Feb. 11, 1930. W. BAECKLER 1,746,411

MEANS FOR ADJUSTING VARIABLE CONDENSERS

Filed Jan. 22, 1929

Fig. 1.

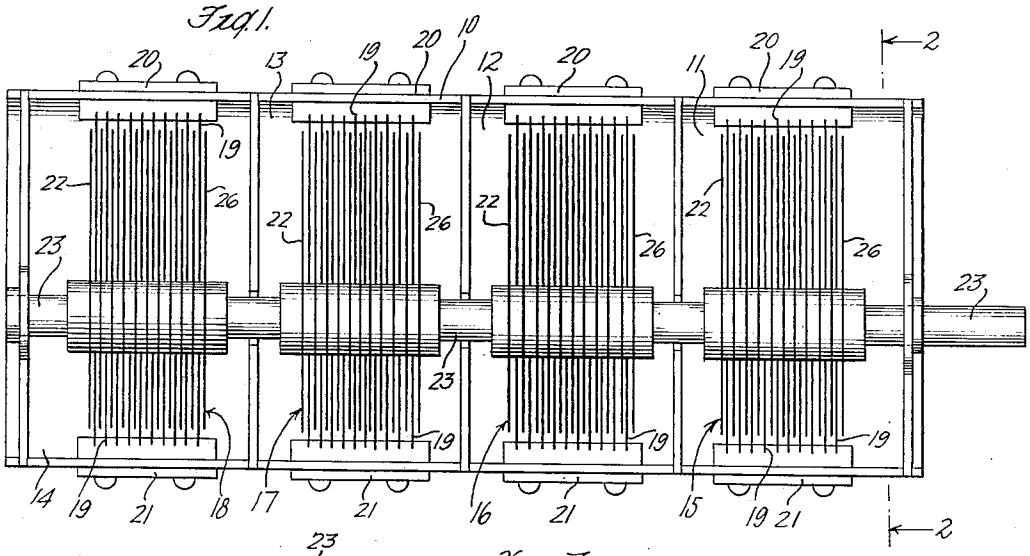


Fig. 2.

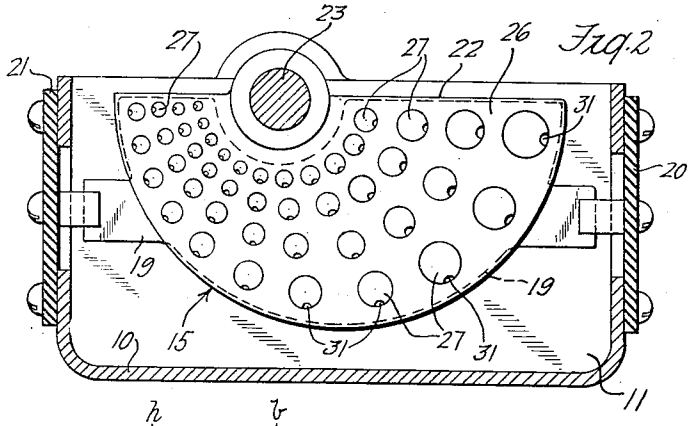


Fig. 4

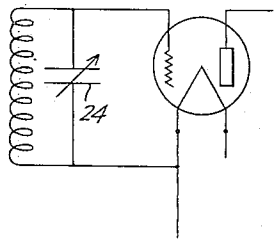


Fig. 3

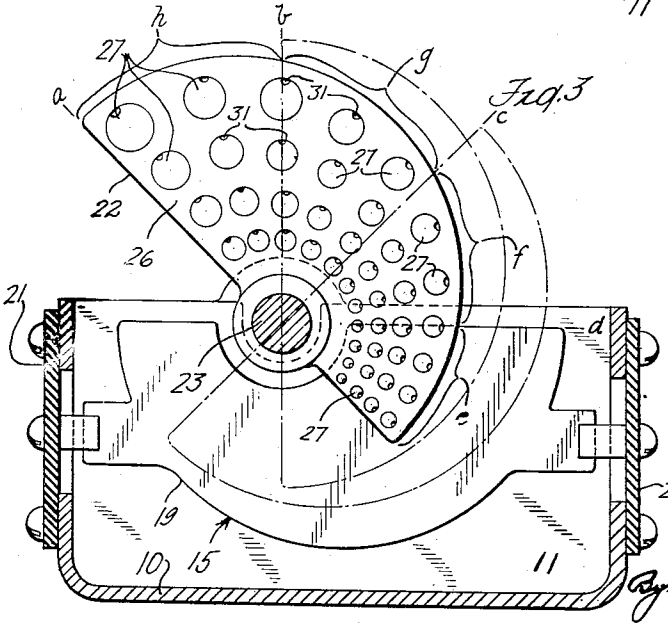


Fig. 5

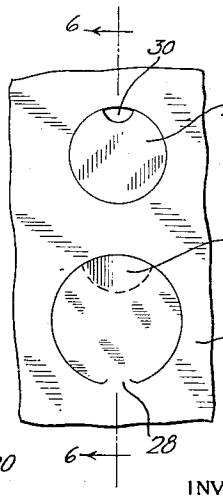
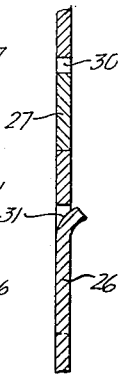


Fig. 6.



INVENTOR:
Walter Baeckler,
BY
Byrnes, Townsend & Brickenstein,
ATTORNEYS.

Patented Feb. 11, 1930 1,746,411

UNITED STATES PATENT OFFICE

WALTER BAECKLER, OF LAKEWOOD, OHIO, ASSIGNOR TO NATIONAL CARBON COMPANY INC., A CORPORATION OF NEW YORK

MEANS FOR ADJUSTING VARIABLE CONDENSERS

Application filed January 22, 1929. Serial No. 334,277.

This invention pertains to variable condensers adapted for tuning the circuits of radio receivers and more specifically to a means for matching the capacities of a gang of such condensers at various positions within their range.

In a multi-stage radio frequency amplifier, employing one variable air condenser for tuning each stage, it is common practice to mechanically connect the several condensers so the stages may be simultaneously tuned by the operation of a single condenser control. For the proper functioning of such an amplifier, it is essential that each stage be tuned to substantially the same frequency, as an amplifier is non-selective and insensitive if the frequencies to which the successive stages are tuned are not very nearly identical. To fulfill this requirement, it is essential that the several condensers in the uni-control system, or gang, have identical capacities in all positions, or, to use a term well known in the art, the condensers must track. Not only must they match at a given frequency, say 1000 kilocycles, but the rate of capacity change during the movement of the tuning control must be the same for all, so that, being matched at 1000 kilocycles, they will also be matched at 600 kilocycles, or at any other frequency within the range of the amplifier. It is very difficult to commercially manufacture such a gang of variable condensers so their capacities match throughout their range, and considerable economy is effected if wider tolerances are allowed in the manufacture and assembly, and the resulting differences eliminated by subsequent adjustment of the individual condenser units so they track with the remainder in the gang; the magnitude of these adjustments being determined solely by the deviation of the particular unit under test.

Therefore, one object of this invention is to provide a means for matching the capacities of a gang of variable condensers at various points within their range so that when they are used to tune the circuits of a radio frequency amplifier, the tuned circuits will match throughout their range. Another object is to provide a means for adjusting variable air condensers at the time of manufacture, so the capacity of each throughout its range is substantially the same as that of another condenser adopted as a standard. Other aims, objects, and novel features will be apparent from the drawing and the following description.

The objects of this invention are attained by the mechanism shown in the accompanying drawing, in which:

Fig. 1 is a plan view of a gang of condensers embodying this invention.

Fig. 2 is a transverse view along the line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is the same view as that of Fig. 2 showing the movable plates of the condenser in various adjusted positions.

Fig. 4 is a schematic diagram of a circuit adapted for being tuned by one or more of the condensers of the gang shown in Fig. 1.

Fig. 5 is an enlarged view of two forms of the partially detached portions shown at 27 in Figs. 2 and 3, and

Fig. 6 is a sectional view along the line 6—6 of Fig. 5 looking in the direction of the arrows.

The invention may be applied to a gang of condensers such as that shown in Fig. 1 comprising a frame 10 having four compartments 11, 12, 13 and 14 with one of four condensers 15, 16, 17 and 18 in each compartment. Each of the four condensers 15, 16, 17 and 18 may have a plurality of connected stator plates 19 carried by the frame 10 but insulated therefrom by the insulating supports 20 and 21, and a plurality of connected rotor plates 22 carried by a shaft 23 which in turn is held in the frame 10 by bearings in which it may rotate to move the rotor plates of all four condensers in unison. The four condensers 15, 16, 17 and 18 are constructed exactly alike in so far as it is commercially practicable.

When connected in the circuits of a radio frequency amplifier each of the condensers 15, 16, 17 and 18 may be arranged to tune the grid circuit of a vacuum tube of one of the stages by connecting each in its respective circuit in the position shown by condenser 24 in the schematic diagram of Fig. 4.

A three stage radio frequency amplifier and antenna input system, tuned by four condensers such as those shown in Fig. 1 is well known in the art and it is understood that the gang of condensers may comprise any plural number as the invention about to be described is not limited to a gang comprising the particular number shown. Furthermore, the gang of condensers may be different from that shown, as this invention may be applied to two or more variable air condensers operated in unison regardless of their arrangement.

In order to adjust the capacities of the condensers 15, 16, 17, and 18, so they match throughout their range I provide one of the end plates such as 26 of each of the condensers with partially detached portions which may be removed as required to reduce the capacity of part of the condensers in the gang to that of one or more of the others at various adjusted positions or capacities within their range.

The partially detached portions are preferably portions of the end plate that are partially punched out but left so they will remain in place during shipment and use, but may be readily removed with a suitable instrument when the condensers are adjusted. These partially detached portions may be punched out entirely and then pressed back in place where they are held by the friction of the surrounding metal as shown at 27 in Figs. 5 and 6, or they may be only partially punched out and left with a portion 28 of the metal 26 unsevered. One side of each of the partially detached portions 27 may be removed to provide an opening 30 in which the end of a pointed instrument may be inserted to pry them out of the plate 26, or one side of each of the partially detached portions 27 may be turned up to form an ear 31 under which the end of a pointed instrument may be inserted to pry them out of the plate. It is understood, of course, that these partially detached portions may be of a form different from those shown.

The partially detached portions 27 may be formed in and distributed throughout the end plate of each of the condensers in a variety of sizes, shapes, and patterns, but satisfactory results may be secured when they are arranged as shown in Figs. 2 and 3. In condensers such as those illustrated the end plates are rotor plates and the partially detached portions 27 are formed in these plates so they may be easily reached and removed, but they may be formed in any of the plates of either the rotor or stator.

The rotor 22 of the condenser in Fig. 3 is shown in four positions, *a*, *b*, *c*, and *d*. These four positions represent positions of the rotors of condensers 15, 16, 17, and 18, at which their capacities may be adjusted to identical values. These four positions are selected for the purpose of illustration as, actually, the condensers may be adjusted in more or less positions according to their accuracy and the requirements of the circuits in which they are used.

In adjusting the capacity of the condensers 15, 16, 17, and 18, so they match throughout their range, the rotors of the condensers may first be set at position *a*. In this position only the portion or area *e* of the rotor plates are meshed with the stator plates, and it is this portion *e* of the rotor plates that controls the capacity of each of the condensers. Each of the four condensers is now examined or tested by a method well known in the art to determine its relative capacity. For example we will suppose that condenser 15 is found to have a slightly higher capacity than that of the other three 16, 17, and 18, which we assume to be substantially alike at this setting. To reduce the capacity of condenser 15 to that of the others, one or more of the partially detached portions 27 in the area *e* of the end plate of condenser 15 is removed.

The rotor plates of the four condensers may then be moved to position *b*. In this position an additional portion or area *f* of the rotor plates is meshed with the stator plates. In this position the relative capacity of each of the four condensers is tested and, for example, we will suppose that the capacity of condenser 16 is found to be higher than that of the other condensers. To reduce the capacity of condenser 16 to that of the others, one or more of the partially detached portions 27 in the area *f* of the end plate of condenser 16 is removed.

The rotor plates of the four condensers may then be moved to position *c*. In this position an additional portion or area *g* of the rotor plates is meshed with the stator plates. In this position the relative capacity of each of the four condensers is tested and, for example, we will suppose that the capacity of condenser 17 is found to be higher than that of the others. To reduce the capacity of condenser 17 to that of the others, one or more of the partially detached portions 27 in the area *g* of the end plate of condenser 17 is removed.

The rotor plates of the four condensers may then be moved to position *d*. In this position an additional portion or area *h* of the rotor plates is meshed with the stator plates. In this position the relative capacity of each of the four condensers is tested and, for example, we will suppose that the capacity of condenser 18 is found to be higher than that of the others. To reduce the capacity of condenser 18 to that of the others, one or more of the partially detached portions 27 in the area *h* of the end plate of condenser 18 is removed.

When the condensers are in position *a* it is obvious that the only partially detached portions 27 that may be removed to alter their capacity are those in area *e*. When the

condensers are moved to position *b* only the partially detached portions 27 in area *f* should be removed to alter their capacity, because, if any of the portions 27 are removed from area *e* the capacity of the condensers will not match when moved back to position *a*. Likewise, when the condensers are in position *c* the partially detached portions 27 should be removed from the area *g* only, as any removed from areas *e* and *f* would spoil the match or adjustment of the condensers when their rotors were moved back to positions *a* or *b*. When adjusting the condensers it is understood, of course, that the partially detached portions 27 may be removed from one or more of the condensers at any position as required to reduce the capacity of any number of high capacity condensers to that of one or more condensers having a lower capacity, as the invention is not limited to reducing the capacity of one condenser to that of several others in the method just described for purpose of illustration.

Condensers such as those described herein may also be adjusted to match a standard condenser. This adjustment may be made during the course of manufacture, thereby economically producing more accurate condensers that may subsequently be assembled in gangs with the assurance that they will match, or track. The method of adjusting the capacity of single condensers to that of a standard condenser may be the same as the method described herein for adjusting the capacity of one condenser to that of another in the same gang.

Various alterations and adaptations may be made in the construction and arrangement of the apparatus shown and described herein without departing from the invention or sacrificing any of the rights thereunder.

I claim:

1. A variable condenser in which at least one of the plates thereof has a plurality of partially-detached portions of which certain ones may be removed to reduce the capacity of said condenser so it substantially matches that of another operated in unison therewith at various adjusted positions within the range of both.

2. A gang of variable condensers in which at least one of the plates of each condenser has a plurality of partially-detached portions of which certain ones may be removed to reduce the capacity of one or more of said condensers to substantially that of another of said condensers at various adjusted positions within the range of said condensers.

3. A gang of variable condensers in which at least one of the plates of each condenser has a plurality of partially-detached punchings of which certain ones may be removed to adjust the capacity of one or more of said condensers to that of another of said condensers at one or more positions within the range of said condensers.

4. A gang of variable condensers in which at least one of the movable plates of each condenser has a plurality of partially-detached punchings of which certain ones may be removed to adjust the capacity of one or more of said condensers to that of another of said condensers at one or more positions within the range of said condensers.

5. A variable air condenser having a plate with partially-detached portions therein of which certain ones may be removed to adjust the capacity of said condenser so it is substantially identical with that of a standard condenser throughout its range.

In testimony whereof, I affix my signature.

WALTER BAECKLER.