May 12, 1942. L. E. GAVITT 2,282,759

ANTENNA LOOP

Filed Aug. 3, 1940 2 Sheets-Sheet 1

Fig. 1.

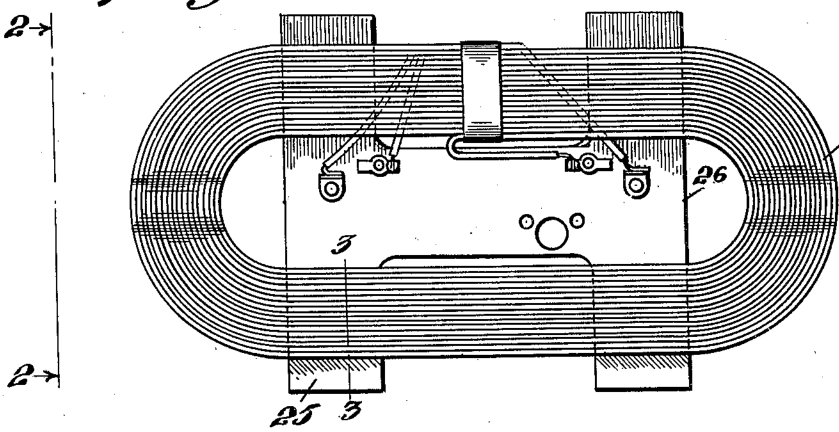

Fig. 2.

Fig. 3.

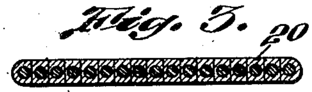

Fig. 4.

Fig. 5.

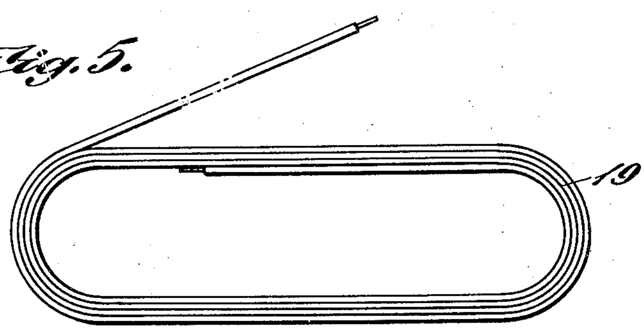

Fig. 6.

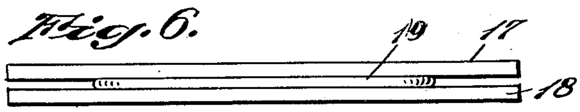

Fig. 8.

Fig. 7.

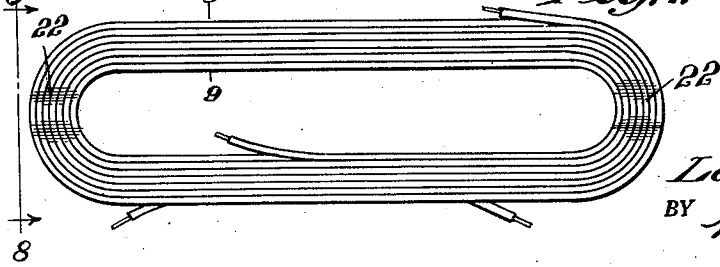

Fig. 9.

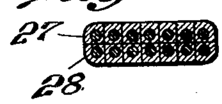

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Fig. 10.

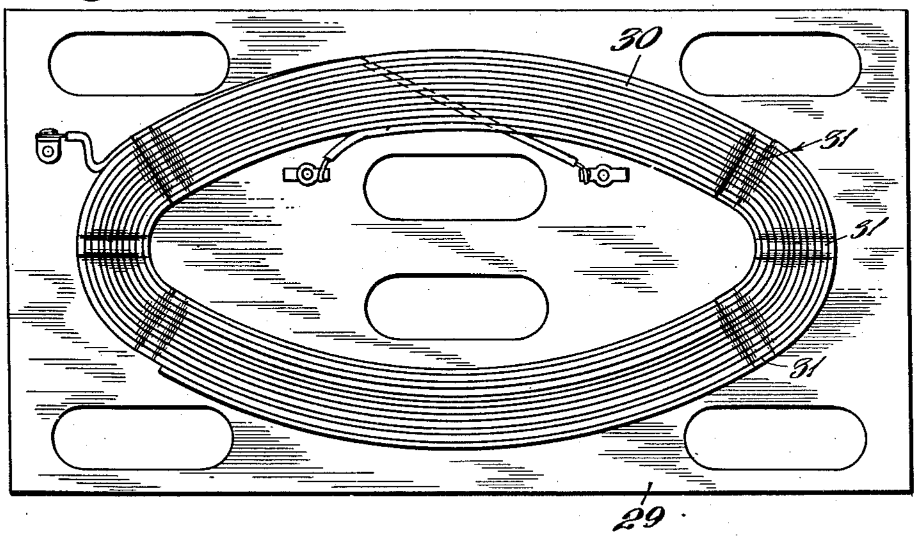


Fig. 11.

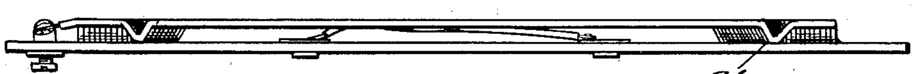


Fig. 12.

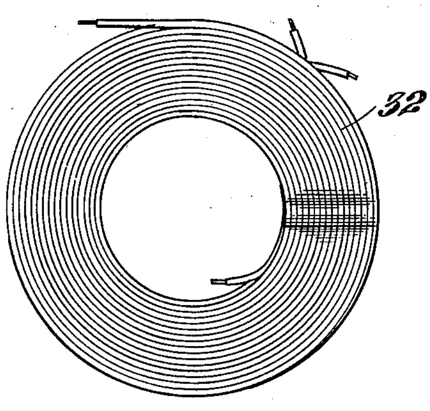


Fig. 13.

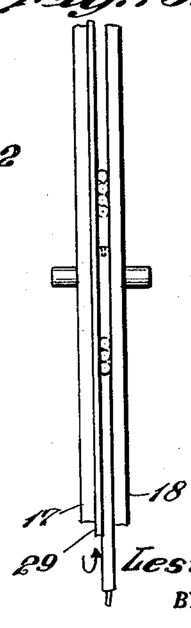
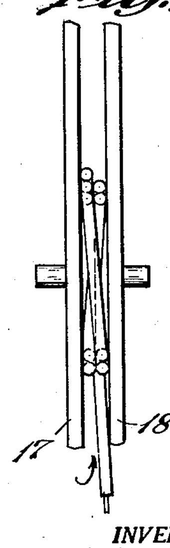


Fig. 14.



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UNITED STATES PATENT OFFICE

2,282,759

ANTENNA LOOP

Lester E. Gavitt, West Brookfield, Mass., assignor to Gavitt Manufacturing Company, a corporation of Massachusetts

Application August 3, 1940, Serial No. 350,735

15 Claims. (Cl. 250—33)

This invention relates to an antenna loop of the type used for radio reception and has for one of its objects to provide a loop in which there is considerable freedom to provide the shape or design of loop which may be desired and yet obtain the advantages herein provided.

Another object of the invention is to provide a loop which will have low loss insulation in its physical design.

Another object of the invention is to provide a loop having a high efficiency or Q.

Another object of the invention is to provide a loop which will have a low distributed capacity and yet obtain good electrical characteristics.

Another object of the invention is to provide the mounting of the loop in such a manner that the efficiency is maintained.

Another object of the invention is the method of producing the loop and adjusting the inductance of the same.

A further object of the invention is a method of treating a loop so as to cause the same to be more nearly permanent in its characteristics notwithstanding adverse weather conditions.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings:

Fig. 1 is a top plan view of a coil or loop mounted on a support in accordance with this invention;

Fig. 2 is an end view on line **2—2** of Fig. 1;

Fig. 3 is a section on line **3—3** of Fig. 1;

Fig. 4 is a broken view in elevation or plan showing a length of wire utilized;

Fig. 5 is a plan view of a loop of wire wound in generally spiral character;

Fig. 6 illustrates the plates between which the wire is wound;

Fig. 7 is a top plan view of a coil in modified form embodying the so-called bank winding;

Fig. 8 is an end view on line **8—8** of Fig. 7;

Fig. 9 is a section on line **9—9** of Fig. 7;

Fig. 10 is a top plan view of a modified form of the coil;

Fig. 11 is an edge view thereof;

Fig. 12 is a still different modified shape of coil;

Fig. 13 is an edge view illustrating the plates between which the single layer coil is wound with a support therefor;

Fig. 14 is a view of the plates between which a bank form coil is wound.

In the manufacture of antenna loops, the manufacturer is given certain specifications for the manufacture of a loop which includes the design or shape of the loop, the inductance in microhenrys, etc. It is desirable that the Q or efficiency rating be high and that the coil be as permanent as possible in the qualities of the same after adjustment and completion of the same. Several factors enter into the inductance and the distributed capacity; several variables must be taken into consideration in the preparation of the coil of the proper distributed capacity, such as, for instance, the dielectric constant of the coil insulator used, the space between the conductors, the size of the conductors and the portion of the coil mounting which comes within the field of its activity. It is desirable that the distributed capacity be low so that high-frequency tuning may be had. It is also desirable that the efficiency be high in order that greater ranges for the radio-receiving apparatus may be had. Certain of the variable factors which enter into a coil of this character have been materially improved that these desired results may be improved. It is desirable that the leads from the coil be located in certain locations; and heretofore, in order that the inductance might be adjusted, these leads had to be rearranged in a manner which was rather unstable for the accomplishment of this result. In order that the leads may not be disturbed, I have provided for deflecting the coil to reduce its effective area whereby its inductance may be changed sufficiently so that the amount of deflection will provide for the desired adjustment of the coil as to its inductance. This provides a quicker, easier and more permanent inductance adjustment than heretofore. Other of the variable elements have also been improved such, for instance, as the impregnation of the coil with a wax having certain properties which will maintain the Q factor higher after certain treatments have been performed which are ordinarily detrimental to a coil of this character; and the following is a more detailed description of the present embodiment of this invention, illustrating the preferred means by which these advantageous results may be accomplished:

With reference to the drawings, **15** designates a metallic wire which has provided thereon a suitable extruded type of insulating material **16** which may be either a plastic, synthetic plastic, rubber, or rubber substitute of good insulating properties which heretofore have been found acceptable in coils of this character. The covered wire is passed through a suitable solvent for this covering or through a cement which, in the case of unvulcanized rubber, may be naphtha or any rubber solvent, or, in the case of vulcanized rubber, may be pure rubber plus naphtha or any binder, or may be a lacquer where an adhesive rather than a solvent is to be used either on the vulcanized or unvulcanized rubber.

The coil is then formed from such covered wire by being built up between a pair of plates **17, 18** (see Fig. 6) by spirally winding the coil about a suitable core or arbor so that one layer will be superimposed on the other in a generally spiral manner, this coil being generally designated **19** in this figure. The solvent or adhesive for the coating **16** serves to cause the layers of the coil to adhere one to the other so that when removed from between the plates **17** and **18**, the coil will set in this wound relation. The plates **17** and **18** are of such suitable material as will not unduly cause an accumulation of the adhesive or solvent on them and will be generally plain, flat surfaces of a material which will maintain these plates in this flat surface formation. The winding will of course take place while the covering is tacky or soft. The covering, in the first place, will be generally round, but, when wound under sufficient pressure by reason of tension on the wire, the softened covering will be deformed into substantially a square in cross section, as shown at **20** in Fig. 3.

After the coil is thus formed and taken from between the plates, in cases where unvulcanized rubber is used there will be a vulcanizing operation performed; although where the wire has been vulcanized before commencing the winding operation, no vulcanizing operation will be performed, but in this case there may be optionally provided an additional binding by reason of paint, varnish or lacquer being spread over the surface to assist in causing the layers or windings of the coil to adhere one to the other.

The leads from the coil will be substantially positioned as they are to be located in the finished product, and the coil will then be subjected to a crimping operation which will cause the crimps or bent-out portions **21** (see Fig. 2) or **22** (see Fig. 8) to be placed in the coil at certain desired locations, and thus the inductance of the coil will be changed. I have found that at the locations of the sharpest bend in the area of the coil, such, for instance, as at the ends of the elliptical shape, is the location where the crimping will be most effective to change the inductance. The greater the crimping, the more the coil is reduced in its effective area, which will be that of the path of the combined layers. The area will be reduced as the depth of the crimp is increased, and as the area is reduced, the inductance of the coil will be reduced. It is found that the change of the inductance in this manner can be controlled within one-tenth of one per cent of the total inductance of the coil, and a very close tolerance may be maintained.

After there has been a preliminary setting of the inductance, this coil is mounted upon a board **25** by cementing the same thereto. The particular shape of this board is of importance. I have found that the less area of support within the desired field which crosses the coil, the less loss, and higher Q will be provided. Thus, I utilize the generally H-shaped support **25**, as shown in Fig. 1. It is also highly desirable that the ends **23** of the coil where the sharpest bends occur be free from the influence of the mounting board, and thus the H provided extends only to the location **26**, as shown in Fig. 1, leaving the ends, which are more critical, free from the influence of the mounting.

To further improve the permanence of the coil so mounted, I impregnate the coil and also the board upon which it is mounted in a wax which will prevent moisture from entering between the layers of the coil or the covering of the coil and also will prevent moisture from entering the board or mounting which is perhaps of even more importance, and I find that when a cerease wax or a petrolatum type of wax which has a microcrystalline structure and a melting point of 155° F. is used for this purpose the loss of efficiency or Q of the coil will be less than 10 per cent when the coil is subjected for 48 hours to a humidity of 90 per cent in a temperature of 72° F. and 1400 kilocycles frequency is passed through the coil for testing the same. After the coil is mounted upon the board and the leads fixed in place, it is again subjected to a further operation of crimping so that the adjustment may be even closer to that desired in the finished article.

Certain variations of the coil above described may exist. A bank type wound coil may be provided by winding two or more layers side by side, as shown at **27** and **28** in Fig. 9 and as illustrated in Fig. 7, the operation being as illustrated in Fig. 14, between plates spaced wider apart than those illustrated in Fig. 6.

It will also be apparent that a different sort of board such as **29** may be provided, as illustrated in Fig. 10, and when utilizing a board such as shown at **29**, the coil is generally designated **30** and is provided with a plurality of crimps **31** at different locations adjacent the end which are further illustrated in Fig. 11. These crimps serve to space the coil from the board and provide a better Q than were the board more closely in contact with the coil.

In other instances, a coil is shown perfectly circular, as at **32**, the same being bank wound or provided with two layers, as shown in Fig. 14. If it is necessary to obtain a variation of the capacity of a single wound coil, this may be done by using a bank wound, or the size of the coil may be reduced where a reduction of capacity in the coil is desirable.

In some instances, the mounting board may be pretreated with some sort of surfacing which will soften upon use of a solvent so as to adhere to a winding, and in such cases the board designated **29** may be placed between the plates **17** and **18**, as illustrated in Fig. 13, so that the winding between the plates will contact the board as wound and upon allowing the winding to be set the coil will adhere to the board and eliminate the necessity of a separate assembly of the coil on the board. In this instance, however, the adjustment by crimping cannot be done, and an adjustment by the arrangement of the lead from the coil to adjust the inductance will have to be resorted to.

I claim:

1. The method of adjusting the inductance of a wire coil of the flat generally spirally wound type which consists in crimping the coil across a plurality of turns thereof in an axial direction, to an extent to obtain the desired resultant inductance of the coil.

2. The method of adjusting the inductance of a pancake generally spirally wound wire coil which consists in crimping the coil across a plurality of turns thereof in an axial direction, to

an extent to obtain the desired resultant inductance of the coil.

3. The method of adjusting the inductance of an elliptical pancake wire coil which consists in crimping the coil across a plurality of turns thereof at the location of sharpest bend in an axial direction, to an extent to obtain the desired resultant inductance of the coil.

4. The method of adjusting the inductance of a wire coil of the flat generally spirally wound type which consists in crimping the coil across a plurality of turns thereof at a plurality of locations in an axial direction, to an extent to obtain the desired resultant inductance of the coil.

5. The method of adjusting the inductance of a pancake generally spirally wound wire coil which consists in crimping the coil across a plurality of turns thereof at a plurality of locations in an axial direction, to an extent to obtain the desired resultant inductance of the coil.

6. The method of adjusting the inductance of an elliptical pancake wire coil which consists in crimping the coil across a plurality of turns thereof at the locations of sharpest bend in an axial direction, to an extent to obtain the desired resultant inductance of the coil.

7. A pancake wound antenna loop generally in a single plane and having a crimped portion extending generally radial to an axis of generation and protruding from said plane in an axial direction of the coil to vary its inductance by bringing portions of the coil extending at right angles to the direction of the crimp closer together.

8. A pancake generally spirally wound antenna loop consisting of a round wire having a covering of generally square cross-sectional area whereby one coil is better supported by its adjacent coil.

9. A pancake wound antenna loop consisting of a round wire having a covering of generally square cross-sectional area and adhering to the next coil whereby one coil is better supported by its adjacent coil.

10. A pancake coil having some portions disposed in a turn about shorter radius than other portions and mounted on a plate support parallel to the plane of the coil and extending across the same at locations to leave the portions of shortest turning radius unsupported and exposed.

11. A pancake coil having some portions disposed in a turn about shorter radius than other portions and mounted on an H-shaped support crossing the active field of the coil at four points and leaving the portions of greatest turning of the coil exposed.

12. The method of winding a coreless antenna loop comprising treating the wire to cause the covering to be adhesive and then spirally winding the wire between plates in contact one turn with the next to cause adherence thereof, and then removing said plates to leave said loop self supporting.

13. The method of winding a coreless antenna loop from covered wire by treating the wire to soften the covering and then winding the wire between flat plates in contact one turn with the next to cause adherence thereof, said winding occurring between plates spaced to provide a pancake coil of the desired thickness.

14. The method of winding a coreless antenna loop from covered wire by applying adhesive to the wire covering and then spirally winding the wire between flat plates in contact one turn with the next to cause adherence thereof and then removing said plates to leave said loop self supporting and thereafter impregnating the coil with wax.

15. The method of winding a coreless antenna loop from covered wire by treating the wire to soften the covering and then winding the wire between flat plates in contact one turn with the next to cause adherence thereof and thereafter mounting the coil on a support.

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