July 13, 1926. 1,592,554

A. A. BURNS

NEUTRALIZING CONDENSER

Filed Oct. 4. 1924

Fig. 1.

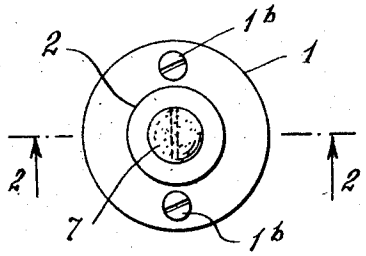
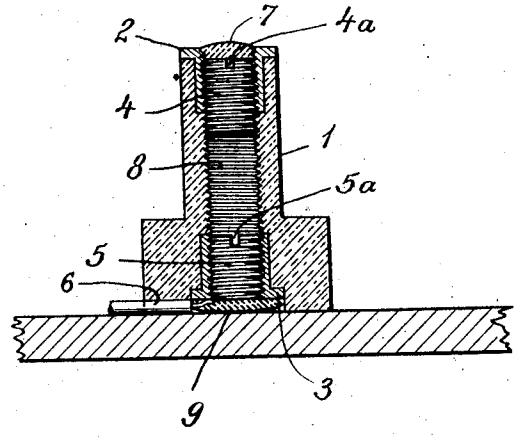


Fig. 2.



INVENTOR
Alfred A. Burns
BY
Pennie, Davis, Marvin & Edmonds
ATTORNEYS.

Patented July 13, 1926. 1,592,554

UNITED STATES PATENT OFFICE.

ALFRED AGUSTIN BURNS, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO GAROD CORPORATION, OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

NEUTRALIZING CONDENSER.

Application filed October 4, 1924. Serial No. 741,563.

This invention has to do with variable electrostatic condensers and more especially balancing or neutralizing condensers adapted for use in radio apparatus, such as amplifiers.

The invention has among its objects, first, to provide a mechanically rigid and stable neutralizing condenser. That is to say, one in which the capacity can be depended upon to remain fixed at any value within its range to which it may be adjusted—notwithstanding the severe mechanical disturbances to which it may be subjected in transportation.

Another object of almost equal importance is to provide a neutralizing condenser which can be easily adjusted—with an exceedingly high degree of accuracy—to the desired value of capacitance. This is essential to proper neutralization of capacity coupling in radio frequency amplifiers and the like and particularly so when the efficiency of the associated apparatus and circuits is high. The reason for this is that the tendency to oscillate due to inherent capacity coupling between the elements of the vacuum tubes increases with every increase of over-all efficiency. And when this efficiency is particularly high neutralization is exceedingly critical.

Another factor of importance in neutralizing condensers is leakage losses. While it is desirable that these losses be low, it is more important that they be constant. A small loss by reason of leakage in a neutralizing condenser can be compensated for and is not likely to be noticeable. But inconstant leakage is another matter for, if the variation is sufficient, these losses will upset the balance. It is, therefore, another one of the primary objects of this invention to provide a neutralizing condenser in which the leakage losses are not only low but substantially constant.

The proper balancing of a neutralized radio frequency receiving apparatus requires expert knowledge and it is therefore desirable to take whatever measures may be available to discourage inexperienced persons from tampering with the adjustments. Therefore, another object of the invention is to provide means for guarding against tampering with the adjustments of the neutralizing condensers.

A further object is to provide a condenser of the kind specified which in addition to meeting all the other objects previously mentioned is economical to manufacture.

The condenser structure representing the preferred embodiment of the invention described in detail hereinafter and illustrated in the accompanying drawing meets all the objects above enumerated as will be presently pointed out. This condenser structure comprises a body portion of insulating material—preferably a porcelain-like material known as sillimanite which is mechanically very strong and durable and of high quality with respect to resistance characteristics. The body portion is of tubular formation and is preferably glazed on its exterior surface to prevent absorption of moisture which would tend to change the leakage losses.

A pair of metal screw threaded plugs are inserted in opposite ends of the tubular body portion and these form the condenser electrodes. The plugs are separated by whatever distance is necessary in order to obtain the desired electrostatic capacity between them.

At least one, and preferably both electrode plugs, are provided with a relatively fine screw thread which engages—with a nice fit—a corresponding thread at each end of the body. The plugs, projecting into the tubular body portion, form therewith an enclosed chamber which, after final adjustment of the condenser, is hermetically sealed—thereby preventing intrusion of moisture and resultant changes of leakage losses.

Although it is not strictly essential to the invention, threaded metal bushings are provided for the screw plugs. These bushings are secured to the opposite ends of the body and seated in recesses provided for them therein. The bushings provide convenient means for making external electrical connections to the plugs without in any way interfering with the necessary adjustments.

After final adjustments of the screw plugs to the required capacitance they are sealed with sealing wax or other suitable sealing material and a distinctive mark such as the manufacturer's trade mark or other symbol is impressed on the seals. These marks are preferably chosen so that they cannot be easily reproduced by others than the condenser or radio apparatus manufacturer and they, accordingly, provide a certain tell-tale

indication of any attempt to tamper with the neutralizing condenser adjustment.

In the drawing Fig. 1 is a plan view and Fig. 2 is a longitudinal cross section taken along the line 2—2 of Fig. 1 of a neutralizing condenser in accordance with this invention and representing the preferred form thereof. This structure comprises a tubular body portion 1 of insulating material such as sillimanite in the opposite ends of which are seated and secured metal bushings 2 and 3 which are internally threaded to receive metal plugs 4 and 5 respectively which form the electrodes of the condenser. These plugs are provided with screw driver slots at 4^a and 5^a. If the body portion 1 is made of an insulation material, such as sillimanite, capable of being machined it is internally threaded as illustrated. The internal thread in the body portion forms a continuation of the internal thread in the bushings 2 and 3. This thread is preferably of fine gauge, for example 32 per inch.

External circuit connections are made to the bushings 2 and 3. A connecting wire 6 is shown connected to bushing 3 and a similar connection would be made to bushing 2. The condenser is adjusted to the proper capacity by first removing the plug 4 and adjusting the plug 5 by rotating it with a screw driver to such position that when the final adjustment of plug 4 is made the top surface of the latter will come below the top surface of bushing 2. The adjustment of plug 4 is made after the condenser has been connected in circuit.

It is desirable that the chamber 8 formed by the body portion 1 and plugs 4 and 5 be hermetically sealed and that the conductivity of the body 1 be maintained constant in order that the leakage losses may be substantially invariable. To these ends the exterior surface of the body 1 is preferably glazed and thereby rendered impervious to moisture and the plugs are sealed with sealing wax or other suitable material as indicated at 7 and 9. These seals are provided not only for maintaining an hermetic seal for the chamber 8 but they serve the added purpose of discouraging any tampering with the adjustment of the condenser, on the part of the user of the apparatus. A suitable symbol, such as the trade mark of the radio apparatus manufacturer, may be impressed on the seals 7 and 9.

Radio apparatus is usually sold with a guarantee which is conditional upon the apparatus not being tampered with by the purchaser, but unless some special provision is made for indicating that the apparatus has been tampered with, there is no way for the manufacturer to insure, beyond a reasonable doubt, that the conditions of his guarantee have been complied with.

In so far as the manufacturers of radio apparatus incorporating neutralizing condensers are concerned, one of the chief causes for apparatus being returned, as unsatisfactory, has been that the neutralizing condensers have gotten out of adjustment either because of their own fraility or because they have been tampered with. The condenser structure herein described is so rigid and substantial that there is practically no possibility of its getting out of adjustment due to mechanical vibration and, by reason of the seals provided, it is practically impossible for the user of the apparatus to tamper with the adjustments of the neutralizing condensers without detection.

Usually this condenser may be most conveniently mounted in a vertical position. Such an arrangement is generally best adapted for conservation of space and facilitates making the final adjustments. For this reason the body portion 1 is enlarged at the lower end to form a base and holes are provided in the base for mounting screws 1^b.

Bushings 2 and 3 are not strictly essential but they are convenient for making external electrical connection thus avoiding the necessity of making connections directly on the plugs 4 and 5. Direct connections to the plugs would necessarily interfere somewhat with the operation of adjusting the condenser.

It is obvious that the design of the neutralizing condenser herein described may be considerably modified without departing from the spirit and scope of the invention.

I claim:

1. A neutralizing condenser comprising a tubular body portion of insulating material, a pair of metal plugs inserted in opposite ends of said body portion, screw thread means for effecting micrometric adjustments of the separation between said plugs, and a pair of internally threaded metal bushings seated in opposite ends of said body portion, said plugs each having external screw threads for engaging the internal screw threads on their respectively associated bushings, means whereby each of said plugs can be rotated and thereby moved toward and away from each other for the purpose of varying the electrostatic capacity therebetween.

2. A neutralizing condenser comprising a tubular member of insulating material, internally threaded metal bushings inserted in and secured to opposite ends of said tubular member, a pair of externally threaded metal plugs, each inserted in one of said bushings, the separation between said plugs determining at least in part the capacity of the condenser, the thread on at least one of said plugs and the cooperating thread on the corresponding one of said bushings being of such fineness that micrometric adjustment of capacitance can be readily effected.

3. An electrostatic condenser especially adapted for use as a balancing or neutralizing condenser comprising a tubular member of insulating material having an enlarged end portion adapted to serve as a base, a pair of metal bushings inserted in and secured to opposite ends of said tubular member, said bushings each having relatively fine internal screw threads, a pair of metal plugs each having an external thread adapted to engage the internal thread in one of said bushings, said plugs each being inserted in one of said bushings, at least one of said plugs being adapted to be rotated in its bushing and thereby moved micrometrically toward and away from the other of said plugs for the purpose of adjusting the electrostatic capacity therebetween; said bushings being adapted to serve as terminals for external electrical connections, and means for sealing said condenser after it has been finally adjusted so that it cannot be tampered with without disclosing the fact that it has been tampered with.

4. An electrostatic condenser comprising a tubular member of insulating material, a pair of electrodes inserted in opposite ends of said tubular member, said electrodes being out of contact one with the other, at least one of said electrodes being micrometrically adjustable toward and away from the other, means for making external electrical connections with said electrodes, said tubular member and electrodes defining a chamber and means for hermetically sealing said chamber, said sealing means comprising fusible adhesive material applied to the otherwise exposed surface of at least one of said electrodes.

In testimony whereof I affix my signature.

ALFRED AGUSTIN BURNS.