crystal detector and the succeeding audio transformer with a .0001 mfd. fixed condenser. The circuit is shown in outline in Fig. 2. It will be seen that a reaction effect almost precisely similar to that obtaining in the Sharman circuit is obtained.

There is a considerable difference, however, in the part of the circuit prior to the valve. Instead of the audio output of the crystal being applied direct to the grid of the valve, it is fed through an audio transformer by means of which a considerable step-up in signal strength is obtained. The by-passed r.f. currents are prevented from taking easy path to earth via the transformer (and incidentally interfering with this component's proper operation) by the interposition of an r.f. choke between the grid of the valve and the secondary of the transformer. Naturally, this choke does not present any obstacle to the passage of audio currents from transformer secondary to grid.

The two current paths are easily followed. The small part of the r.f. current which is by-passed via the .0001 mfd. fixed condenser is applied to the grid of the valve, amplified, and fed back to the tuning coil by means of a reaction coil coupled thereto. The other and major part of the r.f. current is rectified by the crystal, the audio output being applied to the primary of the audio transformer. The output from the secondary of this is applied to the grid of the valve, amplified, and rendered audible by a speaker or telephones in the plate circuit of the valve.

Most of the notes made in connection with the Sharman circuit apply here also, so that it is unnecessary to go over them again. It may be noted, however, that because of the low impedance of the crystal detector, the use of a high-ratio transformer will not result in impaired tone. A ratio as high as 7 or 8 to 1 may be employed if such a transformer is available.

Comparisons.

READERS will no doubt wish to know how the "Trinadyne" compares with the Sharman. Perhaps the best advice is to try them both. However, it will be some guide to say that where signal strength is reasonably good, the "Trinadyne" will give an appreciably greater output—on the local station good speaker strength may be obtained with one valve with this circuit—but that on very weak signals the Sharman is likely to be more responsive.

We have now gone far enough to enable readers to try out both of these extremely interesting circuits. In the first part of our next article in this series further information will be given regarding the "Trinadyne."

Locating Gold by Radio

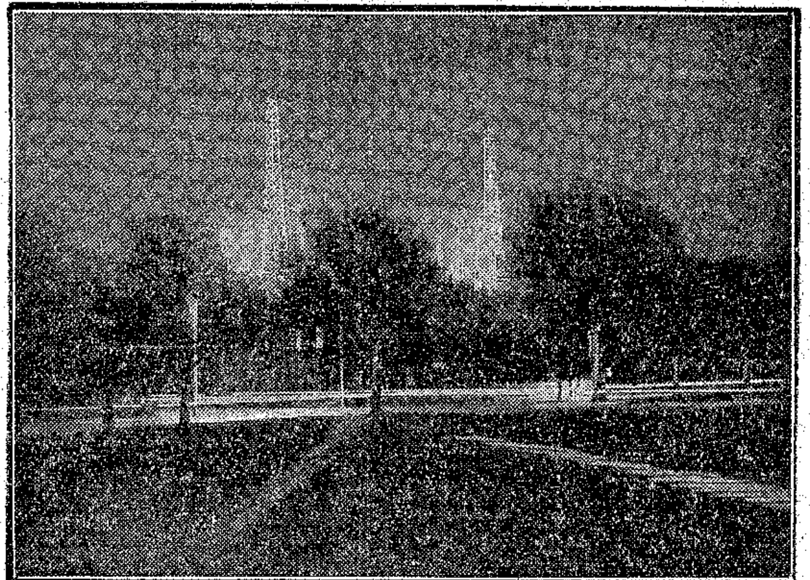
Successful Experiments

SCIENCE and experimentation have relieved modern prospecting for buried treasure of its former vicissitudes. Nowadays, magnetism, electricity and radio are being harnessed to locate valuable deposits of subterranean ores and oil. The detailed geological knowledge of promising regions now available replaces the tedious pioneering treks of daring prospectors who roamed and roved over unexplored country and delved with pick and pan into rock-ribbed terrain.

The modern geophysical methods of prospecting are based on definite physical principles and are the products of rational research. They are not related in any way to the fictitious divining rod or "doodle bug" systems of hocus-pocus oil deposit discoveries. "The divining rod is either a fraud," says no less an authority than "Uncle Sam," or is founded on some "physiological principles concerning which we know little or nothing—like the sense of direction in migrating birds and fishes."

Ore bodies, including all the precious metals as well as salt domes and oil "caches," are now being located by magnetic gravitational, electrical and seismical survey methods, while radio is being tested for its applicability to similar purposes.

The dawn days of geophysical prospecting hark back to the World War when technical detectors of submarines were perfected. The propeller sounds of submarines in motion were located by means of special hydrophones invented for that purpose, while magnetic sleuths discovered the whereabouts of the steel ships at rest, by the reflection of sound waves.



An unusual view of 3YA's towering masts, taken at night.

Underlying Principles.

A CLOSE analogy exists between hunting submarines under water and locating ores buried far underground. Detection of either depends on the difference between the properties of the body and its surrounding medium.

In ores the difference is sometimes magnetic, as in cases where iron ore occurs, or it may be electrochemical, as in the case where a sulphide ore is present. Various electromagnetic effects result from certain combinations of ores in the earth. Hence some of the new electrified detectors are direct or continuous current, and others use alternating current with a wide range of frequencies.

Important differences in density facilitate gravitational detection by the use of a special pendulum or torsion balance. Where the materials differ in elasticity as well as in density, the velocity of sound or shock waves varies and can be determined by seismic systems—a quake recorder is used to pick up any reflected or refracted waves caused by an explosion. The best prospecting methods to apply depend upon the geological structure of the region and the type of ore sought.

Recently, experts of the U.S. Bureau of Mines have been testing the efficiency of electrical systems of ore detection on Caribou Mountain in Colorado, a locality which has yielded more than 50,000,000 dollars (£10,000,000) in subterranean wealth recovered as commercial gold, silver, copper, lead and tungsten. The geology of that region has been explored thoroughly, while it is ideally adapted to magnetic methods of geophysical prospecting.

Hence there was a background of conclusive data for direct comparison with the results of the recent electrical surveys. This was the first time that such comparisons have been attempted, and the results demonstrated conclusively the reliability of the new methods of electrical prospecting.

THE simple and portable apparatus used in the latest Government experiments harnessed ordinary radio "B" batteries of 45 volts each as sources of direct current, while a U.S. Army signalling set, employed in communicating through the ground in wartime, provided alternating current when required. A frequency of 1300 cycles per second was found most satisfactory.

The electrified current was introduced into the ground by two electrodes, each comprising several stakes linked together with stranded copper wire and two parallel copper wires pegged to the ground every hundred feet. Ordinary angle iron stakes obtained from the army were more durable than the zinc-coated iron pipes with copper wires attached that were first used. The parallel bare copper wires were 600 feet long and were laid out along meridians 50 feet apart. Special reels designed for the purpose were used in the placing of this wire, while high resistance headphones were employed in keeping tab on the passage of the electric current through the soil.

The tests of radio reception through the ground which were successful up to distances of 550 feet were made with a home-made superheterodyne 9-valve radio set. The radio receiving set was placed in a shaft of the Caribou mine, 550 feet below the surface, and there picked up music broadcast from a neighbouring city. These experiments tend to confirm the theory that radio waves pass through rock wihtout much attenuation. Radio signals will penetrate sea water—a good conductor—to a depth of from 50 to 60 feet, which indicates that they would penetrate approximately ten times as far through a poor conductor like dry rock.—G. H. Dacy, in "Science and Invention."