Reaction Condensers

A Safety Device

WITH regard to reaction condensers, in some circuit arrangements these may have a large voltage—the whole voltage of the B battery—across from one set of vanes to the other, and therefore, unless some safety device is included in circuit with the battery and condenser, it is clear that serious damage may be caused by an accidental contact between a moving vane and a fixed vane. A fuse is perhaps the simplest form of protection, and it has the advantage that, being of comparatively low resistance and free of inductance, it does not interfere with the other adjustments in the circuit. An alternative protection is a fixed condenser—which may be of the mica variety—introduced in series with the variable condenser. Of course this means that we are again dependent upon the insulation of the fixed condenser, but generally the insulation of a good quality fixed mica condenser may be relied upon with much more certainty than that of a variable air condenser. The introduction of the fixed condenser in series with the variable condenser means that the setting of the variable condenser will be altered, and if the fixed condenser is of too small a capacity, it may be that the desired resultant capacity is thrown outside the range of the variable condenser. A capacity of .002, even up to .005 microfarad, may be used for the fixed condenser, and it is important also that, in addition to an adequate capacity, this condenser should have mica insulation. If the condenser is not of appropriate capacity and quality, the overall amplification will be reduced and sharpness of tuning will be lost.

WANTED AND FOR SALE.

For column of casual advertisements see page 32.

Oscillation, Capacity and Inductance

Explanation by Sir Oliver Lodge

I SUPPOSE everyone knows that a circuit which includes both inductance and capacity is liable to oscillate, at a certain definite frequency, dependent on the produce of the inductance and capacity (writes Sir Oliver Lodge in "Popular Wireless"). If you double one and halve the other, the rate of oscillation remains the same. If, on the other hand, you halve both, the rate of oscillation would be quadrupled: it would give what in sound is equivalent to a double-octave rise in pitch. Increasing either the capacity or the inductance lowers the rate of vibration.

By employing a very big condenser and a coil with a great number of turns, one can reduce the rate of vibration actually down to acoustic frequency. Electric rates of oscillation are usually extremely rapid, a hundred-thousand a second, for instance. But with a very big coil and a very big inductance, the rate of oscillation can be reduced to a few hundred a second; and any vibration at the rate of a few hundred a second, if it is made to disturb the air, will give a musical note.

Whistling Sparks.

An experiment of that kind is best performed with a Leyden jar as the capacity, or with some other strong condenser that can stand a big potential, so that it will give a spark. A spark is a means of disturbing the air: it heats the air, and usually gives a sort of crack, which is quite audible. But if the spark is taken from an oscillating circuit, one that vibrates about six thousand or two thousand a second, you won't hear a crack, you will hear a whistle, or even a musical tone of lower pitch than that.

Last century I used to demonstrate these whistling sparks, with a battery of Leyden jars as the capacity, and with a great coil of wire as the inductance. One could thus bring the spark-note down till it corresponded with some of the notes on a piano.

In some engineering undertakings these electric oscillations or surgings occasionally gave trouble. When Dr. Ferranti, long ago, laid large electric underground mains from Deptford to London, the lines had a great capacity; there was also a considerable amount of inductance in the big dynamos employed.

So the result was that the circuit had a natural rate of vibration, rather slow but decidedly powerful; and accordingly the voltage rose above what was provided for, and was liable to burst the insulation, until proper precautions were taken to combat the tendency.

If you have a long bath half filled with water, and tip the bath lengthways, the water oscillates to and fro, and may easily splash over the edge. That sort of thing happened in the electrical case. The surging electricity overflowed or splashed over or burst through the insulation; or, if it didn't, there was a danger of its doing so. This was very instructive, and excited a good deal of interest.

The same sort of thing would be less likely to occur in a land line, because a land line has much less capacity, and therefore the energy stored would be less. That is one reason why in long-distance electric power transmission engineers prefer overhead lines to underground mains! Any surgings that may be encountered are less likely to be violent.

One can get surgings even in a land line. I used to stretch long copper wires—if you can call them wires—as thick as one's finger, round a big theatre, excite high voltage surgings by means of Leyden jars, and show that the sparks that could be obtained from the long leads were very much longer than corresponded with the applied voltage.

Electric Momentum.

If the natural length of spark was ½ inch the surgings might give a spark as much as 3 inches by the accumulated momentum. For it must be understood that the magnetic field which surrounds a current confers momentum upon it; and when this is combined with the elastic storage of energy called capacity, it behaves like a loaded spring which can oscillate to and fro with violence, the rate of oscillation depending on the elasticity and the load. The load or the inertia corresponds to inductance in the electrical case, the elasticity corresponds to capacity.

I have seen the effect of these electric surgings in some of the early large-scale radio aerials, when a great steel mast formed an appendage to the circuit. An electric current surged up and down in this mast with such violence that blocks of timber placed against the mast to strengthen it in a storm were charred and smoked, and might have caught fire.

This was notably the case in that installation arranged by Dr. Goldschmidt near Hanover; and very strong insulators had to be employed in order to prevent their destruction. Wireless operators, as a rule, are not concerned with these violent effects; the self-generated oscillations at a receiving station only produce howling. But the fundamental principles are much the same, whether great or small power is employed; and the rate of oscillation can be reckoned in the same sort of way.

Tips and Jottings

Panel Appearance.

SO far as screw holes are concerned, most panel-mounting components are now so made that the knobs cover any fixing devices, and the only screws exposed are those holding the panel to the brackets and securing it to the front edge of the baseboard. If the holes are in all cases counter-sunk somewhat deeper than necessary in order to make the screwheads flush, the small depressions above them can be filled up with wax, cut off with a sharp knife, and polished so as to be quite indistinguishable from the panel material. It is actually easier to do this filling and polishing on mahogany and walnut-finished panels than on plain and highly-polished black ebonite, for a little red and brown wax can be blended to match the pattern perfectly.

Improving Tuning Limits.

IN many old-fashioned sets failure to tune down below a certain limit is due to the fact that the variable condensers have what we should call nowadays an unduly high minimum capacity, though it was regarded as very low in the early days of broadcast receiving equipment. To substitute up-to-date variable condensers for old ones is a perfectly straightforward job which can be carried out in a few minutes in most sets. The expense involved is quite small, for the price of condensers to-day is astonishingly low considering how well they are designed and made. The best type to choose for the set intended for the reception of foreign as well as home stations is undoubtedly the straight-line frequency since this gives an almost equal separation of stations from near the bottom to near the top of its tuning limits. No condenser, whether square-law or S.L.F., is likely to give a perfectly straight-line graph between zero and maximum, but when good patterns are used with suitable valves and circuits the curved portions of the graph will be very small and its straight portion very long in comparison.