A Thermionic Wizard

The Aladdin's Lamp of Modern Science

DAY by day, the thermionic valve is demonstrating its marvellous qualities in an ever-increasing field of specialised application. Owing to the fact that the electron stream, the "working principle" of the valve, possesses hardly any inertia, this invention is admittedly the most delicate and sensitive relay known. It is capable of responding freely and instantaneously to the slightest applied impulse, without any lag or any perceptible loss of energy. It is also unique as a generator of high-frequency oscillations, and it is equally steady and reliable when handling the few watts of a small transmitting station as when generating the thousands of watts radiated from a powerful one. Its remarkable qualities are thus conducive to the development of its potentialities extending far outside the field of wireless for which it was originally devised.

Medicine is one instance in point. The virtues of electricity have long been recognised by medical science, both as a curative agent and as a means for pain alleviation. Thus the use of high-frequency currents, induced by a valve oscillator, is at present rapidly growing in favour in the medical world of to-day. The stethophone is a further illustration of the use of the valve in medical science. In this instrument an ordinary stethoscope is used in conjunction with a multi-stage valve amplifier, thus magnifying sounds which would otherwise remain obscure and possibly unidentified. In this way the stethoscope represents a valuable asset in the modern art of diagnosis.

Finally, high-frequency currents produced by valve generators are now being employed for cauterising purposes as well as for actual surgical operations. By using currents of radio-frequency from .25 to 2 amps. in strength, it is possible to cut through bone and tissue in an absolutely antiseptic manner, and without loss of blood.

Another property of a valve which is utilised in many different ways is its extreme sensitivity to any change in external circuit conditions, especially when the set is on the "threshold" of oscillation. If, for instance, the reaction coil of a valve receiver is set just short of the oscillation point, the set can be made to "howl" by placing the hand near the coils, or by passing a metal object through the open core of one of the inductance coils. By utilising these peculiarities, a number of ingenious alarms have been devised. A coil forming part of the plate circuit of a "trigger" valve, can be placed near a safe or window, and the approach of a burglar detunes the circuit sufficiently to set the trigger valve into self-oscillation. This in turn causes the plate current to alter suddenly, thereby establishing a contact which rings an alarm bell.

In a German factory the pilfering of valuable metal by workmen has been detected by means of a very similar circuit arranged around a special exit door. The door windings are connected to a superheterodyne receiver, which is sensitive enough to detect the presence of any hidden metal, by giving rise to an alteration of the normal tuning note in the 'phones as the culprit passes through.

A similar principle underlies an arrangement used in prospecting for the presence of metals. A part of the detector circuit is slung in the form of a Hertzian oscillator below the fuselage of an aeroplane, which flies over the area to be explored. The presence of mineral deposits below the ground surface, exercises a "damping" effect on the "search" coils, which creates a change in the characteristic beat-note of a super-sonic receiver, and so gives a reliable indication to the prospecting aviator.

The combination of a selenium cell with a thermionic amplifier has been used to detect the presence of unauthorised persons when opening a safe or strong-room door. The change in the lighting conditions alters the resistance of the selenium cell, which in turn sets a trigger valve into oscillation, and so rings an alarm. A very similar combination has been used to give automatic indication of the approach of fog. A ray of light from a distance is focused upon an optical cell, which is connected to a "trigger" valve circuit in such a way that when the atmosphere becomes opaque, thus cutting off some of the light, a relay is actuated and automatically brings the harbour fog signal into operation.

An identical arrangement is used inside a chimney stack to give a warning when the smoke emitted contains more than the regulation percentage of soot and other impurities. Excessive atmospheric pollution is thus prevented, an automatic alarm being given when the smoke becomes too apoque, and thus too dirty.

Amongst other applications, mention may be made of railway signalling devices in which trap or loop circuits laid on the permanent way co-operate with valve amplifiers mounted in the locomotive, and automatically give audible or visible signals of track conditions ahead. One final ingenious application may be mentioned. A valve can be used to give audible warning of the accumulation of dangerous gases in a coal-mine. The operation in this case depends on the change of "tuning note" of a pipe resonator, the fundamental frequency of which is determined by the density of the contained column of air. The intrusion of noxious gases alters the original density, and so actuates a local alarm.

In conclusion, it would not be an exaggeration to state that the valve is probably the most marvellous invention of all time, and its applications to various widespread uses are by no means all discovered.

THE object of any radio frequency amplifying stage is to magnify the weak long-distance signals before they reach the detector, thus adding greatly to the range and sensitivity of the receiver.

New Developments

WORK is shortly to commence on the B.B.C.'s new headquarters in Portland Place, Oxford Circus, and it is estimated that the total cost of the building will be in the neighbourhood of half a million pounds. This building will contain at least twelve studios, of which two will be twice as big as the largest now in use at Savoy Hill. There will also be a super-studio, intended for the accommodation of large orchestras, choirs, and massed bands. These studios will occupy the centre of the building, and will be grouped one above the other. They will be surrounded by offices, and will thus be protected from any extraneous interference.

SLOWLY but surely the world is being covered with a network of wireless telephone services. One of the latest additions is the restricted service between Great Britain and Buenos Aires via Paris or Berlin. The charge is £2 3s. per minute, with a minimum of three minutes. Another important development towards establishing regular inter-continental communication was demonstrated recently in Australia, when a conversation between officials in Sydney and New York was maintained by means of wireless telephony.

AUSTRALIAN broadcasting is now put on a basis of State control by the Federal Government's acceptance of the tender submitted by the Australian Broadcasting Co., a group comprising Union Theatres, Ltd., Fuller's Theatres, Ltd., and J. Albert and Son, Ltd., music dealers, of Sydney. The tender provides for a three-year contract. Listeners will pay an annual licensé fee of 24s., half of which will go to the programme contractors, who should thereby be assured under present conditions of an annual income of £240,000.

The contractor is required to furnish "programmes of general interest and of sufficient diversity to cater for the reasonable tastes of the community as a whole." Severe penalties are prescribed for non-compliance with the agreement, including the forfeiture of a bond of £5000, wholly or in part, which the contractor is required to deposit.

The maintenance of stations and their equipment will be the responsibility of the Government, the sole duty of the contractor being to supply programmes.

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