PUBLISHED
MAY 18, 1943.
BY A. P. C.

H. J. R. VON BAEYER ET AL
TRANSMISSION LINE
Filed Nov. 30, 1940

Serial No.
367,936

Fig. 1

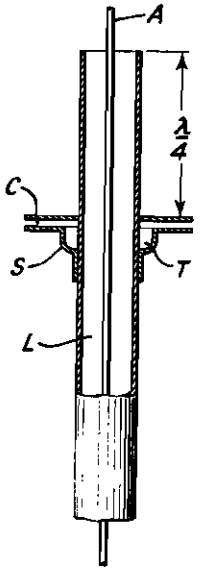


Fig. 2

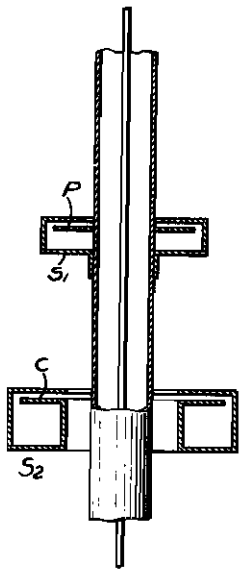


Fig. 3

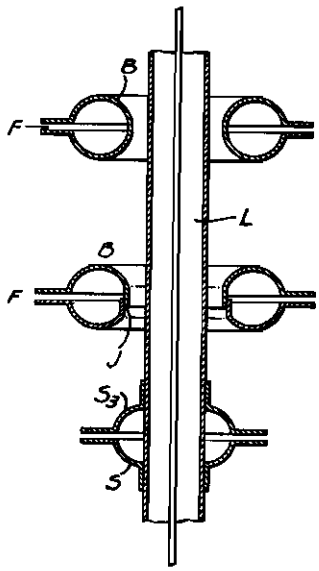


Fig. 4

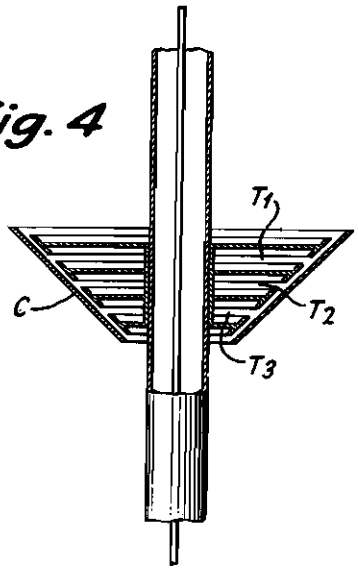
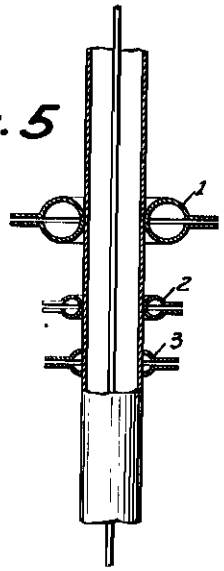


Fig. 5



INVENTORS
HANS JAKOB RITTER VON BAEYER,
HANS-OTTO ROOSENSTEIN
AND FRIEDRICH TISCHER
BY H. S. Rowe
ATTORNEY.

Published May 18, 1943

Serial No. 367,936

ALIEN PROPERTY CUSTODIAN

TRANSMISSION LINE

Hans Jakob Ritter von Baeyer, Hans Otto Roosenstein and Friedrich Tischer, Berlin, Germany; vested in the Alien Property Custodian

Application filed November 30, 1940

To suppress the so-called shell waves traveling along the outer conductor of shielded radio frequency lines or cables the use of "stopper pots" or traps has been suggested in the prior art. These essentially consist of a metallic cylinder of $\lambda/4$ length surrounding the outer conductor and unilaterally connected with it. Where relatively long waves are dealt with the geometric dimensions of these traps turn mostly out to be so large that constructional difficulties arise. It is, moreover, desirable in many instances to insure an excluder or suppressor action only at a single point and to alter the line as little as possible otherwise. To the said end, according to the invention, a concentrated or lumped capacity is used with the trap, with the result that the other dimensions of the excluding structure are diminished to such an extent that the geometric proportions of the excluding trap become far less than $\lambda/4$, indeed, they can be reduced practically to any desired extent.

There are quite a number of different ways and means adapted to carry the basic idea of the invention into effect, and some of these shall be hereinafter described by reference to the appended drawing which shows several exemplified embodiments.

Figure 1 shows a coaxial line L. The inner conductor thereof terminates in an antenna A. In order to avoid waves travelling along the shell or outer conductor, a trap is provided at a distance of $\lambda/4$ below the end of the outer conductor as indicated at T. This trap essentially comprises a concentrated or lumped capacity C and a small cup-shaped part S. By shifting the said part S having a capacitive flange, it is possible to tune the trap. This arrangement still carries current on the top face of the upper capacity flange from the line (arrow), and this current is suppressed to zero value only at the entrance end of the trap, that is to say, on the outer edge. If, also, this current is to be suppressed, and if a current anti-loop or node is to be established directly at the conductor, then the arrangement shown in Figure 2 will prove of greater advantage in which the input of the trap circuit is arrangcd directly on the conductor surface or in such a way that no currents of the kind mentioned in connection with Figure 1 are able to arise. As to the rest the embodiment Figure 2 in all essential details corresponds to that shown in Figure 1.

Figure 3 shows at the same time various ways of designing the suppressor pots or traps comprising lumped capacity. The upper pot or trap consists of an annular hollow body or chamber which is fitted with capacity flanges and which either is shifted directly on the line L or which surrounds the line while being spaced apart therefrom a distance that is small compared with the wavelength. The trap is, in the latter case, entirely separated from the transmission line and is readily shifted therefrom. The traps in the upper portion of Figure 3 amount to substantially a single turn toroid having a flange shaped concentrated capacity for tuning. If this circuit is to be made tunable, then recourse may be had to the embodiment of a trap shown further below. In this embodiment the ring comprises two parts being shiftable in each other. The trap shown at the bottom of Figure 3, finally, is merely a symmetrical modification of the trap of Figure 1.

The selectivity of the traps described is substantially greater than that of the stopper systems of $\lambda/4$ known in the art inasmuch as inductance and capacity no longer are uniformly distributed, in fact, merely a capacity is practically involved which, even with slightest changes occasions a substantial change in the tuning. By resorting to suitable screw construction, it is an easy matter to insure the desired accuracy of tuning. If an entire frequency band or a number of frequencies are to be excluded rather than a single frequency, then a plurality of traps tuned to different waves may be mounted in sequence. This is illustrated by way of example in Figures 4 and 5. The embodiment, Figure 4, comprises a joint and common capacity plate C which conjointly with the various traps T_1, T_2, T_3 allows to build a geometrically reduced trap or stopper systems designed for three frequencies. It will be obvious that also in this embodiment the drawback described by reference to Figure 1 can be avoided by choosing a suitable form of construction along the lines of embodiment Figure 3, if the excluder action is to be insured directly on the conductor. Figure 5 utilizes the type of trap shown at the top in Figure 3 so that no further explanation is required.

The tuning and the properties of the trap or pot circuits may be acted upon and regulated at will by filling the same with materials possessing convenient dielectric constants, permeability and conducting powers. In fact, a medium inhering adequate loss may here serve at the same time to directly attenuate and suppress the wave to be eliminated. In an embodiment of this kind, for instance, a hemp rope may be wrapped or braided with wires in such a way that two semicylindrical cups placed opposite each other are

formed. This rope being tuned to resonance by its diameter may be wrapped around the conductor to be rid of radio frequency waves thus resulting in an arrangement resembling that shown on top in Figure 3, though with this distinction that a substantial ohmic drop is occasioned. A further modification involves a lumped capacity connected across the ends of a toroidal coil surrounding the transmission line. The toroidal coil may be conveniently constructed by lacing a conductor around a wooden ring adapted to be placed over the transmission line.

The invention is not confined to the purpose of eliminating or suppressing what has briefly been called "shell" waves, in fact, it can be used also to suppress waves of definite frequency on any kind of conductor at all. From other constructions known in the prior art it distinguishes itself especially by its extremely reduced geometrical proportions.

HANS JAKOB RITTER VON BAEYER.
HANS OTTO ROOSENSTEIN.
FRIEDRICH TISCHER.