track over which a movable contact member travels.

The reactance may be raised or lowered by movement of the shorting contact-member on the track, at low radio frequency potential, and the currents in the radio frequency circuit travel only across the exterior surface of the movable shorting member, here shown as a rotating wheel or roller that revolves around the track.

In its movement the shorting contact member of the reactor permits a smooth and gradual variation in the frequency of an oscillatory circuit together with a facile adjustment from a low frequency to a high resonant frequency of the tube, or similar device, being tested, regulated, or measured, and without changing the inductance or the capacity, and without inherent end-losses of a tapped inductance.

To this end the invention consists in certain novel features of construction and combinations and arrangements of parts as will hereinafter be described, and more particularly pointed out in my appended claims.

In the accompanying drawings I have herein illustrated several complete examples, and modifications, of my invention, wherein the parts are combined and arranged, according to modes I have devised for the practical application of the principles of my invention.

Figure 1 is a view in elevation, with parts in section, showing the reactor with an exterior track and rotary traveling contact member or short circuiting roller, and the operating means for revolving the roller or rotary wheel.

Figure 2 is a top plan view of the appliance in Fig. 1.

Figure 3 is a detail sectional view showing a modified form of the helical track for the shorting member.

2

Figure 4 shows the helical track composed of twisted wires or conductors; and Figure 5 is a transverse sectional view at line 5—5 of Fig. 4.

Figure 6 is a vertical sectional view showing multiple helical tracks within the interior of a tubular base, and equipped with complementary shorting members and operating means.

Figure 7 is a fragmentary transverse sectional view at line 7—7 of Figure 6 through the interior track.

Figure 8 is a fragmentary perspective view with parts shown in section showing a modified form of a base for the track.

Figure 9 is a top plan view illustrating a modified form of the device showing a helical track mounted on a flat horizontal base.

Figure 10 is a view showing a side elevation of the device shown in Figure 9 with parts shown in section.

Figure 11 is a view similar to that shown in Figure 9 illustrating a further modification wherein the track is oppositely positioned.

Figure 12 is a wiring diagram showing the oscillatory circuit, together with a vacuum tube in the radio frequency circuit, and other electrical appliances.

In order that the operation and utility of the reactance or reactor may readily be understood Figure 12 illustrates a vacuum tube V in connection with the radio frequency circuit or track 4, 5, 6, and the traveling contact or shorting wheel W; and the oscillatory circuit which is grounded at G, includes a radio frequency choke coil designated as R. F. C., together with condensers C and D, and resistance coil as R.

In Figures 1 and 2 where the first form of the invention is illustrated I employ as a base 1 a tubular cylinder of insulated or non-conducting material and provided with a suitable bottom support 2. The exterior periphery of the cylinder base is fashioned with a pair of helical and parallel grooves 3, 3, that are adapted to receive and retain an integral track composed of parallel helical wires or conductors 4 and 5, spaced at optimum distance apart, and short circuited at one end, as by a retaining pin 6, to provide a dead end for the parallel conductors.

At the opposite or lower end of the track, the conductors are equipped with terminals 7 and 8 that are electrically connected with the tube V in the diagram of Fig. 12.

These parallel conductors or wires 4 and 5, which preferably are spaced apart a distance greater than diameter of a wire conductor, provide a fixed helical track or guide for the mov-

able connector, short circuiting bar, or movable contact, which is here shown as a roller or wheel W, having an exterior annular and rounded flange 9. The flange 9 is held in between the two parallel conductors of the track as the wheel revolves around the base and the flange retains the wheel against displacement as it travels spirally in a vertical plane; while the wheel thus supported rotates with its annular periphery in constant frictional and electrical contact with the two parallel conductors. As the rotating wheel revolves around the base it provides a moving contact member, supported between the conductors, and it provides a short circuit across the exterior surface of the wheel in contact with the exterior surfaces of the two conductors forming the supporting and guiding track.

The wheel travels upwardly around the helical track on the base, and for guiding its movement in a vertical plane, the wheel is slidably journaled by its bearing hub 10 upon a rod 11 having stop nuts 12 threaded thereon at its lower end. This depending rod is swiveled or pivotally mounted at the longitudinal axis of the helical track, to carry the wheel around the track, and means are provided for retaining the rod in operative relation to the track, and for retaining the wheel or roller in constant frictional and electrical contact with its track.

For this purpose, the removable head 13 of the tubular cylindrical base, is equipped with a central upright operating or power shaft 14 that is journaled in a bearing bushing 15 which is coupled by nut 16 in the cylinder head, and a radially extending horizontal operating arm 17 is mounted on the shaft by its head 18, a set screw 19 being employed for securing the arm in adjusted position on its shaft.

The outer free end of the arm is longitudinally slotted at 20 to receive and retain the upper end of the rod 11 which merges with a resilient inverted U-shaped bow or arch 21, and this bow terminates in an attaching end 22 that is mounted rigidly in a hole drilled in the arm and fastened thereto by a pair of lock nuts 23 and 24.

A coiled spring 25 is stretched across the bow or arch of the rod with its opposite ends anchored to the rod and the attaching end of the rod, and under tension the spring retains the wheel or roller in frictional and electrical contact with the conductors forming the track.

Various changes and alterations may be made in the parallel helical conductors forming the track, as for instance in Fig. 3, the track may consist of a coaxial cable 26 encased within a wrapper 27 that is exteriorly slotted to accommodate the periphery of the rotor or wheel W. In Figs. 4 and 5, a further modified form of the track is illustrated as two twisted conductors 28 and 29.

In Fig. 6 the use of multiple vertically spaced tracks are located within the interior of a cylindrical drum or tubular base, and multiple circuit closing wheels are revolved within the tubular base for co-action with the track. As here shown the revolving rod 11 is distended by its resilient yoke 21 to hold the three wheels W in frictional and electrical contact with the respective conductors of the three tracks 30, 31, and 32, that are embedded in the interior grooves of the tubular base, or in its inner lining 33.

In the modified form shown in Fig. 8, the base or support for the track is shown in the form of a flat slab 34 having rounded ends, and exterior grooves in which the spaced conductors 4 and 5 are mounted, for co-action with the rotary and revolving contact member or wheel W.

A further modified form of the base or support for the helical track is shown in Figs. 9 and 10, where a flat, preferably horizontal base 35 of rectangular shape, is equipped with a helical track including the two parallel conductors or wires 36 and 37 having a short circuited inner end 38, and the two outer ends or terminals 39 and 40 for connection with the tube being tested.

The wheel W rotates with its annular flange 9 between the conductors of the track, and the wheel revolves with its periphery in electrical contact with the conductors, with its hub 10 slidably journaled upon a radially extending operating rod or arm 41 having a head 42 on its free outer end.

The inner end of the operating rod is provided with a head 43 mounted upon the upright operating shaft 44 that is journaled in bearings 45 of the base 35, and a holding down spring 46 is positioned about the shaft and interposed between a collar 47 and the head 43, to retain the rod 41 in depressed position with the wheel resiliently held in frictional and electrical contact with its track.

In the design shown in Figure 11 the arm or rod and wheel are similar to the arm and wheel of the design shown in Fig. 9, and the parts are mounted on a similar post or vertical shaft on a similar base. The track, however, is positioned opposite to the track shown in Fig. 9 wherein the conductors 36*a* and 37*a* are connected at the outer end of the coil on the post 38*a*, and the terminals 39*a* and 40*a* are positioned at the center. With the terminals positioned in the center the unit can be constructed to have a straight line frequency turning curve which would be very advantageous particularly on the very high frequencies.

The invention, is therefore, an improved method of obtaining a wide range of frequencies for use in an oscillatory circuit for radio transmission and reception using a reactance having an inductance winding including a plurality of parallel wires connected effectively for R. F. at one end with the other end having independent terminals and with the wires provided with a traveling short.

Having thus fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. A helical linear reactance comprising a cylindrical wall of non-conductive material, a pair of spaced conductors positioned in spaced relation around the cylindrical wall, said conductors connected together at one end of the cylindrical wall, terminals on the opposite end of the cylindrical wall with each conductor of the pair connected to a terminal, a shaft journaled in one end of the cylinder, an arm carried by the said shaft, a rod carried by the arm and extended along the surface of the cylinder, spaced from the surface of the cylinder and parallel thereto, and a wheel freely rotatable on said rod and positioned to contact both conductors of the pair providing a traveling bridge for connecting the conductors at varying distances from the said terminals.

2. A helical linear reactance comprising a cylindrical wall of non-conductive material, a pair of spaced conductors positioned in spaced relation around the cylindrical wall, said conductors connected together at one end of the cylindrical wall, terminals on the opposite end

of the cylindrical wall with each conductor of the pair connected to a terminal, a shaft journaled in one end of the cylinder, an arm carried by the said shaft, a rod carried by the arm and extended along the surface of the cylinder, spaced from the surface of the cylinder and parallel thereto, a wheel freely rotatable on said rod and positioned to contact both conductors of the pair providing a traveling bridge for connecting the conductors at varying distances from the said terminals, and means resiliently urging the said wheel into contact with the said conductors.

3. A helical linear reactance comprising a cylindrical wall of non-conductive material, pairs of spaced conductors positioned in aligned coils around the cylindrical wall, the conductors of each of said pairs being connected at one end and having terminals on the opposite ends, an arm pivotally mounted in one end of the cylinder, a rod carried by the arm, said rod extended along, spaced from and parallel to the surface of the cylinder, wheels positioned to correspond with the coils, mounted on and rotatable on said

rod, said wheels positioned to contact the conductors of the pairs, respectively, providing traveling bridges for connecting the conductors at varying distances from the terminals of the coils.

ROLAND D. REED.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
916,541	Eastham	Mar. 30, 1909
1,911,980	Vance	Mar. 30, 1933
2,051,520	Evans	Aug. 18, 1936
2,126,541	DeForest	Aug. 9, 1938
2,238,420	Johnson	Apr. 15, 1941
2,260,877	Ware	Oct. 28, 1941
2,295,348	Leach	Sept. 8, 1942
2,367,922	Bock	Jan. 23, 1945
2,405,890	Kunz	Aug. 13, 1946
2,471,777	Reinartz	May 31, 1949