Jan. 28, 1941. G. L. USSELMAN 2,230,125

COMPRESSED AIR CONDENSER

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Fig. 1

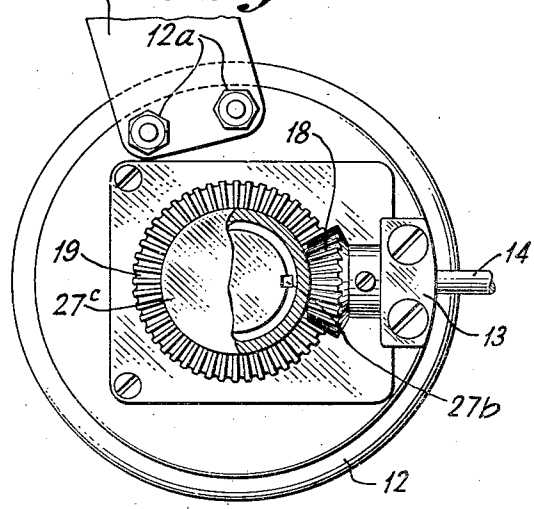
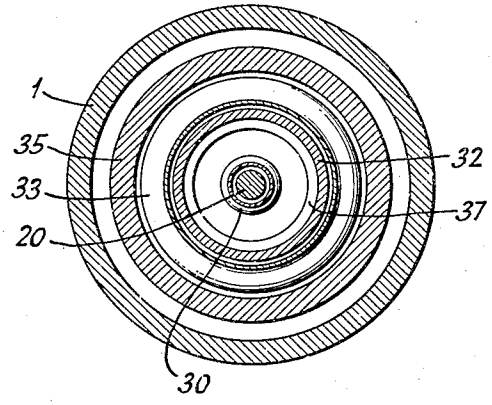


Fig. 3



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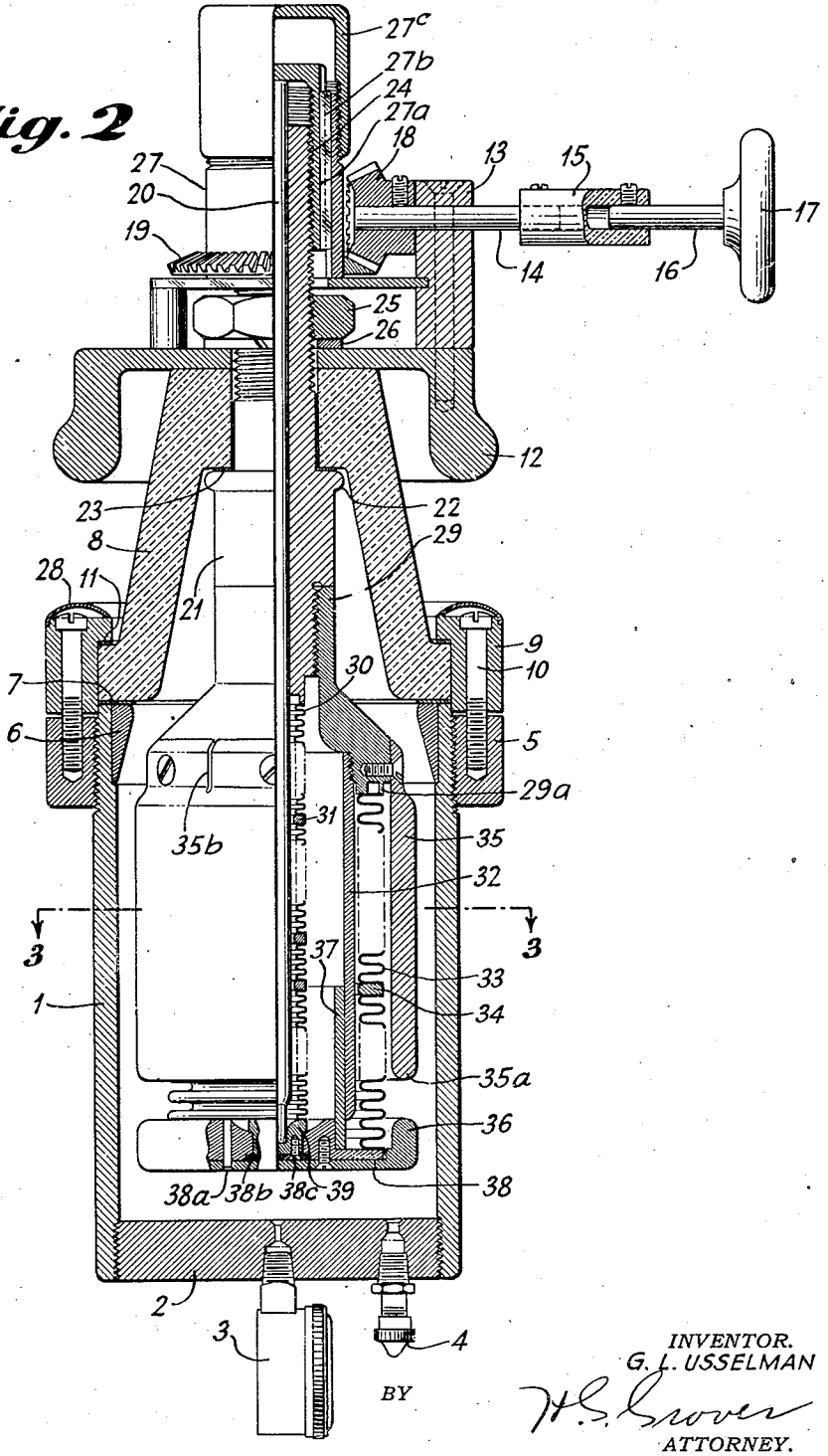
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Fig. 2



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UNITED STATES PATENT OFFICE

2,230,125

COMPRESSED AIR CONDENSER

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Application October 9, 1937, Serial No. 168,118

5 Claims. (Cl. 175—41.5)

This invention relates to improvements in electrical condensers of the compressed air type which are particularly adapted for ultra-short wave transmission.

An object of this invention is to provide further improvements in compressed air condensers of the type shown in the Hansell et al. Patent #2,192,062, issued February 27, 1940, and in my copending Appln. Ser. No. 138,111, filed April 21, 1937.

Another object of this invention is to provide an improved compressed air condenser which has associated therewith a corona shield located at the top of the central insulator.

A further object is to provide a condenser in which a portion of the corona shield is combined with terminal means.

Another object is to provide an improved condenser of the type referred to, in which electrical strains and stresses to which the insulator is subjected are materially reduced.

Still another object of this invention is to provide an improved rotatable system for changing condenser capacity, which system may be operated from any desired angle relative to the axis of the condenser.

Other objects are to provide a condenser of overall electrical efficiency and to provide a condenser easy to assemble, thereby minimizing manufacturing costs.

One of the specific features of this invention is the use of an "Invar" rod which comprises an alloy of nickel and steel or similar metallic material, which has a comparatively small heat coefficient of linear expansion for the movable central shaft. More fully, I have found that when the ordinary compressed air neutralizing condenser is used in an ultra-high frequency circuit the external parts of the condenser are maintained at a fairly constant temperature for the reason that the heat is carried away from the external casing comparatively rapidly. However, the heat generated in the inner parts due to the conduction of high frequency current cannot be conducted away as rapidly and consequently the internal parts rise in temperature, therefore, and expand. Since the external parts do not expand in proportion, there results an undesirable increase of condenser capacity. This, according to my present invention, is substantially eliminated. Furthermore, to maintain an efficient condenser circuit at the ultra-high frequencies, my condenser has been made short and broad.

Another improved feature of my compressed air neutralizing condenser is that the corona shield is arranged to be used as one of the terminal connections to the condenser. This arrangement makes it possible to have a very short path from the terminal of adjacent apparatus and the inner condenser element. Also, the gear portion of the rotatable system is mounted on the flat top portion of the corona shield.

This invention will best be understood by referring to the accompanying drawings, in which:

Fig. 1 is a plan view of the improved condenser;

Fig. 2 is an elevation partly in section of Fig. 1; and

Fig. 3 is a cross-section of Fig. 2, the section being taken on line 3—3.

Referring now in detail to the figures of the drawings, the outer electrode condenser casing 1 is composed of any good conducting metal, such as for example, silver, brass, copper, or the like, and is provided with a substantially heavy base 2 threaded and soldered air tight into part 1. The base 2 is threaded to receive an air gauge 3 and a fluid valve 4. The upper portion of casing 1 is threaded on the outside contour thereof to receive a collar 5. The inner wall of the upper portion of casing 1 is provided with a tapered shoulder ring 6 soldered to casing 1 on top of which is located a rubber gasket 7. A cone-like insulator 8 is secured to casing 1 by means of insulator clamp ring 9 and by a plurality of filister head screws 10 which are threaded into member 5. A gasket 11 is interposed between the shoulder of insulator 8 and member 9 to prevent mechanical strains which might otherwise damage the insulator.

Located on top of the high voltage insulator 8 is a disc-like member 12, the outer periphery of which is rounded over to form a corona shield. The upper portion of member 12 is made substantially flat to receive a bearing member 13 for a shaft 14 and terminal studs 12a and terminal member 12b.

Insulator 15 is interposed between shaft 14 and a shaft 16 which terminates in an operating knob 17 located preferably outside the transmitter panel (not shown). At the other end of shaft 14 there is secured a small bevel gear 18 cooperating with beveled gear 19 which is arranged to rotate a threaded inner nut 27a, which in turn pushes against push rod or shaft 20. The bearing 13 may be arranged at any angular position of member 17 with a corresponding change in gears or a universal joint. Shaft or push rod 20 is made of "Invar" or any other material having

a small thermal or heat coefficient of linear expansion.

A hollow stem 21 having a rounded over shoulder portion 22 is located within the upper portion of insulator 8. A gasket 23 prevents leakage of the air and also acts as a mechanical seat to prevent breakage of the insulator. The upper portion of stem 21 is provided with a fine thread 24 which serves the dual purpose of clamping stem 21 to the insulator by means of nut 25 and lock washer 26 and in addition carries an inner cap-like nut member 27a which is internally threaded to run on thread 24. A key 27b is interposed between a collar 27 which is secured to gear 19 and inner cap-like nut member 27a. Rotation of knob 17 raises and lowers the position of the inner nut member 27a which, in turn, allows shaft 20 to be raised or lowered within the casing 1. Due to internal compression of the compressed air, shaft 20 is always forced upward and rides in the upper portion of inner member 27a. To protect the moving parts from injury and to limit the motion of nut 27a, the upper portion of collar member 27 is threaded to receive a cap member 27c.

To prevent brushing or corona to the fillister head screws 10, there is provided a thin metallic cover 28 which is secured to member 9 by means of a pressed fit on the outside periphery.

The internal construction of compressed air condenser is generally similar to that shown in Figs. 5 and 6 of the Hansell et al. Patent #2,192,062. It is to be noted that the entire shape of the condenser has been materially altered to reduce undesired impedance at ultra-high frequencies by reducing as much as possible the physical length of the condenser and increasing the diameter wherever necessary to obtain the desired capacity. The fixed portion of the inner electrode 35 has been materially increased, slotted at 35b by a plurality of slots and rounded over at the ends 35a to prevent brushing to the variable portion the inner electrode 36.

The inner bellows 30 is secured to the lower portion of member 21 and is provided with ring-like guide members 31 which slide in operative engagement on shaft 20. The outer bellows 33 are connected and soldered together by a ring-like washer 34. Interposed between the inner and outer bellows is a tube-like element 32, the outer surface of which acts as a guide for ring-like washers 34 and the inner portion or surface as a guide for a telescoping tubular member 37.

The upper portion of member 32 is threaded to a collar 29 which is in turn threaded at the lower portion of stem 21. To provide ease of the condenser assembly, the outer flexible bellows have been designed to be removable by having the threaded collar member telescope over the inner bellows, the diameter being larger than inner bellows 30 so as to allow removal of members 29, 32, 33, 34, 35, 37 and 38 after shield 36 and retainer disk 38b and screws 38c have been removed. Member 29 has a thin rim 29a which makes it easy to solder on bellows 33. The variable inner electrode portion 36 is fastened to member 21 by means of a flange-like member 38 which has a portion 39 secured thereto by retainer disk 38b, screwed to part 39, for centrally guiding inner rod 20. In order that there may be fluid communication between the inner and outer bellows, members 36 and 38 are provided with a small aperture 38a, the inner bellows 30 being arranged to withstand the air pressure of the condenser and at the same time acting as an air seal by being soldered to members 21, 31 and 39. The outer bellows 33 has equal pressure on both sides and carries substantially all the radio frequency currents of the condenser from the fixed portions 21 and 29 of the inner electrode 35 to the adjustable portion 36.

In normal circuit operation of this condenser, the gas or air is placed under a pressure of substantially one hundred and fifty to two hundred pounds per square inch. Such a condenser at this pressure would be capable of efficiently handling approximately 30,000 volts R. M. S. When it is desirable to vary this condenser, the adjustable knob 17 is rotated and the surface area and/or the dielectric thickness is changed by moving the adjusting nut 27 clockwise or counter-clockwise. Assuming that stem 21 has a right hand thread when adjusting nut 27 is moved clockwise, members 20, 36, 37, 38 and 39 will be pushed downward to increase the active capacity by decreasing the dielectric thickness of the condenser fluid or gas below 36. Similarly, when adjusting nut 27 is moved in a counterclockwise direction, members 20 and 37 will telescope upward within members 22 and 35, and thus decrease the capacity between the lower surface of member 36 and the inner base portion of casing 1.

While only one embodiment of this invention has been described, it is to be distinctly understood that condensers of this general type are capable of other modifications, for example, gears 18 and 19 may be substituted by any other means for producing mechanical movement such as a linkage system. Therefore, this invention should not be limited except as to such limitations as are clearly imposed in the appended claims.

What is claimed is:

1. An electric condenser comprising a casing, said casing acting as one electrode for said condenser, a hollow cone-like insulator supported by said casing, a central electrode secured to said insulator, said central electrode formed of two parts and joined by a plurality of flexible bellows to permit variations in the length of said central electrode within said casing, adjusting means comprising an "Invar" rod, the space between the electrodes within said casing being filled with a gas under pressure acting as a dielectric for said condenser, a cup-shaped member having a rounded flange forming a corona shield, said cup-shaped member supported on the upper end of said cone-like insulator, a bearing on the top of said cup-shaped member a shaft carried by said bearing one end of which terminates in gearing means comprising a pair of bevel gears for varying the capacity of said condenser, a threaded adjusting nut turned by said gears to move said "Invar" rod to vary the length of said central electrode, and an operating knob having an insulated member secured to the other end of said shaft.

2. An electric condenser comprising a casing, said casing acting as one electrode for said condenser, a hollow cone-like insulator supported by said casing, a central electrode secured to said insulator including an upper and a lower portion, said lower portion formed of two parts, one of said lower parts having an inner group of flexible bellows, the other lower part of said central electrode having an outer group of flexible bellows to permit variations in the length of said central electrode within said casing, said upper portion of said central electrode having an external

thread, a movable nut surrounding said external thread, a gear secured to said nut, adjusting means comprising an "Invar" rod cooperating with said nut to vary the length of said central electrode, the space between the electrodes within said casing being filled with a gas under pressure acting as a dielectric for said condenser.

3. An electric condenser comprising a casing, said casing acting as one electrode for said condenser, a hollow cone-like insulator supported by said casing, a central electrode secured to said insulator, the space between said casing electrode and said central electrode being filled with a gas under pressure acting as a dielectric for said condenser, said central electrode formed of two parts threaded together including an upper and a lower portion, one of said lower parts having an inner group of flexible bellows to seal the inner portion of said condenser from the outside atmosphere, the other lower part of said central electrode having an outer group of flexible bellows to seal the gas under pressure from said outside atmosphere, said group of flexible bellows being secured to said central electrode so as to permit variations in its length, said upper portion of said central electrode having an external thread, a nut surrounding said external thread, a gear secured to said nut, and adjusting means comprising a second gear meshed with said first gear, a rod-like member cooperating with said nut and gears to vary the length of said central electrode.

4. An electric condenser comprising a casing, said casing acting as one electrode for said condenser, a hollow cone-like insulator supported by said casing, a central electrode secured to said insulator, said central electrode formed of two parts and joined by a plurality of flexible bellows to permit variations in the length of said central electrode within said casing, adjusting means passing through said flexible bellows, the space between the electrodes within said casing being filled with a gas under pressure acting as a dielectric for said condenser, a cup-shaped member having a rounded flange forming a corona shield, said cup-shaped member supported on the upper end of said cone-like insulator, a bearing on the top of said cup-shaped member, a shaft carried by said bearing one end of which terminates in gearing means comprising a pair of bevel gears for varying the capacity of said condenser, a threaded adjusting nut turned by said gears to move said adjusting means to vary the length of said central electrode, and an operating knob secured to the other end of said shaft.

5. An electric condenser comprising a casing, said casing acting as one electrode for said condenser, a hollow cone-like insulator supported by said casing, a central electrode secured to said insulator including an upper and a lower portion, said lower portion having a fixed and an adjustable portion, an inner tube secured to said adjustable portion of said central electrode, telescoping members to couple said fixed and adjustable portions together, a flexible metallic member located on both the inside and outside of said telescoping members to permit variations in the length of said central electrode within said casing, said upper portion of said central electrode having an external thread, a movable nut surrounding said external thread, adjusting means comprising a gear secured to said movable nut, a second gear meshed with said first gear, an "Invar" rod cooperating with said nut to vary the length of said central electrode, the space between the electrodes within said casing being filled with a gas under pressure acting as a dielectric for said condenser.

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