

THE VERSATILE BROWN BOVERI V.H.F. MOBILE RADIO

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The author picks out the most important applications from the wide range of mobile radio, and describes the principles on which the system operates.

THE properties and special advantages possessed by the new Brown Boveri type RT5 v.h.f. radio set open new and wide fields to radio communication. It is the ideal solution wherever time is valuable or personal contact is desirable, regardless of position or intervening terrain.

Methods of Operation

In spite of the many and various ways in which it can be applied, the Brown Boveri mobile radio system has two basic units which always remain the same—the transmitter and the receiver. Normally they work in one of the following frequency bands: 30–41, 70–90, 156–174 or 450–470 Mc/s; if specially requested, however, the transmitting and receiving range can be modified to any frequency between 30 and 500 Mc/s. The sets can contain up to four interchangeable channels separated by at least 50 kc/s. Apart from the normal speech range for telephony of 300–3000 c/s the system transmits teleprinter signals or telemetering and control impulses. For these and also for

rapid telegraphy the signals are superimposed on the telephone conversation, so that each set or speech channel can be used for several purposes.

Complete reliability is assured by various degrees of stand-by arrangements up to the stage providing automatic switch-over to reserve channels.

The most popular arrangements, which can be inter-combined at will, are illustrated in Fig. 1. Using the same basic instruments the various forms of system or methods of operation can be obtained by correspondingly modifying the operating instruments and by special supplementary equipment.

The most important calling and dialling systems are as follows: Simple loudspeaker- or tone-calling by which all stations can listen together; selective calling of a particular set or group of sets (the remaining stations can, if desired, be locked out, so that they are not able to take part in the conversation or even listen; up to 90 numbers can be called); impulse calling where selection is performed by dialling, as with the ordinary automatic telephone. The numbers which may be called in this case are almost unlimited.

The possibility of working into private or public systems must also be mentioned. The line and radio sections

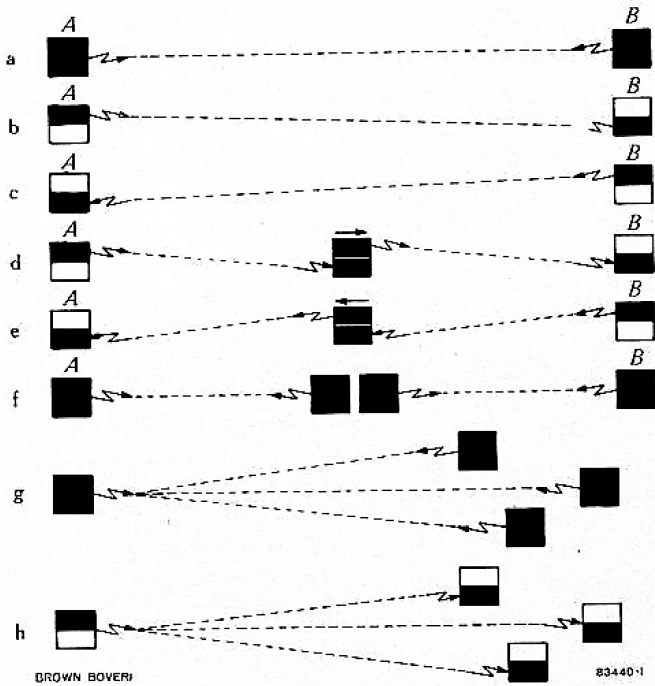


Fig. 1. — The usual methods of operation of the Brown Boveri mobile radio

- (a) Direct communication in a simple two-station system—duplex operation
- (b) Simplex operation, A speaking
- (c) Simplex operation, B answering
- (d) Simplex relay system, A speaking
- (e) Simplex relay system, B answering
- (f) Duplex relay system, simultaneous transmission and reception between A and B
- (g) Star system for simplex or duplex operation
- (h) Simple broadcast system, one-way traffic between transmitter and individual receivers

■ = Transmitter and receiver working
 ▨ = Transmitter only
 ▩ = Receiver only

Power Transmission and Pipelines

In addition to systems transmitting electrical energy over long distances, pipelines carrying water, oil and natural gas also form important networks. The increasing interconnection of such lines demands a reliable communication system, measurement and control over long distances without delay being essential for perfect load balancing. Permanent radio communication links always operate more reliably and economically than line, wherever the lines between level- and load-measuring point or controls pass over water, trackless territory or through areas liable to be stricken by catastrophe. The following are examples of uses for mobile radio in such installations:

Electricity: Telemetry and remote supervision of electrical instruments or water-level gauges, particularly upstream from large power stations.

Gas and oil: Remote control of pumps and valves in large gas and oil pipelines.

Water: Cascade control of water pumps based on reservoir level. Control of valves and sluices in relation to supply or consumption rate. Flood warning when a given river or dam level is exceeded.

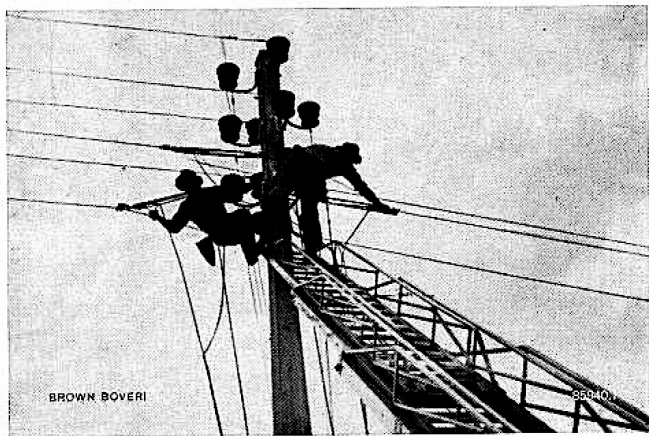


Fig. 2. — The breakdown gang...

can be maintained in contact permanently or switched automatically or by hand for single conversations only.

Public Utilities

Mobile radio can be of great assistance to electricity, water and gas services, where maintenance or inspection teams can be reached regardless of their location. Radio communication allows rapid identification of a fault in the distribution system, whereupon the faulty line can be disconnected and the supply maintained by an alternative route. Rearrangements in supply can be made by direct personal contact, also material ordered for repairs (see front cover of this issue) and the necessary precautions taken. The type RT5 mobile radio set enables precious time to be gained by reducing the duration of an interruption, and thus increases the security of the staff and general public.



Fig. 3. — ...is in radio communication with its headquarters

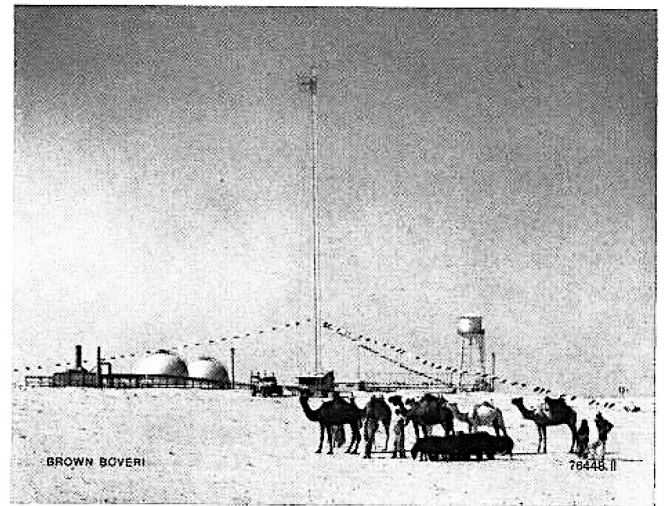
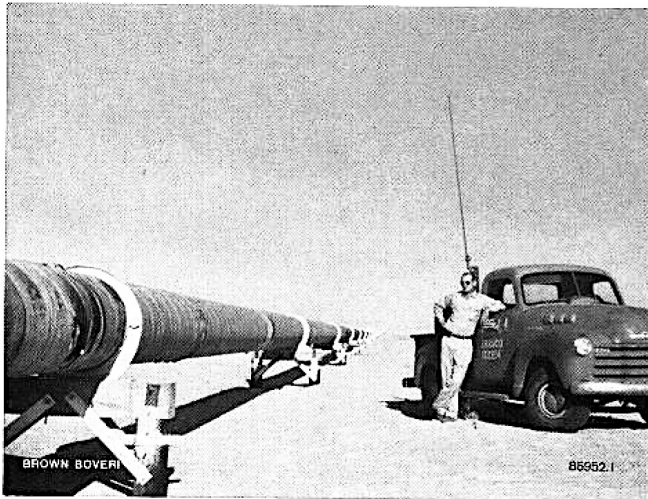


Fig. 4 and 5. — Brown Boveri v.h.f. mobile radio assures verbal contact even in hot countries

Parallel to the actual measuring and control channels it is usual to hold speech channels open for transmitting operational messages. Such multi-channel transmission increases the economic value of the RT5 set. Within the same system it is possible to remain in communication with inspection or maintenance teams, if necessary working into public or private telephone systems.

Railways

On the railways, the applications of mobile radio can be classified under three distinct headings—traffic control, track maintenance, and marshalling.

Traffic control involves connecting the moving train with the telephone system, whether for official instructions (dispatching) or private conversations.

For track maintenance the duty of the radio system is to link repair gangs on the line with the next station or the

railway telephone system. This repair service application primarily assists the security of the working gang, and also speeds the supply of material. The time saved when breakdowns and accidents occur remote from stations is therefore quite considerable.

Mobile radio takes on special significance for marshalling, where the aim is to ensure speedy manoeuvring of wagons in mutual safety. The radio-equipped shunting engine can report its position and destination at any time, and the signal-box or yard foreman can complete a task rapidly or interrupt it—even when a group of wagons is already in motion—and give corrected or complementary instructions (Fig. 6). The signals and orders can also be indicated visually on illuminated diagrams.

Tramways and Mountain Railways

The risk of unforeseen incidents is greater on tramways and mountain railways than on main-line railways. Without giving the operating company a chance to prepare for them, sudden difficulties and interruptions may arise, the harmful effect of which must be countered by rapid rearrangements or counter-measures.

The accident rate for trams increases with the rush-hour traffic. A blockage must be overcome by diverting cars to another route or by putting duplicate vehicles in service, if a serious congestion is not to develop. A mobile radio system enables a large number of vehicles to be immediately reached en route, whereby even a simple broadcast system (vehicles equipped with receiver only) can give excellent service.

Many mountain railways are exposed to sudden changes of weather. Avalanches, snowdrifts, floods, landslides, and often simply fallen trees may form an unexpected



Fig. 6. — Shunting is accomplished more smoothly and with greater certainty using a radio-equipped locomotive

obstruction. The reporting of such incidents and the direction of the repair gangs (snow ploughs, equipment and crane trucks), as well as the giving of the "all-clear" when the trouble has been overcome, is particularly convenient by radio as the location of occurrences of the foregoing nature cannot be anticipated, and frequently the telephone wires suffer as well.

No tramway or mountain railway undertaking is immune from interruptions in service; it is, however, within the power of the undertaking to limit the expense of such incidents by utilizing radio links. A service operating with the aid of Brown Boveri type RT5 v.h.f. radio sets is no longer completely at the mercy of traffic breakdowns, as the fact that reports can be obtained from all along the route and the necessary instructions given without delay enables disturbances to be brought under control and valuable time saved.

Factory Transport

For internal traffic in large factories, steel works and collieries, in fact wherever loads have to be transported between stores, workshops and loading points, considerable economic advantages are obtained when a mobile radio system is employed. The type RT5 sets take up little room, and can be built into a vehicle at any time. Favourite places are under the seat of a truck or lorry, in the roof of fork-trucks and cranes, and in the tool-box of shunting locomotives and tractors. Any means of transport which can be classed as "auto-mobile" is suited to "remote command" by radio (Fig. 7).

Every factory has to adapt the manner of operation of a radio system to the peculiarities of its own transport system. Maximum economy is achieved when empty



Fig. 7. — Internal factory transport is more economical when trucks, lorries, fork-trucks and cranes are directed by radio

journeys are avoided and valuable time is saved which would otherwise be spent in waiting or storage, or in machines being held up. The penetrating properties of the v.h.f. waves are indeed surprising; a driver can be reached by his controller at any time without any interference from machinery or other plant, even though the vehicle may be inside a workshop or building having a steel roof or girders. Besides being able to control the transport from a central point, it is also possible to work into the telephone system from the individual vehicles, so that the widest range of offices imaginable can be reached through the one fixed radio station. Organizing the factory radio system is a rewarding task for any factory planning office, for the overall efficiency of a radio-equipped vehicle is appreciably raised. The fact that the type RT5 set can be supplied for frequencies up to 500 Mc/s should ease the frequency-allocation problem, as the lower wave-bands preferred for long-distance communication need not suffer the additional encumbrance of factory traffic.

Road Transport

In road transport, both passenger and goods, it is important to raise the ratio of paid trips to empty journeys. The cost of taxi, parcels and express goods services is increased by single journeys. The ability to combine various part-loads bound for the same destination or locality is therefore desirable. It is seldom, however, that there are sufficient orders on hand before a journey commences; therefore taxis in particular, where speediest possible service is expected, must be able to receive new orders en route at any time regardless of position. Mobile radio has rendered excellent service in such cases (Fig. 8). Goods services running to a prearranged schedule can be given new instructions by radio, while taxis whose routes cannot be planned in advance find it useful to be able to pick up a chance passenger. A car which has discharged a fare reports back its position and waits until the controller has another journey to allot from that area. The fact that a passenger can speak during the journey to any subscriber on the public telephone system has made radio-equipped taxis particularly attractive. Although the private "car-phone" is likely to be limited to a small number of professions (doctors, civil engineers, contractors, press reporters, etc.), the application of mobile radio to long-distance transport is of great value: one well-sited transmitting and receiving station can cover extensive areas. Moreover, in many countries relay networks are being built up, and in the not too distant future it will be possible

Air Transport

In the air, Brown Boveri sets of the RT5 type serve as a link between helicopters and the ground. Low weight and small dimensions make the sets suitable for quite small aircraft, whereas the frequency range from 30 to 500 Mc/s permits the choice of the particular pattern which is most appropriate in a given instance with regard to altitude and terrain (Fig. 10).

Apart from providing a means of contact between the various ground units, a further interesting application in the world of aviation is the control by radio of warning lights and beacons, such as has been in use for a number of years at Kloten Airport, near Zurich. As long as the central transmitter emits a carrier wave, the warning lights, operating on the steady-current principle and installed over a wide area on buildings and natural obstacles, remain extinguished. Immediately the transmission is stopped, the lights come on with a pulsating rhythm. This system is very reliable, and its initial cost is low, as long

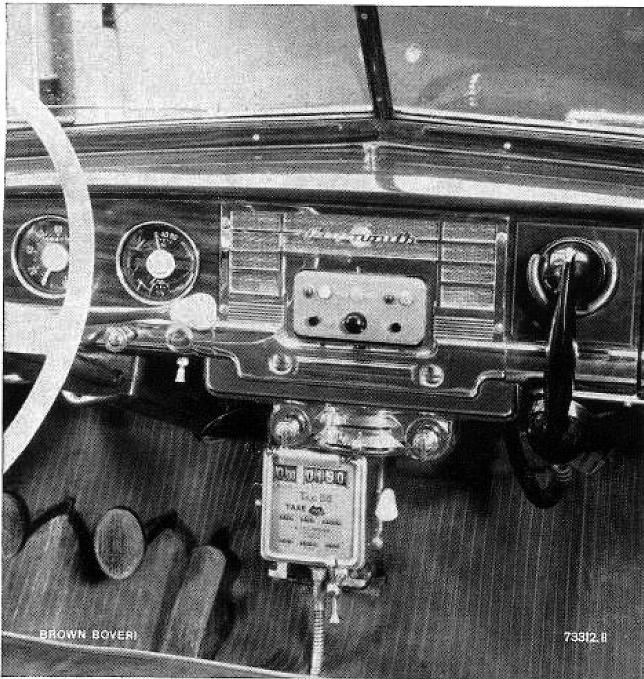


Fig. 8. — A mobile radio set in taxis avoids empty journeys and reduces passengers' waiting time

sible for a person travelling on the arterial roads to telephone from his car exactly as he would from his home.

In the transport business not only is the RT5 mobile radio set a means of reducing unremunerative journeys, the publicity value of the rapid service afforded to customers is also significant.

Shipping

In the world of shipping the main use of mobile radio is for port and river traffic (Fig. 9). On the one hand, radio promotes greater safety (emergency and official messages can be transmitted from the port authority to ships entering or leaving port, or between individual ships, using the internationally agreed frequency of 156.8 Mc/s) and on the other, as for land transport, it assists coastal and river transport vessels and lighters in port to attain higher efficiency and economy. Here, too, orders received while a vessel is under way can reduce empty trips and expensive waiting-time.

Mobile radio is of particular assistance to shipping on inland waterways, where it is in the interests of public safety, either as a permanent link between passenger or freight vessels and the public telephone system, or between motor-boat operators. Brown Boveri sets are to be found on lakes and rivers and in ports of many countries, rendering faithful assistance in the often difficult duties of the crews of police launches, fire floats and lifeboats.

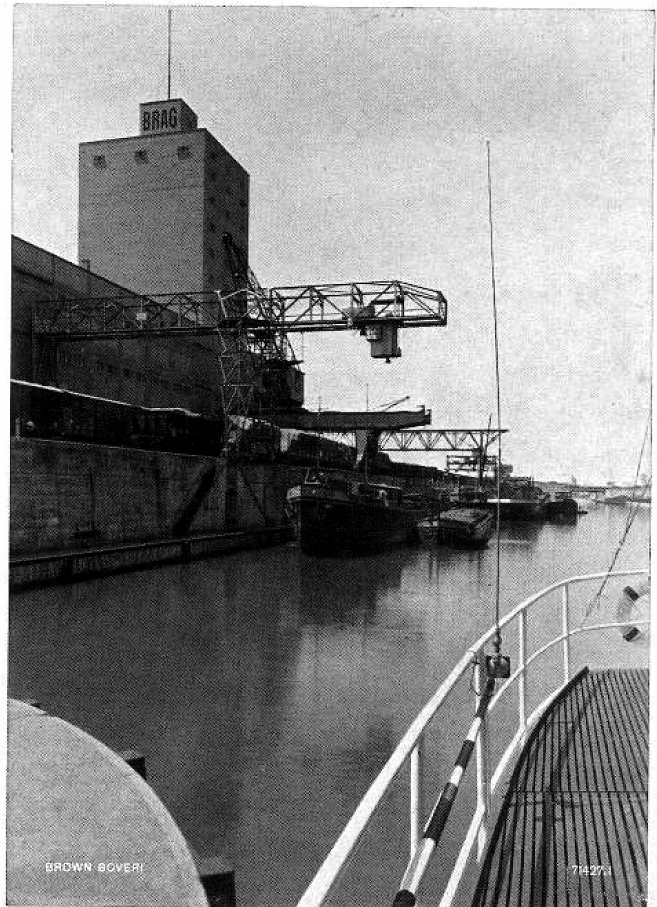


Fig. 9. — Tugs and lighters are in permanent contact with the owners and port authority through the fixed transmitter-receiver station (aerial on silo tower in top left-hand corner)



Fig.10. — On the ground or in the air, the helicopter is in constant touch with the control tower

cables across runways or difficult terrain are unnecessary and warning lights on a temporary obstacle can easily be incorporated in the system.

Police

Police work is often a matter of life or death. It is, therefore, not surprising that the men who are called upon to put everything they know into their work should demand complete preparedness and reliability from their adjunct, the mobile radio. It is for these particular qualities that the Brown Boveri radio is so popular with the police forces of important cities in Europe and overseas. For example, the Préfecture de Police, Paris, has close on a hundred of the Company's sets in operation.

For all police activities, whether criminal investigation, beat duty, traffic or crowd control, the time factor is of major significance in the fight to maintain law and order. An up-to-date police force, therefore, uses radio in an endeavour to gain time and reduce the lead held by the criminal or to keep the effects of an incident from spreading and getting out of control.

At any time, wherever it may be, a patrol equipped with mobile radio remains within reach of headquarters (Fig. 11). They can be directed to any desired task immediately,

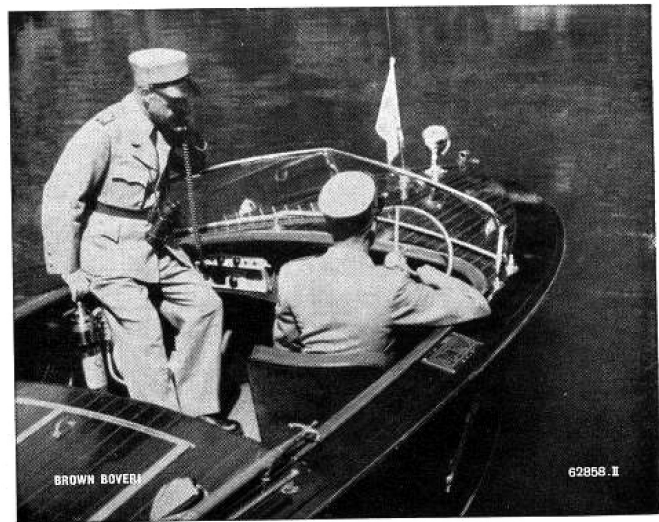


Fig.11. — Anywhere and at any time police equipped with mobile radio can carry out orders without delay

regardless of their position or the availability of an ordinary telephone. The patrol, for their part, can maintain the flow of up-to-the-minute information back to headquarters, ask for reinforcements, for special equipment, medical assistance or ambulances, and check the statements of suspects within a very short time. The versatility of the Brown Boveri mobile set enables the manifold demands of police service to be met without difficulty.

Fire and Ambulance Services

Nowhere is it so vital to gain minutes, even seconds, as in fire services. The rapid appearance of the brigade makes it possible for a small fire to be quenched before it develops into a full-size conflagration. Time saved by an ambulance crew often enables persons to be rescued from most dangerous situations.

In such cases mobile radio is not only valuable for giving the initial alarm: at the location of a fire or accident it is also essential to have a direct link with headquarters, particularly when reinforcements or special equipment are required. For many years now Brown Boveri v.h.f. radio has been used by the fire brigades of many cities in Europe and overseas (Fig. 12).

Armed Forces and Civil Defence

Radio communication has long since been an essential accessory to all military formations. It would be superfluous to do more than mention its service in action. Noteworthy, however, is the resistance of the Brown Boveri set to extreme conditions (shock, blast, vibration),



Fig. 12. — In Europe and overseas the Brown Boveri mobile radio is in service with fire brigades by day and night

such as are experienced in tanks (Fig. 13), where special fixing arrangements permit reliable operation.

The ability to change frequency is of particular value where command vehicles are concerned as it permits variation of the network formation. In addition, the set can be used for relay purposes on frequencies up to 500



Fig. 13. — Robust construction and adaptability make the Brown Boveri mobile radio an effective means of communication even under the most arduous conditions

Mc/s. Given line-of-sight conditions, good reception is possible at distances up to 100 km. The minimum channel spacing of 50 kc/s permits the use of a number of parallel links without causing congestion of the frequency spectrum. The number of channels between individual command posts can be increased, decreased, changed over or split by a suitable grouping of sets. For a small number of channels, a v.h.f. relay is an ideal means of communication for the tactical commander.

Radio Reporting and Commentating

It has become a regular feature of broadcasting services to give running commentaries on sporting and other public events. The commentator with his microphone is a common sight at conferences, on the sports ground or on the track, with his companion the mobile radio set (Fig. 14



Fig. 14. — The Press, sports organizations and broadcast services make use of v.h.f. radio for the rapid transmission of sports results

and 15) to bridge the distance to the broadcasting station. Regardless of the weather, climate, time or place, the RT5 set is always ready to transmit a faithful reproduction of the report. At major gatherings in Europe and overseas it acts as the means of communication for the administrative organization, press reporters, and medical and ambulance services.

Complementary to or Replacing the Telephone

Even the best-planned telephone system can suffer interruption by accident or due to technical causes. While the line remains interrupted a mobile radio link forms an

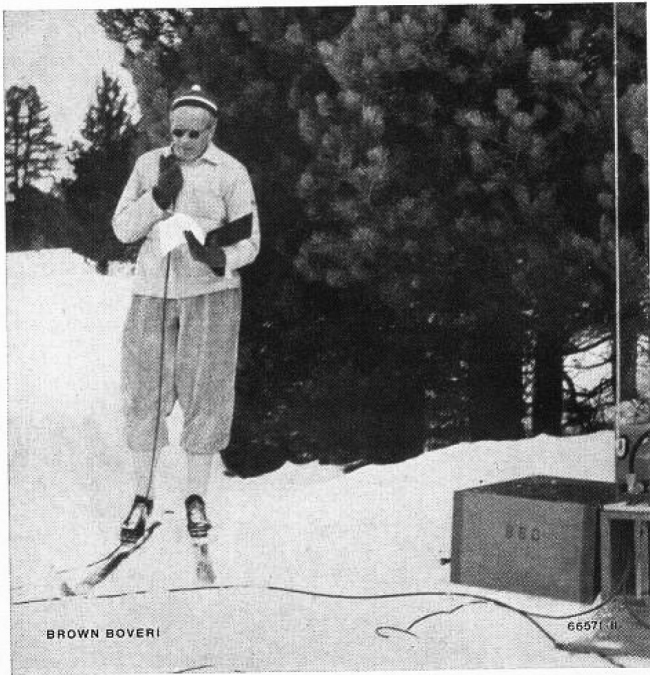


Fig.15. — Whether in the tropics or in ice and snow, the mobile radio is always at the reporter's disposal

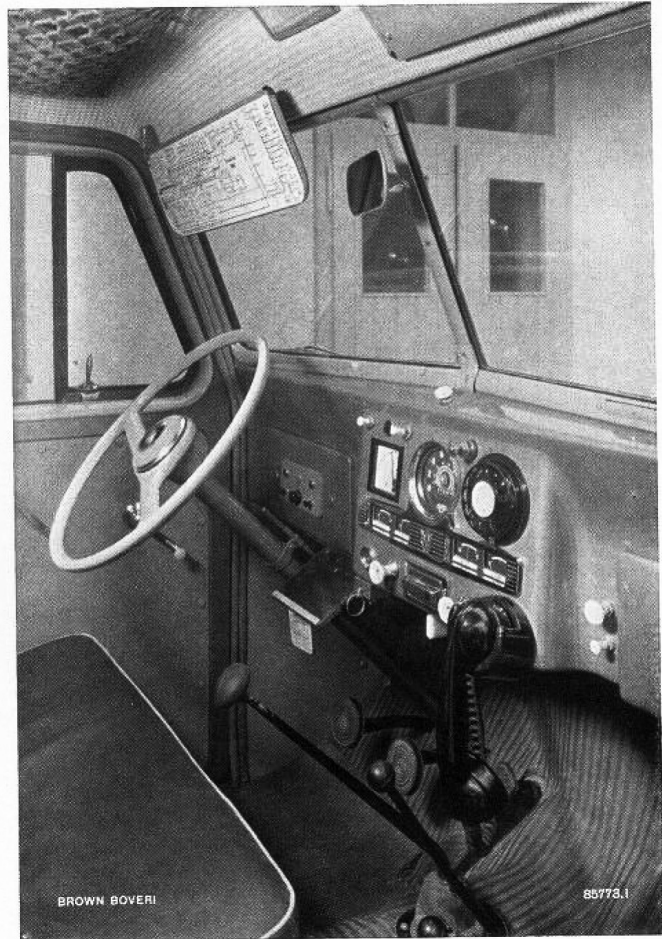


Fig.16. (right) — The ideal vehicle for the erection foreman: in front of him is a plan of the system, within easy reach of his right hand the hand-set and a dial to connect with the public telephone system

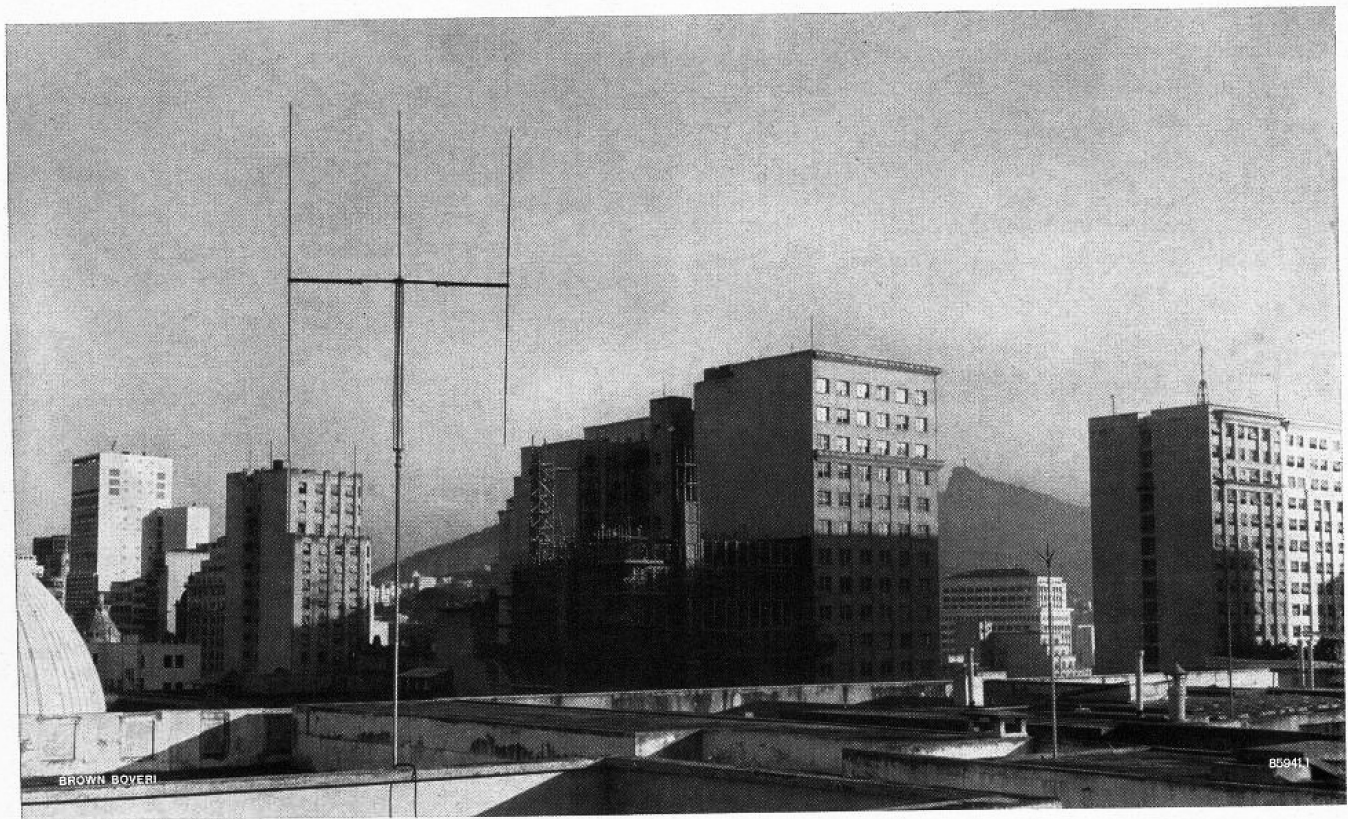


Fig.17. — The directional aerial on the roof of a city skyscraper transmits the telephone messages from the head office direct to factories in the provinces

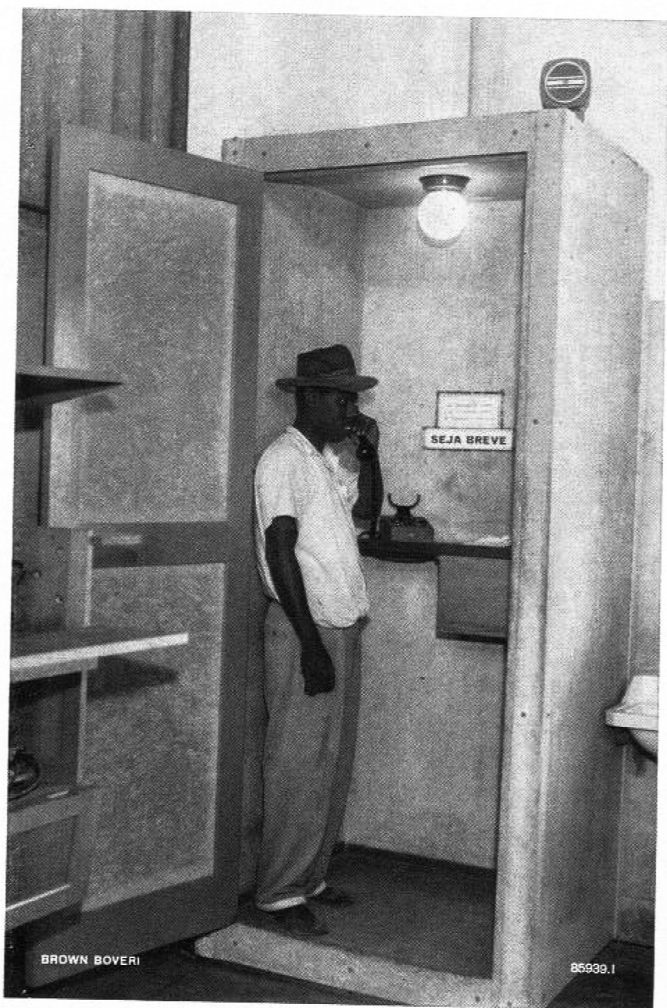


Fig.18. — In countries with difficult terrain the telephone lines into the heart of the country are replaced by v.h.f. radio stations

effective stand-by, as it is ready at any time and can be carried in any type of vehicle. Such emergency stations can be fitted with appropriate additional equipment for operational variants, so that they can transmit special signals peculiar to each telephone system, e.g. for the automatic system (Fig. 16). V.h.f. radio also forms a first-class permanent alternative to lines, wherever the latter would have to cross difficult terrain (e.g. mountains, avalanche slopes, ravines, rivers, lakes or dense forests).

A temporary radio service is also useful when additional communication facilities are required for a short time, such as for festivals, exhibitions, conferences, and meetings.

A special case is the remote radio control of transmitting or receiving stations which are sited well away from the telephone system to obtain favourable radiation conditions. Apart from telephony, it can also be used for transmitting telegraphic and teleprinter signals, whereby several of these channels can be superimposed on one telephony channel. With the subdivision of the Brown Boveri RT 5

set into a separate transmitter and receiver it is quite simple to arrange for one-way traffic (to the transmitting or from the receiving stations).

Reliability and Upkeep

The development and design of the Brown Boveri RT 5 v.h.f. radio set (Fig. 19 and 20) is the result of ten years' experience in the construction of such installations. The valuable data gained from operating under various conditions and in many lands was of course taken into account in the design of the latest model. Particular attention has been devoted to those factors which increase the reliability and simplify periodic maintenance. For example, Fig.21 shows how simple it is to check a fixed station and, if necessary, repair it. Fig.22 gives some idea of the rapid interchangeability of the mobile units; simply release

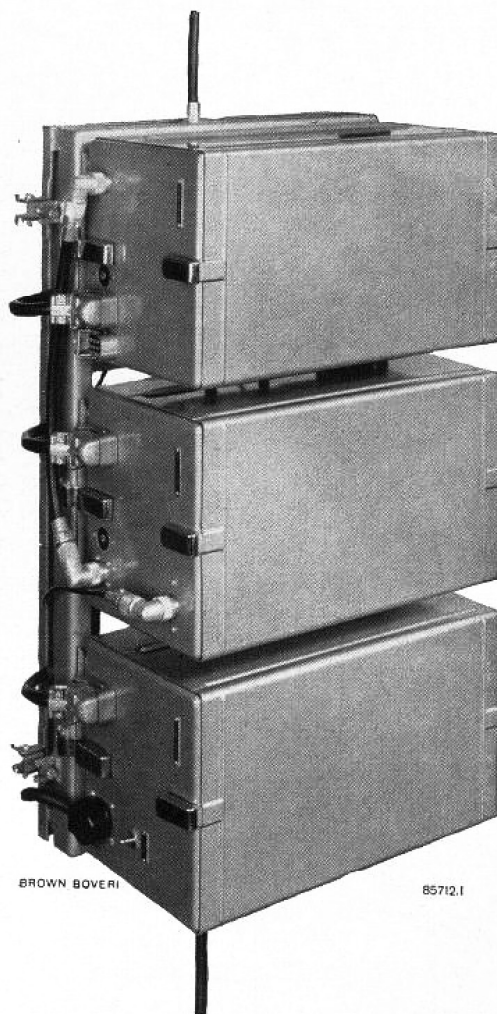


Fig. 19. — Fixed v.h.f. radio set type RT5 on a swivelling wall mounting

Top: Transmitter Middle: Receiver
 Bottom: 115/125/220/250-V, 50/60-c/s power pack

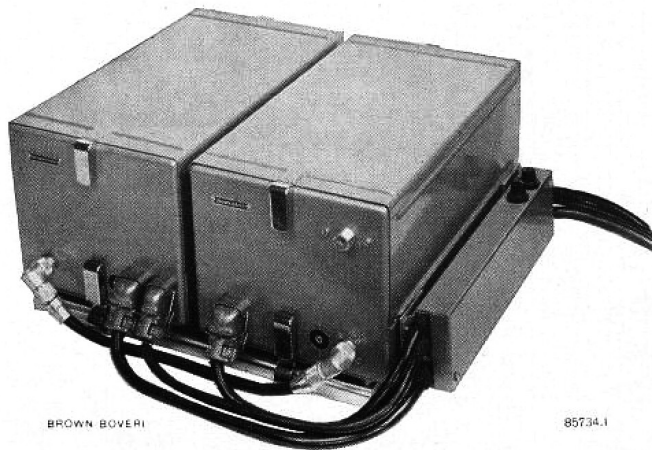


Fig.20. — Mobile radio set type RT5 on chassis for mounting horizontally or in vehicles

Left: Transmitter Right: Receiver
The set is fed straight from a 6- or 12-V battery.

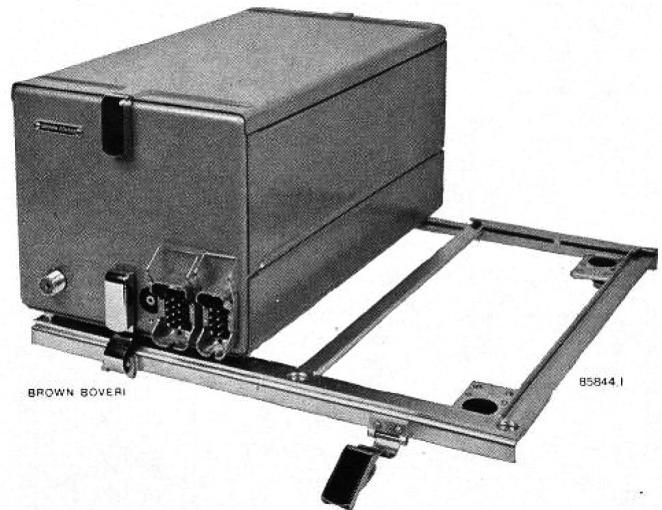


Fig.22. — Assembling and dismantling the set can be performed speedily and conveniently, even in mobile stations

the toggle-catch and the transmitter or receiver is free to be lifted off the mounting for overhaul. Refixing the sections to the sprung frame is equally simple.

The reliability and robustness, together with the convenient method of fixture, form the basis of the superiority of the Brown Boveri mobile radio for rough service under

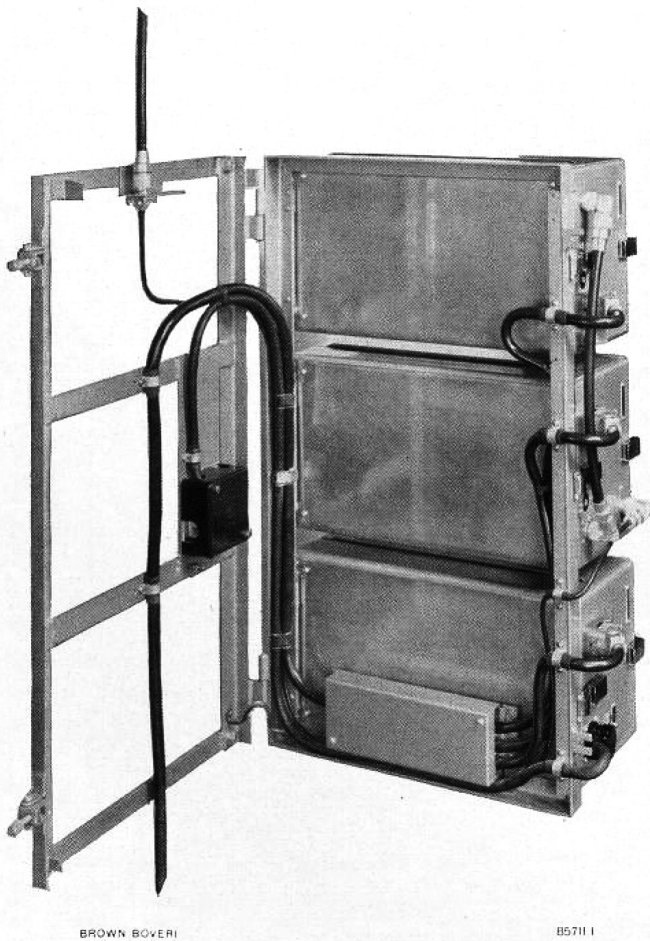


Fig.21. — Rear view of a set (in this case a fixed station) demonstrating accessibility, the wall mounting being designed to pivot



Fig.23. — Hand-set of a fixed Brown Boveri type RT5 radio station
Right: Built-in loud-speaker
Left: Knobs for volume control and channel selection, also two indicator lights which show the state of the station and the system.

difficult conditions. No special knowledge is needed to operate the set (Fig.23). The RT5 can therefore be employed with success in a multiplicity of fields of human endeavour and will also find increasing application in various other spheres not enumerated in this article.

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