Dec. 6, 1938. H. J. CRAYMER 2,139,443

VARIABLE INDUCTANCE

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Fig. 1

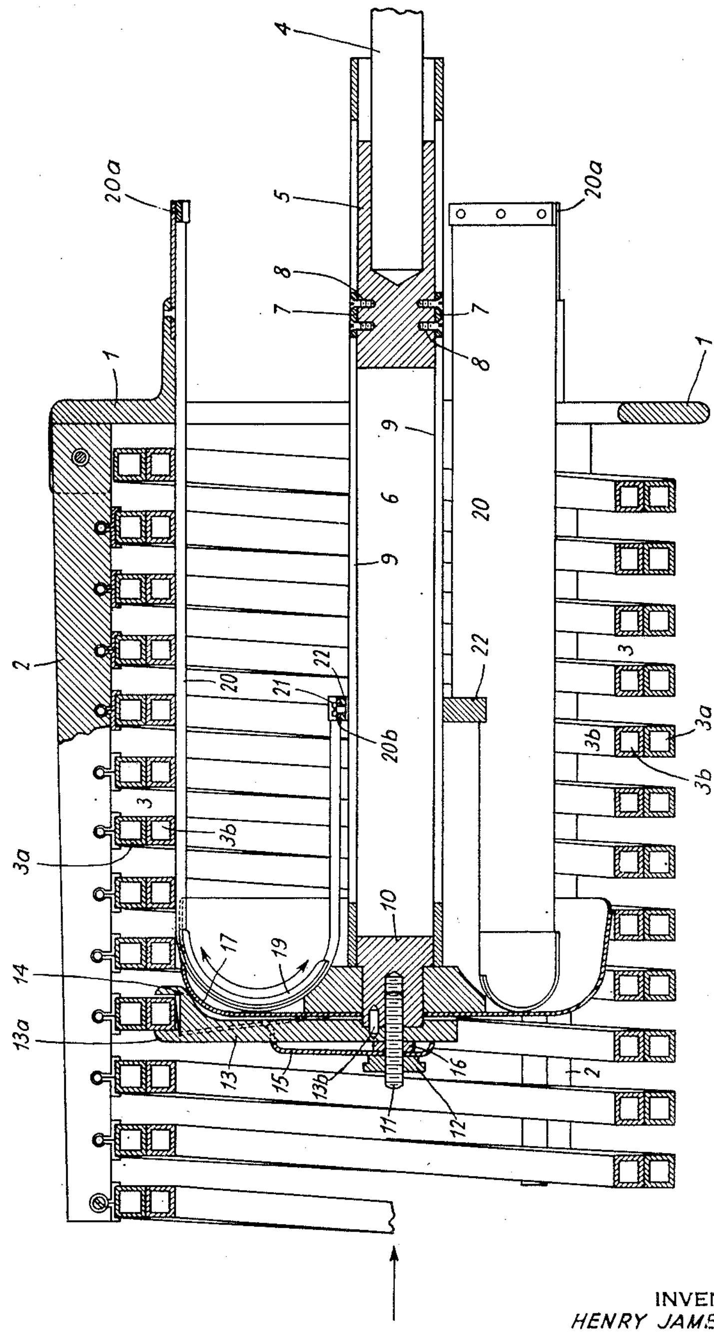

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Fig. 2

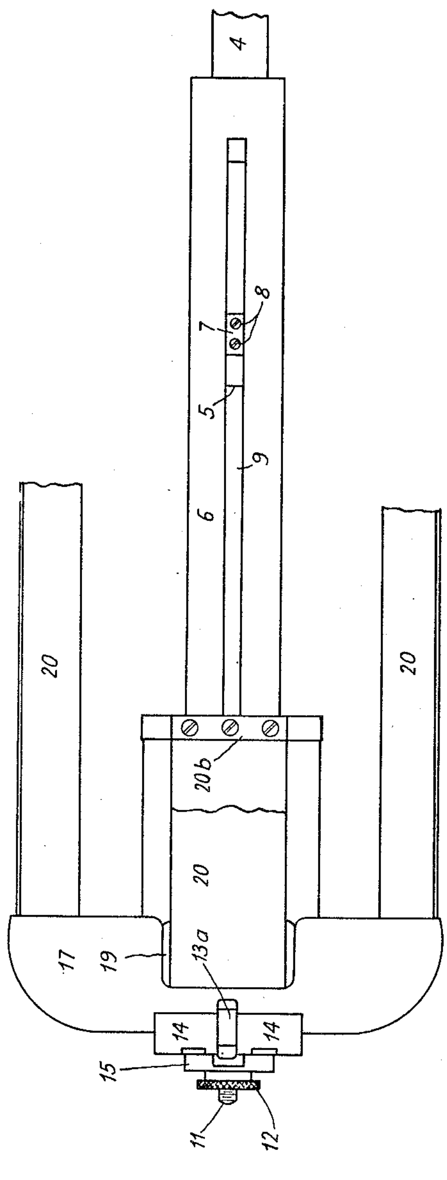

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Fig. 3

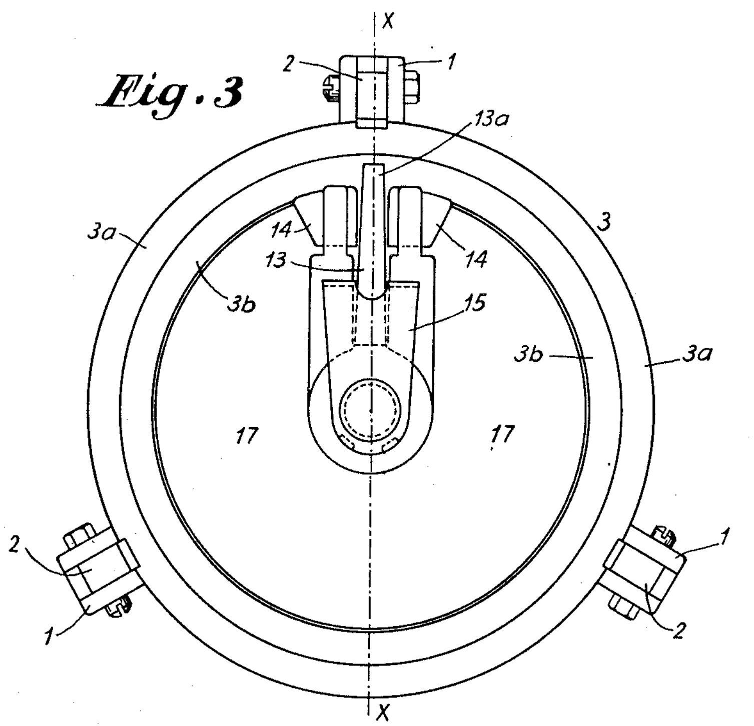
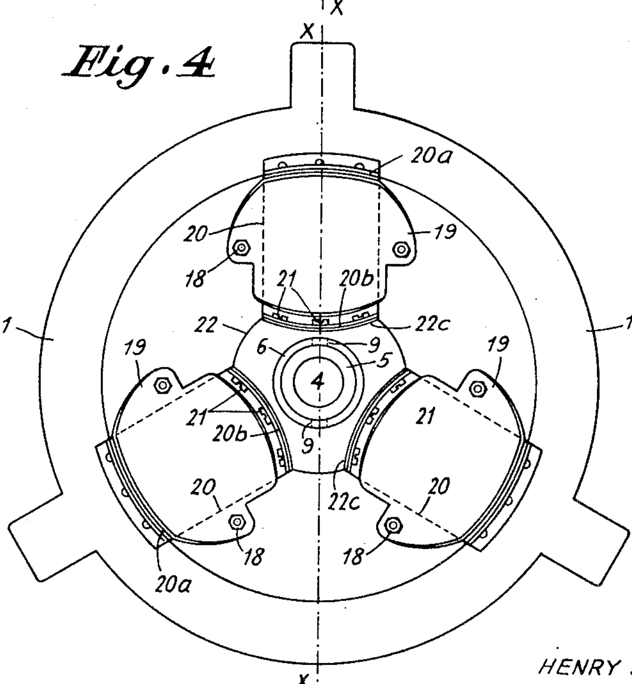


Fig. 4



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UNITED STATES PATENT OFFICE

2,139,443

VARIABLE INDUCTANCE

Henry James Craymer, Chelmsford, England, assignor to Radio Corporation of America, a corporation of Delaware

Application April 25, 1936, Serial No. 76,365
In Great Britain May 11, 1935

6 Claims. (Cl. 171—242)

This invention relates to variable inductances and though not limited to its application thereto, may be advantageously employed to provide variable inductances suitable for use (for example as anode tuning coils) in thermionic valve wireless transmitters operable over short wave length ranges, e. g. over a range extending from about 13 to 100 meters.

According to this invention a variable inductance comprises a coil of fixed spaced turns and variable contact is made to said coil by contact means which engage said coil and move with or form part of a rotatable longitudinally movable arm arranged within said coil, said arm being rotatable with respect to and arranged to move longitudinally with a carrier member having a bearing therefor, said carrier member being in turn in part carried by a plurality of strip springs bent back upon themselves and attached each at one end to a fixed part of the coil structure said springs passing through guides in or attached to said carrier member and having their other ends attached to a member which can slide longitudinally with respect to a guide coaxially arranged within the coil.

Preferably, the guide coaxially arranged within the coil is a coaxial shaft provided for rotating the arm and carrying the said arm radially at its end and preferably also the carrier member is a pan-like conductive member and the springs are arranged to short-circuit those turns of the coil at any time between said carrier member and the fixed ends of the springs.

The invention is illustrated in the drawings accompanying the specification which drawings show one form of water cooled continuously variable inductance in accordance with the said invention. In the drawings, Fig. 1 is a sectional elevation taken on the line X—X of Figs. 3 and 4, Fig. 2 is a plan taken at right angles to Fig. 1, but with the coil and its framework omitted, Fig. 3 is an end elevation viewed from the left of Fig. 1, and Fig. 4 is an end elevation viewed from the right of Fig. 1.

Referring now in detail to the drawings, the structure therein shown consists of a framework 1 to which are rigidly attached by means of insulating strips 2 the turns of a helical coil 3 which is formed of two hollow square sectioned conductors 3*a* 3*b* through which cooling water is passed e. g. to the anode water jacket of a valve (not shown) in whose anode circuit the coil is connected, the water going to the jacket through one conductor and returning therefrom through the other. The inductance is varied by rotating a handle (not shown) which is attached to a shaft 4 which runs in a bearing (not shown)—for example a bearing in a panel—so that it cannot move longitudinally. The shaft 4 is fixed to a plug 5 which is a sliding fit in a tubular shaft 6 and relative rotary movement between the parts 5 and 6 is prevented by means of keys 7 screwed by screws 8 to the plug 5 and projecting up into slots 9 in the tubular shaft 6. At the other end of the shaft 6 is a plug 10 to which is attached by means of a stud 11 and nut 12 a radial arm 13 formed with a claw end 13*a* to engage the coil 3. A pin 13*b* compels the arm 13 to rotate with the tubular shaft 6. Contact brushes 14 of silver or coppered carbon make contact with the coil 3, these brushes moving with the arm 13 and being held up against it by a spring 15 clamped between the nut 12 and a distance piece 16. Rotatably mounted with respect to the plug 10 and shaft 6, but fixed longitudinally with respect thereto is a copper pan-shaped member 17 to which are attached by means of nuts and bolts 18 three guide members 19 arranged at 120°. Through the guide spaces left between these guide members 19 and the pan 17 are passed three approximately flat (slightly arcuate transversely) strip springs 20 each fixed at one end 20*a* to the end of the coil framework and each fixed at the other end 20*b* by means of screws 21 to a spider 22 which embraces the tubular shaft 6 and is formed with arcuate faces 22*c* to receive the spring ends.

In operation, when the shaft 4 is rotated the arm 13 also rotates and due to its engagement with the coil 3 imparts longitudinal movement (relative to the coil 3 and to the shaft 4) to the pan 17, guides 19, shaft 6 and other parts longitudinally fixed thereto. Accordingly, relative movement of the springs 20 to the guide spaces between the parts 17 and 19 takes place as indicated by the double headed arrow in Fig. 1, the spider 22 also moving longitudinally with relation to the shaft 6.

It will be seen that with this construction the springs 20 automatically provide ample contact area to short-circuit the idle part of the coil—i. e. the part between the brushes 14 and the end where the fixed ends (20*a*) of the springs are attached while it is a simple matter to ensure that the said springs short out the individual turns in the idle length of coil and thus prevent the building up of standing waves therein. Further, the pan 17 assists in preventing the building up of such standing waves since it acts as a screen between the active and idle portions of the coil. Another advantage of the pan 17 is that, as the inductance of the coil is decreased the rate of decrease of inductance per unit angular movement of shaft 4 is (assuming a uniform helical coil 3) accelerated by reason of the increased short circuiting effect provided by the said pan. In practice, this is a valuable advantage since it means that, as the inductance is decreased, the effective inductance per turn is decreased—i. e. the number of turns in proportion to inductance is increased—and this facilitates magnetic coupling of the coil to a load when the coil is adjusted for shorter wave lengths (i. e. reduced inductance). Coupling to a load may conveniently be effected by inserting a coil (not shown) concentrically and coaxially as indicated by the single headed arrow in Fig. 1 inside the coil 3.

It is not necessary that the coil 3 be a uniform helix and in order to satisfy voltage flash-over requirements, the pitch of the coil 3 may be progressively increased towards the end remote from the shaft 4. Again, the coil 3 need not be built of square sectioned conductors for obviously other sections of conductor can be employed e. g. circular.

What is claimed is:

1. A variable inductance comprising a coil of fixed spaced turns, variable contact being made to said coil by contact means which engage said coil to move with and form part of a rotatable longitudinally movable arm arranged within said coil, a carrier member located within said coil, said arm being rotatable with respect to and arranged to move longitudinally with said carrier member, a plurality of strip springs within said coil, said carrier member being in turn in part carried by said strip springs bent back upon themselves and attached each at one end to a fixed part of the coil structure said springs passing through guides in said carrier member and having their other ends attached to a member which can slide longitudinally with respect to a guide coaxially arranged within the coil.

2. An inductance as claimed in claim 1 and wherein the guide coaxially arranged within the coil comprises a shaft arranged for rotating the arm and carrying said arm radially at its end.

3. An inductance as claimed in claim 1 and wherein the carrier member comprises a pan-like conductive member having springs arranged to short-circuit those turns of the coil at any time between said carrier member and the fixed ends of the springs.

4. A variable inductance coil of fixed spaced turns formed of two hollow metallic conductors placed adjacent each other, one of said conductors serving as an inlet and the other conductor as an outlet for a cooling fluid, a variable contact having engaging means to move with and form part of a rotatable longitudinal arm arranged with said coil, a carrier member located within said coil, and a plurality of spring strips attached to said movable arm to short-circuit those turns of the coil at any time between said carrier member and one end of said inductance coil.

5. A variable inductance coil comprising a coil of fixed spaced turns, a variable contact for said coil having contact means to engage said coil and form a part of a rotatable arm arranged within said coil, a plurality of spring strips attached to said movable arm to short-circuit the unused turns of the coil between the arm and one end of said coil, and a shield member secured to and moving with said arm.

6. A variable inductance coil comprising a coil of fixed spaced turns formed of two hollow metallic conductors spaced adjacent each other, one of said conductors serving as an inlet and the other conductor serving as an outlet for a cooling fluid, a variable contact for said coil having contact means to engage said coil and form part of a rotatable arm arranged within said coil, a conductive shield member secured to and moving with said arm, and a plurality of metallic strips in sliding engagement with said shield member to short circuit the unused turns of the coil between the arm and one end of said coil.

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