Communications News

MOBILE AND MICROWAVE RADIO

VOLUME 2, NUMBER 1 CAMDEN, N. J. WINTER, 1952-53

Tapping Canadian Resources With RCA Radio

Communications News

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In This Issue . . .

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MOBILE AND MICROWAVE RADIO

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RCA MOBILE AND MICROWAVE RADIO TERMINOLOGY

"Carfone" is RCA mobile radio equipment designed for 152-174 mc operation.

"Fleetfone" is RCA mobile radio equipment designed for 30-50 mc operation.

RCA 960 mc Microwave radio equipment is designed for "Short-Haul" application.

RCA 2000 mc Microwave radio equipment is designed for "Long-Haul" application.

EDITORIAL VIEWPOINT

New Communications Division

INCREASING demands for radio communications equipment have made it necessary for us to expand our facilities for handling the sales and servicing of this important part of our business. Our Communications Section, which was previously a part of the Broadcast Division, has been reorganized and set up as a full-fledged marketing division.

This newly created Communications Division will devote itself exclusively to serving the communications industry. It will handle all types of mobile and microwave equipment used for radio communications purposes. The new and enlarged facilities of the Division will enable it to provide government agencies, public safety services and industry with greatly improved service.

The Communications Division will be led by the same qualified and experienced men who have headed our activities in this field during recent years. They will be assisted by an enlarged staff of capable and experienced men drawn from associated activities of the company. Together with an increased staff of field representatives we will be in a position to serve our many friends and prospects better than we have ever been able to do before.

J. P. T.

THE MEN WHO SERVE YOU

C. M. Lewis, Marketing Manager
Communications Division

For more than thirty years "Buck" Lewis has been active in some aspect of radio communications. For the past two years he has been manager for Broadcast and Communications Sales and previously he headed Broadcast Field Sales activities. Appointment of this top young executive as marketing manager coincides with the emergence of communications as a full-fledged Division of the Engineering Products Department.

Mr. Lewis started in radio as an amateur in 1920 (9CCS), has been active in broadcasting as operator, design engineer and sales engineer. He attended Baker University and the University of Kansas, served as engineer of KFKU and WREN in Lawrence, Kansas, and became an RCA transmitter engineer in 1934. From 1938 until the outbreak of World War II, he was in charge of Audio Sales, planning many of the nation's outstanding broadcast studios. During the war, as commercial manager, he handled sales of radar to the military. From 1945 to 1947 he was manager of the RCA Broadcast Transmitter Section and during 1948 was field sales manager for Engineering Products in the Chicago region.

In his new position, Mr. Lewis will be in complete charge of the newly created Communications Division.

TAPPING CANADIAN RESOURCES

Radio Overrides Rugged Mountains and Dense Forests

*by Bruce Lanskail**

ONE of the most fascinating industrialization stories is being unreeled today in Canada. Canadian wealth comes from resources located in heretofore inaccessible terrain. Aviation has opened vast new areas to exploration; radio has helped make possible their development.

Mountainous British Columbia has been difficult of access. Consisting of scattered plateaus and valleys hemmed in by mountain ranges, it could be reached only by sea or through mountain passes. Until recently the settled area was confined to a coastal strip. Colossal developments are taking place in the

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TAPPING CANADIAN RESOURCES WITH RCA RADIO

TELEPHONE

Fig. 1—Radio-telephone switchboard. Hub of network serving 2400 coastal vessels, 320 land stations and 60 mobile subscribers. Handles 25,000 calls per month.

COURTESY: NORTHWEST TELEPHONE CO., VANCOUVER, B. C.

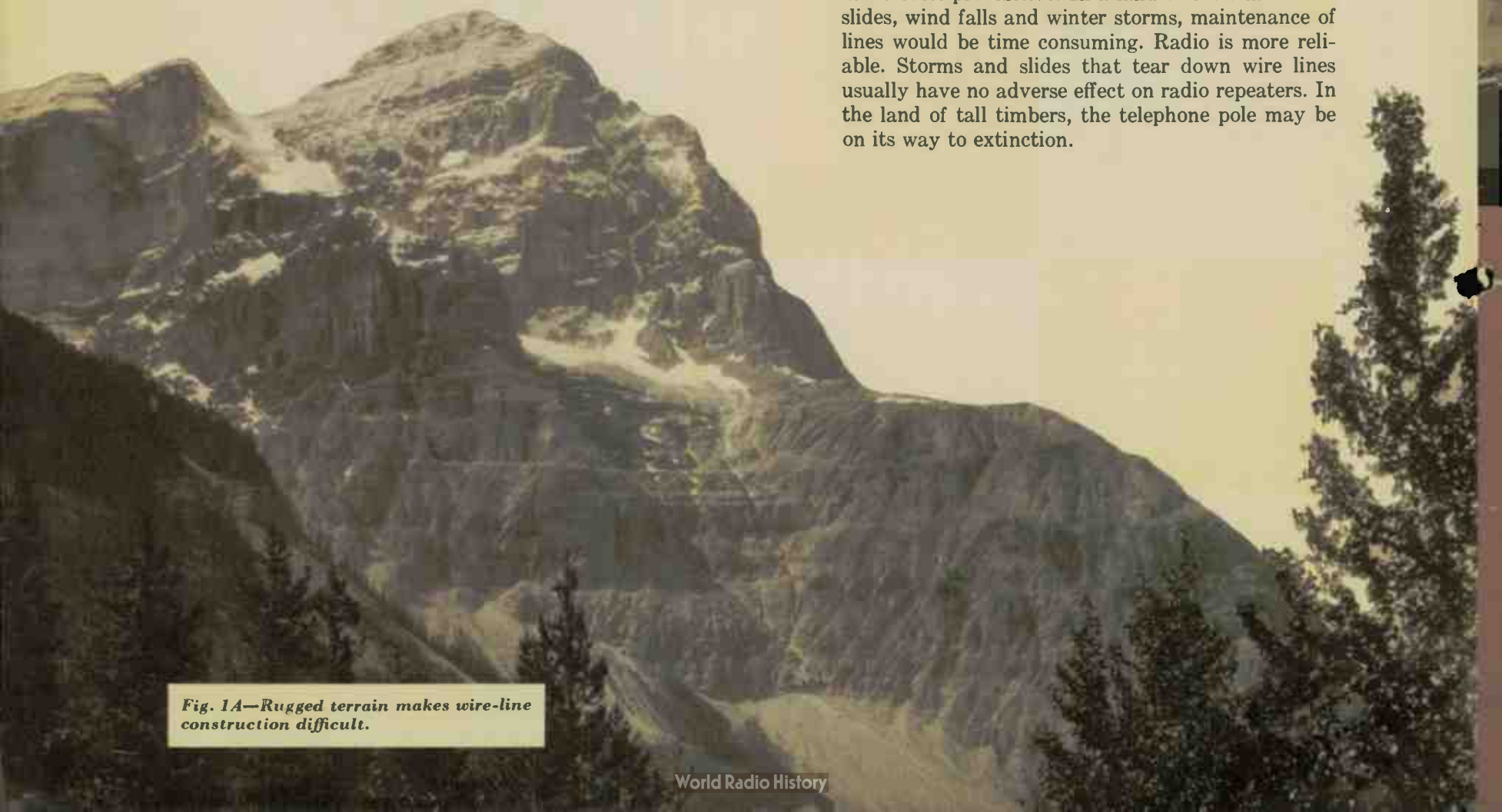

Fig. 1A—Rugged terrain makes wire-line construction difficult.

interior and to the north. In the midst of an industrial boom which has already made Vancouver Canada's third largest city, Canadians are making extensive use of radio to transform isolated regions into integrated civilization.

British Columbia has become Canada's largest user of this space-and-time-challenging means of communications. It serves outlying communities, fishing craft, logging camps, coastal settlements and mines. Police, fire and public works employ it to keep in touch with vehicles and to make their activities more effective. Eventually it will extend to Kitimat and Nechako, 400 miles north in the mountain fastness where the world's largest aluminum power projects are being developed. Then it will extend another 350 miles northeast to Prince George, northernmost railroad junction.

The oil-rich Province of Alberta has found two-way radio expands development, makes industry more productive. Oil and gas companies, and electric utilities utilize this means of communication to speed operations and protect property.

VHF Repeaters

Northwest Telephone Company utilizes 150 mc radio instead of wire lines to connect many outposts with settled areas. A series of repeater stations connects Vancouver with Alert Bay, 220 miles to the north. The radio system is now being expanded farther up the coast making use of latest developments in UHF equipment.

Use of radio rather than land-line or cable means extensive savings in installation and maintenance. Because of difficult terrain, erecting and servicing land-lines would have been practically impossible. Construction crews cutting their way through miles of forest and climbing thousands of feet of mountain, make costs prohibitive. In a land of snow and landslides, wind falls and winter storms, maintenance of lines would be time consuming. Radio is more reliable. Storms and slides that tear down wire lines usually have no adverse effect on radio repeaters. In the land of tall timbers, the telephone pole may be on its way to extinction.

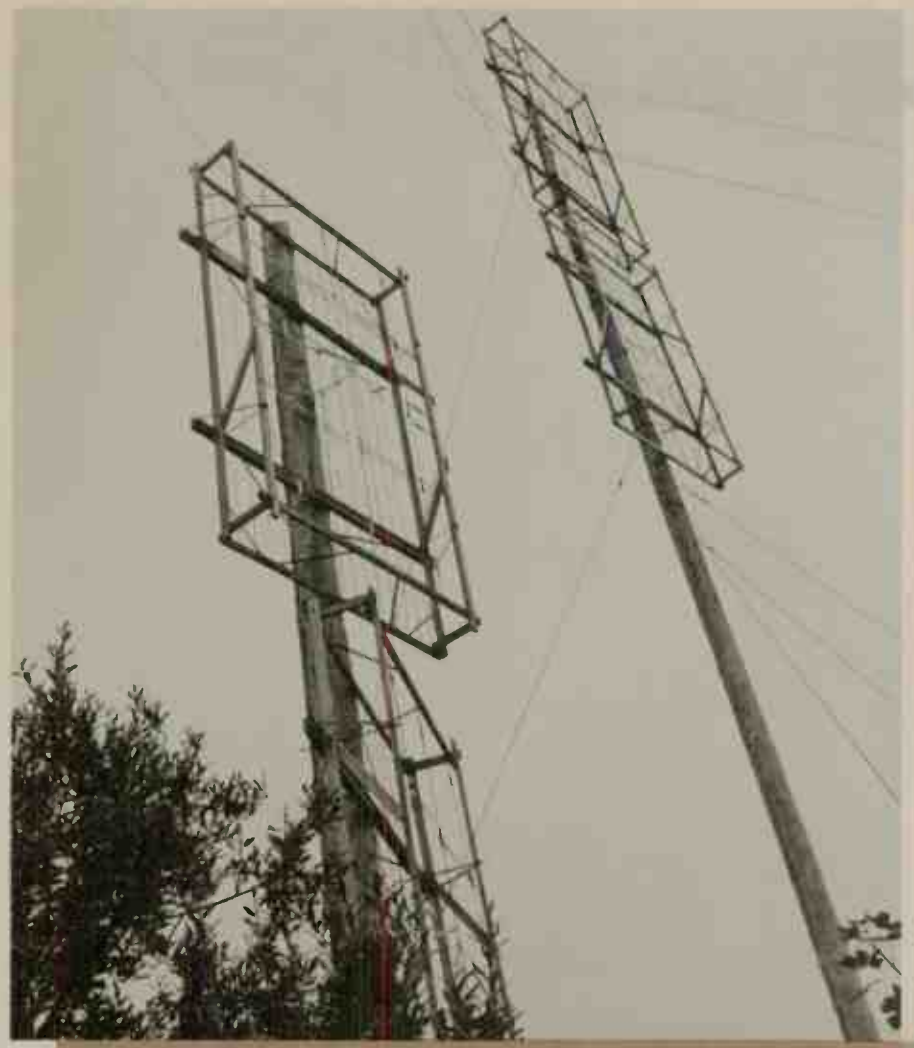

Fig. 2— Antennas used by Northwest Telephone Company at Point Grey.

Fig. 3—Radio repeater stations provide telephone communication.

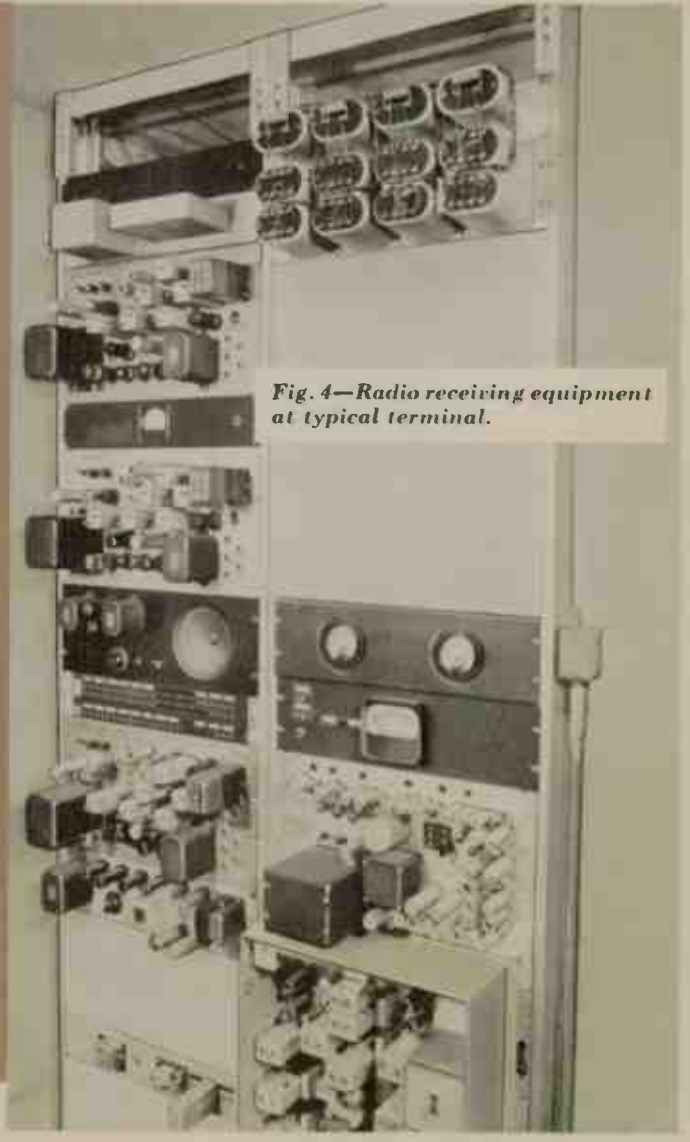

Fig. 4—Radio receiving equipment at typical terminal.

Fig. 5—New Westminster is protected by Carfone radio in police and fire vehicles.

Fig. 6—Vancouver is Canada's third largest city.

Fig. 7—Parliament building in Victoria, Capital of British Columbia.

TAPPING CANADIAN RESOURCES
WITH RCA RADIO

PUBLIC WORKS

Fig. 8—At Copper Mountain 152-mc directional antenna is oriented to Allison Pass.

Fig. 9—Radio station at summit of Allison Pass.

Trans-Canada Highway

Transportation through mountain ranges is a necessary part of the Canadian economy. Since British Columbia became the fourth province in 1869 its links with the rest of the nation have been of chief concern. As a condition of confederation Canada promised to build a railroad across prairies and mountains, joining the older provinces in the east to the new province in the west. Twenty-five years later another railroad was built, through a more northerly pass. Then, just before World War II, the trans-Canada highway wound its way through the mountains.

A particularly important link in the southern trans-provincial highway lies between Hope and Princeton: rugged mountains and high elevations cause numerous urgencies. Snow removal, clearance of rock slides, and road repairs demand immediate attention. To avoid 24-hour patrols highway maintenance vehicles are directed when and where needed by means of radio.

Many of the acute conditions besetting maintenance of telephone lines also affect highway upkeep. Use of two-way communication has enabled authorities to cope with this situation.

B R I T I S H

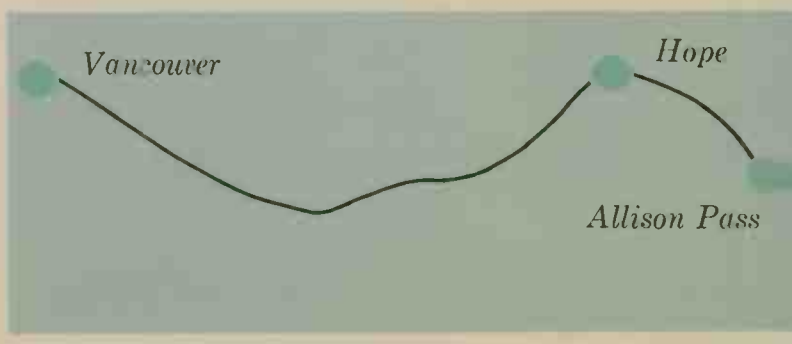

Fig. 10—Vital segment of Trans-Canada highway lies between Hope and Princeton.

Fig. 11—Operator of snow blower keeps in touch with highway office by Carfone radio.

Fig. 12—George Kelly tests two-way communication equipment at Hope.

Highway Maintenance

A combined point-to-point and mobile communication system was devised. Thus, highway authorities keep in touch with all offices and vehicles. Point-to-point communication is established from Allison Pass, operational headquarters, to Hope and Princeton. Mobile communication covers the highway itself.

Fixed stations at Hope, Allison Pass and Copper Mountain employ 40-watt Carfone radio equipment. A 15-watt Carfone at Copper Mountain works a link into a similar unit at Princeton.

At Hope a 12-element directional antenna array is pointed southeast towards Allison Pass. The radio equipment is remotely controlled over telephone lines from the public works office in Hope.

At Allison Pass two transmitter-receivers are employed. One connects to a 602-B antenna orientated west to give greatest signal intensity on Hope circuit. The other connects to a 12-element array pointed southeast to Copper Mountain. The installation is 850 feet above main public works camp at highway level. Power and control lines are brought from camp to installation elevation.

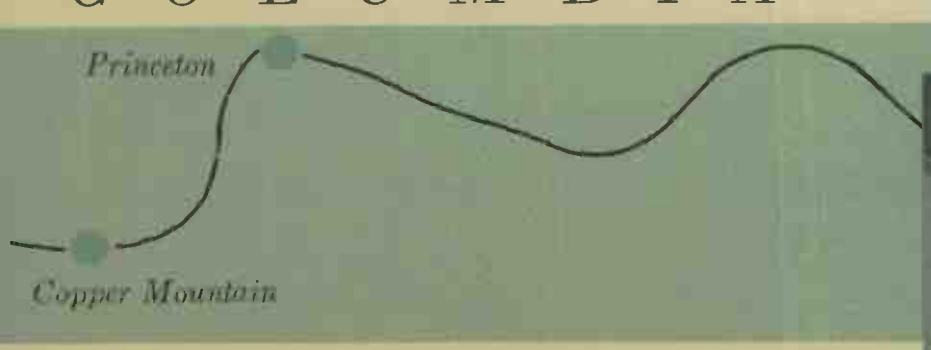

Fig. 13—Radio control at Allison Pass.

Fig. 15—Emergencies can be promptly dealt with.

Fig. 13A—Typical winter scene on highway near Hope.

Fig. 16—Radio saves miles in routing of truck tankers.

Fig. 17—Dump trucks are equipped for two-way communication.

Fig. 18—Radio transmitter-receiver unit is installed inside cab of road grader.

Radio Repeater

At Copper Mountain the 40-watt Carfone connects to a 602-B antenna. Power is obtained from a local mining camp. The station is controlled by 15-watt radio link from Princeton. In effect, Copper Mountain serves as an automatic repeater station.

All equipment is on same frequency—except link between Copper Mountain and Princeton—thus any station can talk to mobile units within range. Allison Pass can talk directly to Hope and Princeton. Complete mobile coverage of the highway means that vehicles can always contact one station or another wherever they may be. Supervisors are in touch with all vehicles and offices to coordinate public works activities.

Fig. 14—Highway maintenance is expedited by use of 15 radio-equipped vehicles.

TAPPING CANADIAN RESOURCES
WITH RCA RADIO

PUBLIC SAFETY

Fig. 19—Mounties employ some 75 Fleetfone-equipped cars.

Fire and Police

Radio in British Columbia is the accepted medium of communication for public safety. Royal Canadian Mounted Police, serving also as provincial police, have in use a large number of Fleetfone equipments. In the lower mainland, Mounties operate six base stations, six in Vancouver Island and installations were recently made in the Kootenay area. Some seventy-five mobile units are in continuous contact with fifteen fixed stations.

Vancouver City fire and public works departments utilize mobile radio for tracing trouble and fighting fires. In the harbor a radio equipped fire boat has helped battle several serious conflagrations. Police and fire cars in New Westminster are likewise equipped with two-way radio.

Fig. 20—Radio-equipped fireboat helps Vancouver battle waterfront blazes.

Fig. 21—Fire Chief Highstead keeps in contact with New Westminster apparatus and stations by radio.

Fig. 22—Radio installation in New Westminster police car.

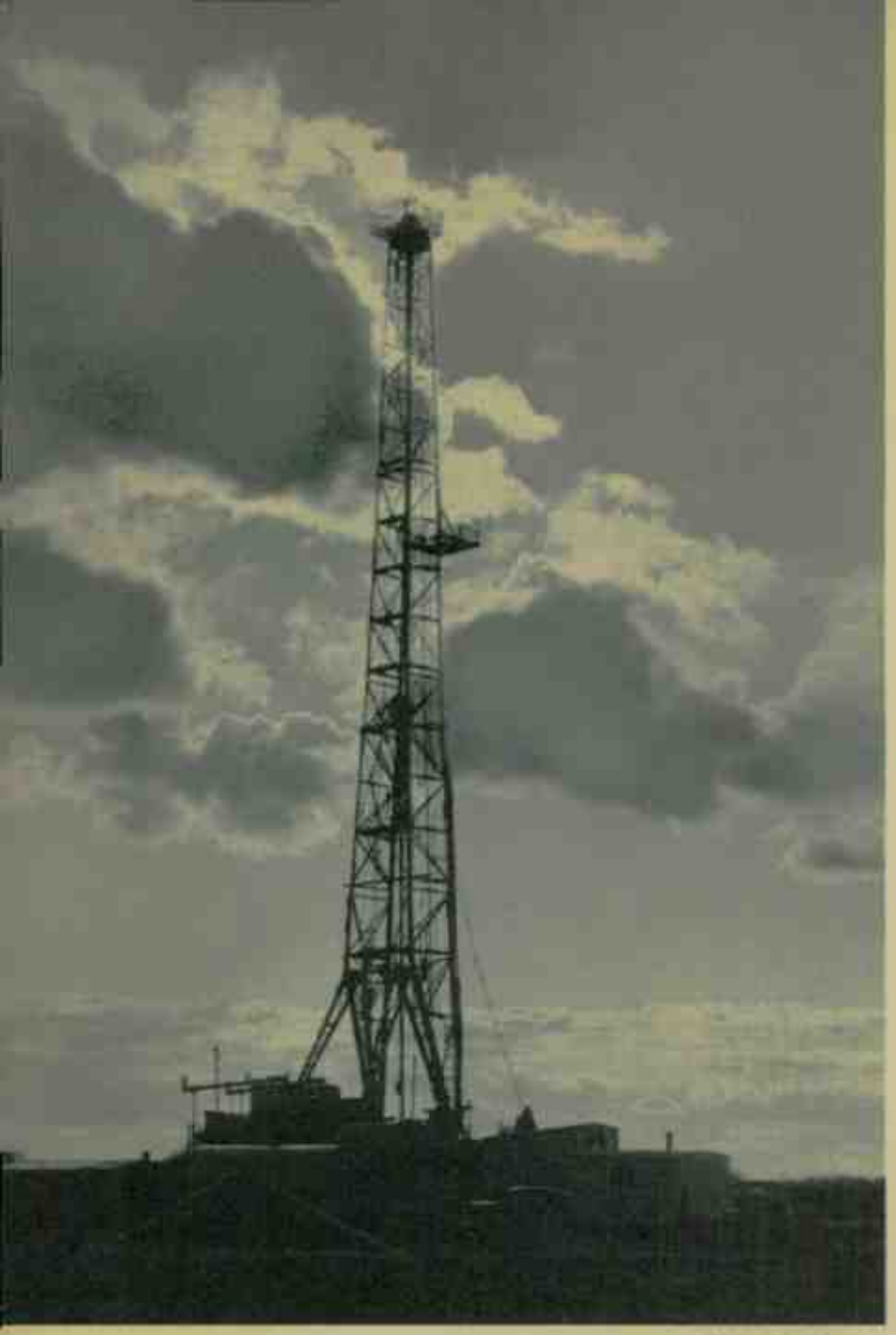

Fig. 23—Oil-rich Province of Alberta.

Fig. 24—Edmonton, capital city of Alberta.

TAPPING CANADIAN RESOURCES
WITH RCA RADIO

PUBLIC UTILITIES

Uninterrupted Service

The Province of Alberta has developed a highly important radio function since the discovery of gas and oil. Gas companies were in difficulty, seeking to maintain lines and keeping abreast of breaks. Two hundred miles of line made detection and repair a slow task. Gas had to be shut off in each user's premises whenever pressure was reduced to a dangerous level. Two-way radio has made it possible to communicate at once with service cars so that repairs can be undertaken without loss of time.

Northwestern Utilities has found mobile communication means increased efficiency of operation and surer protection of property. From Edmonton, the provincial capital, radio extends into various gas fields in a 125-mile radius. Fifty-seven cars and trucks are equipped for two-way communication.

Gas Company Systems

In southwestern Alberta, Canadian Western Gas is building a pipe line to collect gas from wells at Jumping Pound for distribution to Calgary and Banff. This pipe line will also constitute a tie-in with an integrating grid system for export possibilities. Twelve mobile units and a fixed station were initially used during construction of the line in the vicinity of Calgary. A repeater station has now been erected at Jumping Pound and a terminal is being built at Banff. Three frequencies are used; two serve for point-to-point communication; the third for mobile vehicles along the pipe line. Mobile signals are rebroadcast from terminals and repeaters, providing vehicular coverage all along the pipe line.

Fig. 25—Main station of Northwestern Utilities at Edmonton. Antennas orient east to Viking and south to Red Deer.

A link between Calgary and Turner Valley wells will shortly be installed. Long-range planning includes a circuit with five repeater points between Calgary and Burdett, in southeast Alberta, with further connections north to Red Deer. Here the circuit will join that of Northwestern Utilities.

In northern Alberta Northwestern Utilities operates out of Edmonton over two separate links. One runs to the east through Tofield to Viking and the Kinsella gas fields, a distance of approximately 135 miles. The other link runs south through Wetaskiwin to Red Deer, 100 miles from Edmonton. Fifty-seven mobile stations are in operation.

Mountains as Reflectors

Communications circuits of Calgary Power Company extend from Calgary west, through Ghost power house and Kananaskis, to Cascade—4 miles east of Banff. This circuit uses mountains as reflectors, saving a repeater between Cascade and Kananaskis. Distance involved is only 18 miles, but covers a valley between mountains ranging up to 10,000 feet. In addition, a turn of almost 90 degrees occurs at mid-point. Antennas at either terminal are focused in line with the valley, at right angles to each other.

Further use of reflection is made from Calgary to three power houses. Direct communication with Ghost, some 33 miles distant, is cut off by low-ranging hills. The reflected signal from Calgary, via ranges to the southwest, travels approximately 140 miles.

RCA Victor Contributions

Considerable radio equipment has been supplied by RCA to the Northwest Telephone Company. Their 450 mc equipment has been designed by Canadian RCA engineers. Vancouver, Westminster and Royal Canadian Mounted Police employ Carfone and Fleetfone systems. Important contributions have been made by RCA towards solving communications problems of gas and electric utilities. Equipment supplied and installed by RCA Victor Company, Ltd., is assisting to make British Columbia and Alberta fabulously prosperous areas.

Fig. 26—High pressure station near Calgary. Right antenna faces west to Jumping Pound, left faces north to Red Deer.

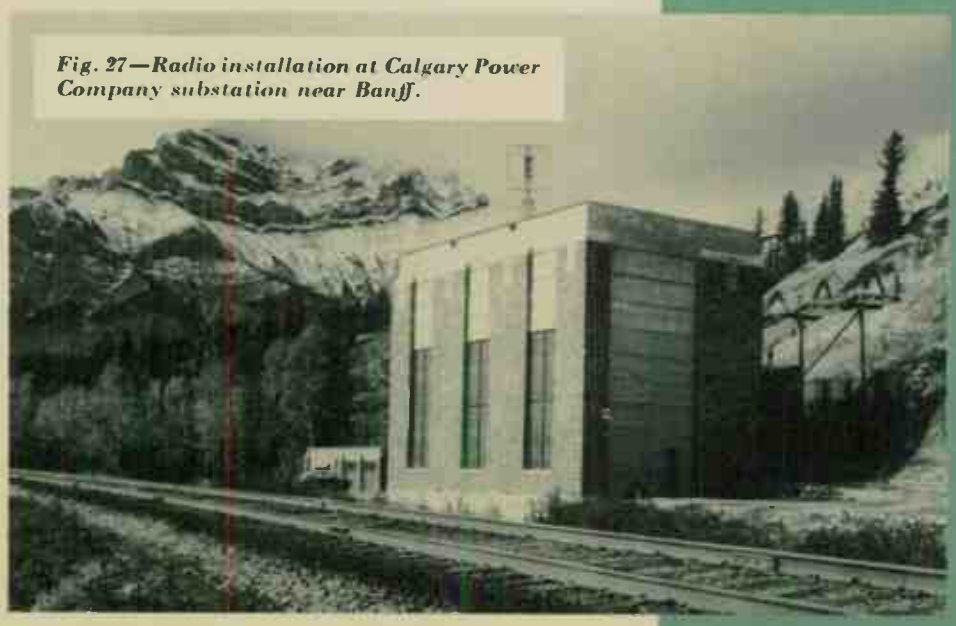

Fig. 27—Radio installation at Calgary Power Company substation near Banff.

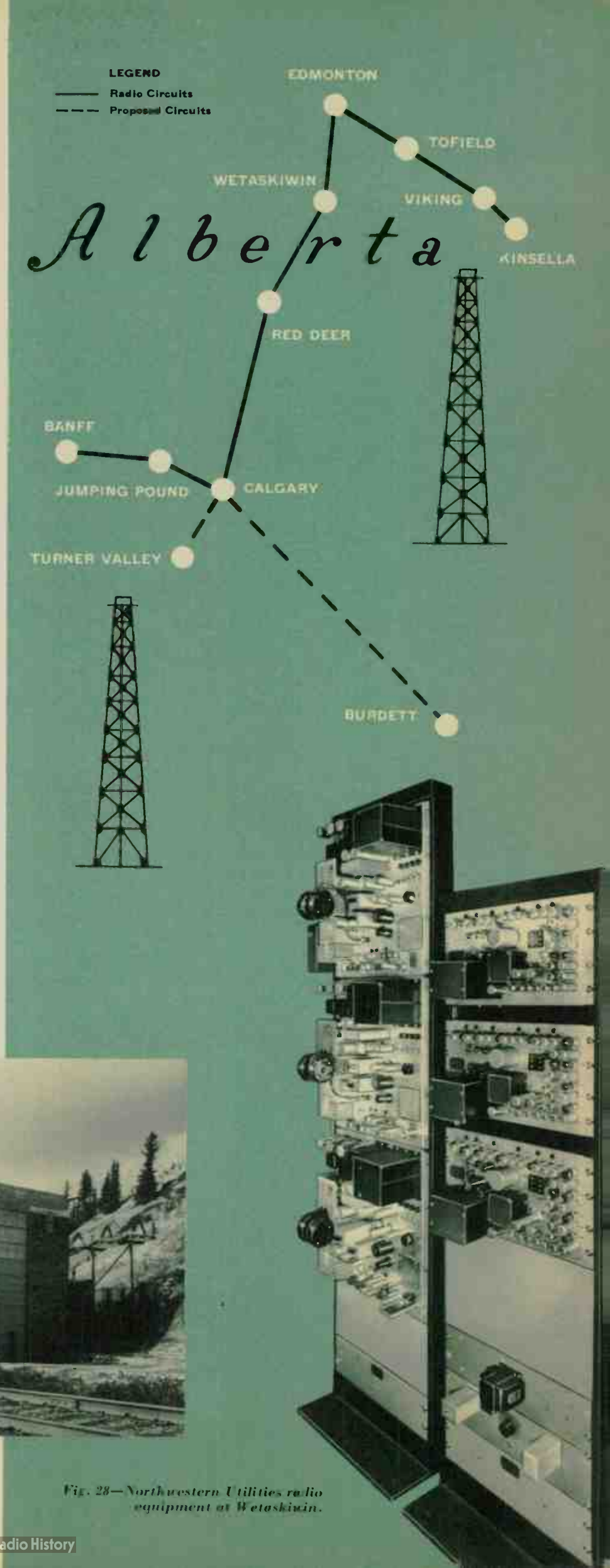

Fig. 28—Northwestern Utilities radio equipment at Wetaskiwin.

Two-Way Communication Between Office and Men in the Field

SHORTENS CONSTRUCTION SCHEDULES

Fig. 1—Estimator Gene Megard doubles as radio dispatcher. Equipment consists of 70-watt transmitter, loudspeaker and handset. All conversations are heard here.

"Radio saves time" reports Charles Davis, Secretary, Davis Construction Corporation, Long Island, New York. "We get in touch with men on jobs faster and move equipment where needed without delay. We finish contracts on schedule."

Two-way radio was installed April, 1951. Eight vehicles are equipped with 30-watt transmitter-receivers. In the office a 70-watt station is nerve center of the system. Each vehicle is assigned a number for fast identification. Under normal conditions, two-way communication extends over a radius of 25–30 miles. Distances up to 40 miles are covered. *Fleetfone* radio equipment is employed.

Mobile transmitter-receiver is contained in single metal case 8 x 11 x 16 inches. This is placed either in trunk of car or in cab of truck. Controls, loudspeaker and microphone are mounted on dashboard. Equipment is powered by car battery.

Base station transmitter-receiver is contained in a 63 x 24 x 18 inch cabinet. Loudspeaker on desk monitors conversations and announces incoming calls. Telephone-type handset is employed for talking with vehicles. Mounted on roof of office building, RCA ground plane antenna 30 feet high radiates the radio signal.

Party Line Operation

Single frequency operation is used. Each vehicle can talk to any other or can talk to office, and office can talk to any vehicle. It's like a party line over which everyone hears everything that is being said. By this means supervisors and key personnel are kept up-to-the-minute on status of jobs.

"Radio cuts operating costs" according to Office Manager Wood. "We save time getting messages back to the office as well as to men in the field. Saving two or three hours per day is not unusual. Since equipment costs as much as ten to twelve dollars per hour to operate, that means considerable.

"On long jobs we have spent as much as forty minutes getting messages from one end to the other. At $1.90 per hour that mounts up.

"We can get spot decisions. There is no delay waiting for men to phone the office.

"Insofar as maintenance is concerned, we get parts fast. Breakdowns are reported at once, keeping overtime to a minimum."

Davis Construction specializes in building roads, airport runways and parking fields. It undertakes federal, state and county besides private contracts. Started in 1898, the business has been handed down from father to three sons. Since 1927, Albert is President, Charles is Secretary and Frank is Treasurer.

"The performance of our two-way communications equipment has exceeded our expectations," reports President Albert Davis. "As a result, we have increased the number of mobile units from eight to eighteen and have added another base station. The latter is located at our field office in Levittown, Pennsylvania."

The Davis radio system was planned by RCA District Manager Harry Boyle, in cooperation with Louis H. Cattaneo, General Superintendent for Davis Construction. Mr. Boyle assisted in filing application with the FCC and provided for installation and maintenance of the radio system.

For more information on two-way radio mail card on page 31.

Fig. 3—RCA mobile radio. Transmitter-receiver mounts in car trunk or truck cab. Speaker and controls mount under dashboard.

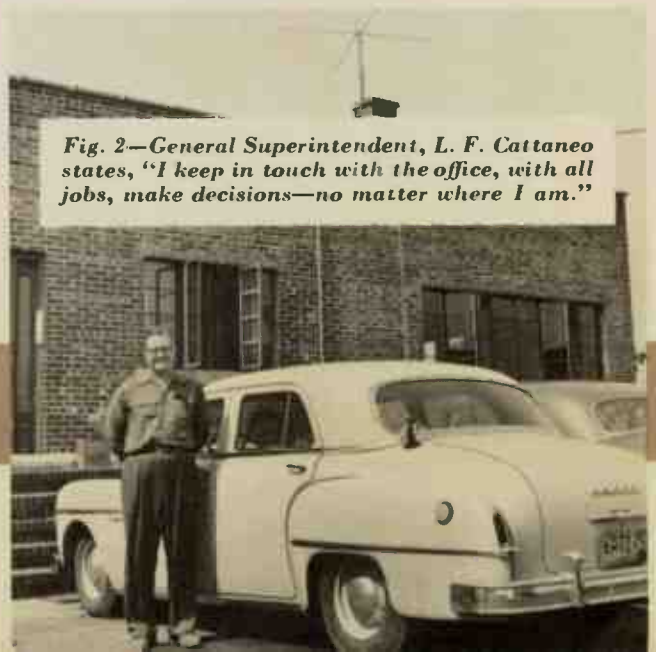

Fig. 2—General Superintendent, L. F. Cattaneo states, "I keep in touch with the office, with all jobs, make decisions—no matter where I am."

Fig. 4—Headquarters of Davis Construction Corporation showing radio antenna. A radius of 25-30 miles from the office is covered.

Fig. 5—Two-way radio is especially useful on jobs which are several miles long and not near a telephone.

Fig. 6—Secretary Charles Davis reports: "Radio saves time contacting men in the field. Especially convenient for moving equipment—can change orders or divert for more important job at once."

Fig. 7—Field mechanic Alfred Colaes says, "Radio is a real convenience. Helps me out when I get stuck on a job—can get men and materials rapidly."

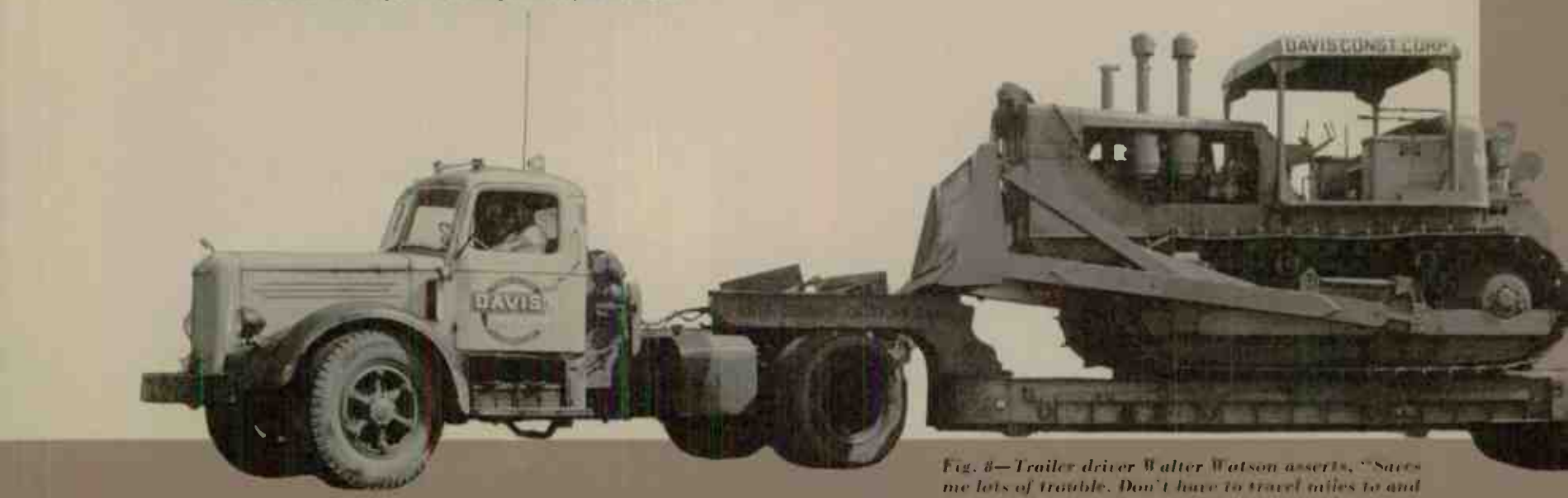

Fig. 8—Trailer driver Walter Watson asserts, "Saves me lots of trouble. Don't have to travel miles to and from a telephone. I can move equipment fast."

PHOTOGRAPHS BY R. B. ALLEN

INTERFERENCE

INTERFERENCE

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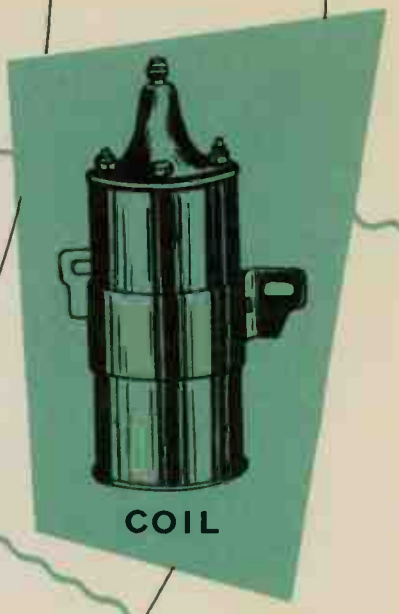
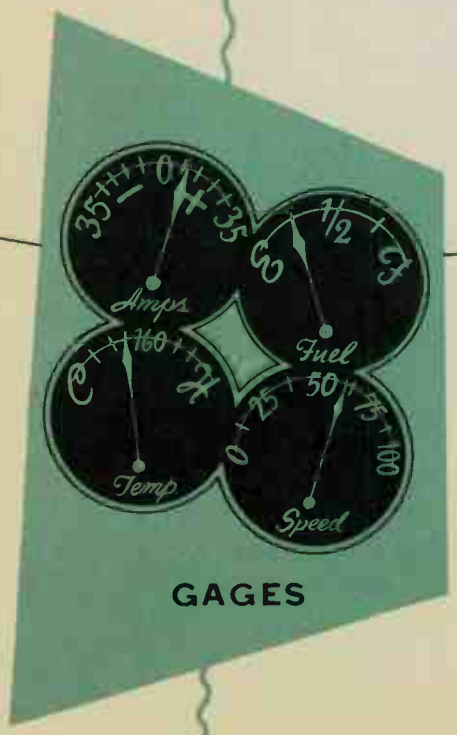
INTERFERENCE

INTERFERENCE

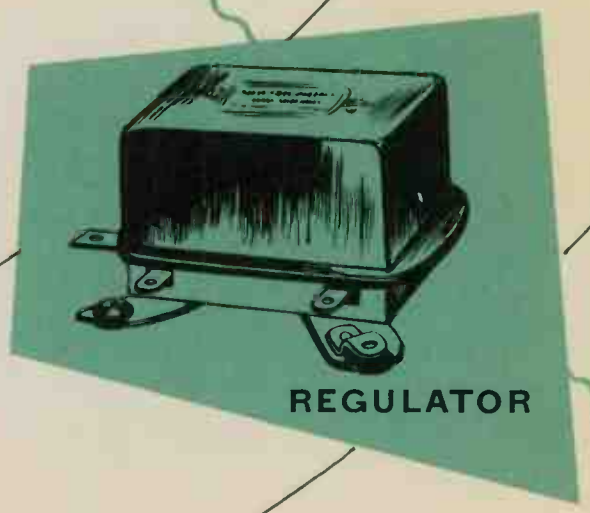


COIL

SPARK PLUG



GAGES



REGULATOR

by Brooks H. Short

Supervisor, Engineering Research Department, Delco-Remy Division, General Motors Corporation, Anderson, Indiana.

HOW TO ELIMINATE AUTOMOTIVE RADIO NOISE

Adapted from an article entitled "Automotive Radio Noise Elimination" appearing in QST, April, 1952, published by The American Radio Relay League, West Hartford 7, Conn.

ELECTRICAL components in cars and trucks constitute potential sources of radio interference. Following a few simple steps these can either be completely eradicated or reduced to negligible proportions. In considering this problem we break the automotive electrical system down into its constituent parts.

Ignition Noises

After distributor contacts have opened and ignition occurred, condenser becomes charged to full battery potential. When contacts close, stored energy flows through condenser lead, breaker points, ground plate, and capacitor mounting bracket. Thus an appreciable amount of inductance is in series with capacitor. Combined with condenser such inductance forms a resonant circuit tuned to a frequency in the broadcast band. This source of interference is usually eliminated by manufacturer in design and construction of distributor. Delco-Remy nests components well down in distributor bowl, shielding source of noise.

A second source of interference lies in distributor proper, occurring each time gap between rotor electrode and a cap insert breaks down. Amount of noise formed is proportional to voltage before breakdown. Frequency is function of time required to break gap down completely. In this phenomenon, ignition coil is raising potential of distributor lead along a 2500-cycle-per-second wave. When potential reaches approximately 10,000 volts distributor gap breaks down, establishing an arc between rotor electrode and cap insert. Simultaneously, capacitance of both lead and spark plug is connected to coil secondary. Sudden increase in capacitance causes voltage to drop sharply—a source of radio noise.

Suppressing Ignition Noises

Resistors are effective in combating this source of interference. Their high impedance prevents high-frequency currents from flowing. A 5000-ohm suppressor unit in each spark plug tower with a 10,000 ohm in the center distributor tower does an effective job. Suppressor elements should consist of molded material having low capacitance. Resistors should closely approximate same value at both high and low voltage.[1]

A third source of ignition noise occurs at spark plug. It has been raised to 8000–22,000 volts, then breaks down to approximately 1500 volts. Change in potential occurs rapidly, creating noise of great magnitude over wide frequency range. Again, resistors constitute best method of suppression. A 10,000-ohm resistor either built into each spark plug or mounted externally is equally effective.[2] See Fig. 1.

Eliminating H-F Transients

Ignition noise may be reflected in coil secondary, transferred to primary, and appear at battery with sufficient energy to drive noise through wiring system. Use of a filter will discourage these transients.

[1]Erie Model L7VR-10ME 10,000-ohm and L7VR-5ME 5000-ohm resistors have been found effective.

[2]Package Electric Division and Pontiac Motor Division of GMC make use of non-metallic high-tension cable to eliminate suppressors both at distributor and spark plugs. Having approximately 3500 ohms resistance per foot it is used for all high tension leads in 1951 Pontiacs. Used in original lengths these leads do an excellent noise-suppression job. But, attempts to shorten them result in extremely short life.

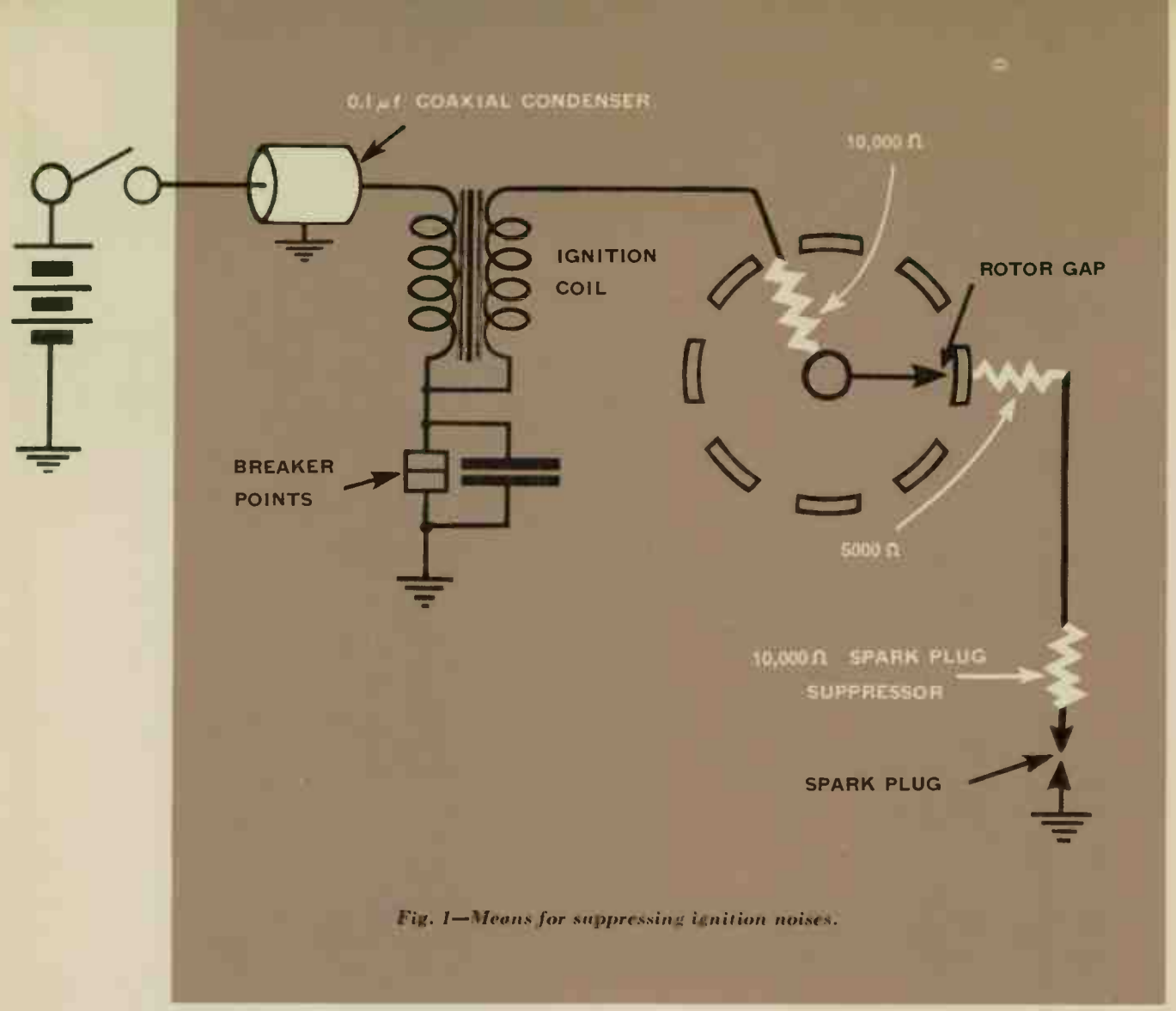


Fig. 1—Means for suppressing ignition noises.

The usual 0.3 μf condenser (Fig. 2) has proved of little value. With a total lead length of only one inch, by-pass action is effective at 2.03 mc, but at 4 mc is practically worthless (Fig. 3).

A capacitor having extremely low inductance is required. Coaxial, or feed-through type, combining large core diameter with thin winding in radial[3] direction gives satisfactory inductance cancellation. See Figs. 4 and 5.

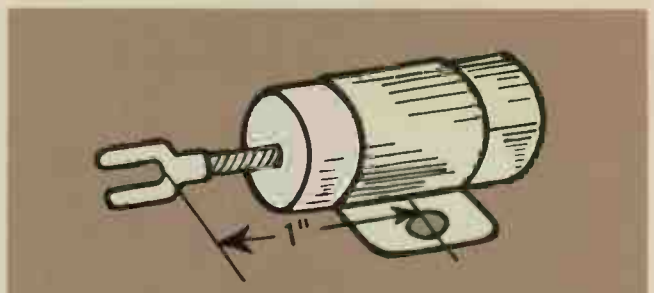


Fig. 2—Inductance of conventional by-pass capacitor restricts usefulness.

Mount coaxial capacitor close to battery terminal of coil, with core installed in ignition-switch lead. This will discourage h-f energy getting into low-voltage wiring. In difficult cases, two capacitors should be used with r-f choke. Value of choke can be determined by experiment to suit particular installation. In making choke, wire used must have sufficient cross-sectional area to carry current without appreciable drop.

[3]These capacitors may be obtained from several condenser manufacturers.

Should additional suppression be required, metallic shielding must be employed. Double-braid shielding, pulled over high-tension leads and grounded at both ends, will eliminate residual noise.

Generator Noises

Brushes carrying current to and from commutator constitute a source of interference. Although brushes appear to be in mechanical contact with commutator, they are actually separated by a gaseous medium. Current is conducted between brush and commutator by a group of parallel arcs (Fig. 6). As more current is carried, more arcs are formed. Arcs are continuously forming and dying out. No one arc persists very long. This sputtering, formation and decay of conducting arcs is a source of noise.

Another disturbance arises from commutation. In Fig. 7 (1) and (2) indicate conductors on opposite

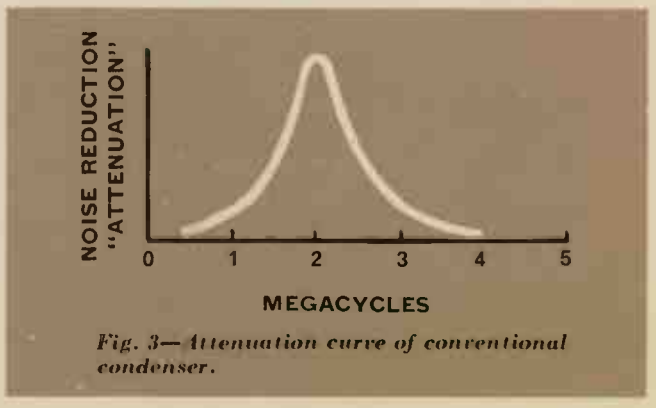


Fig. 3—Attenuation curve of conventional condenser.

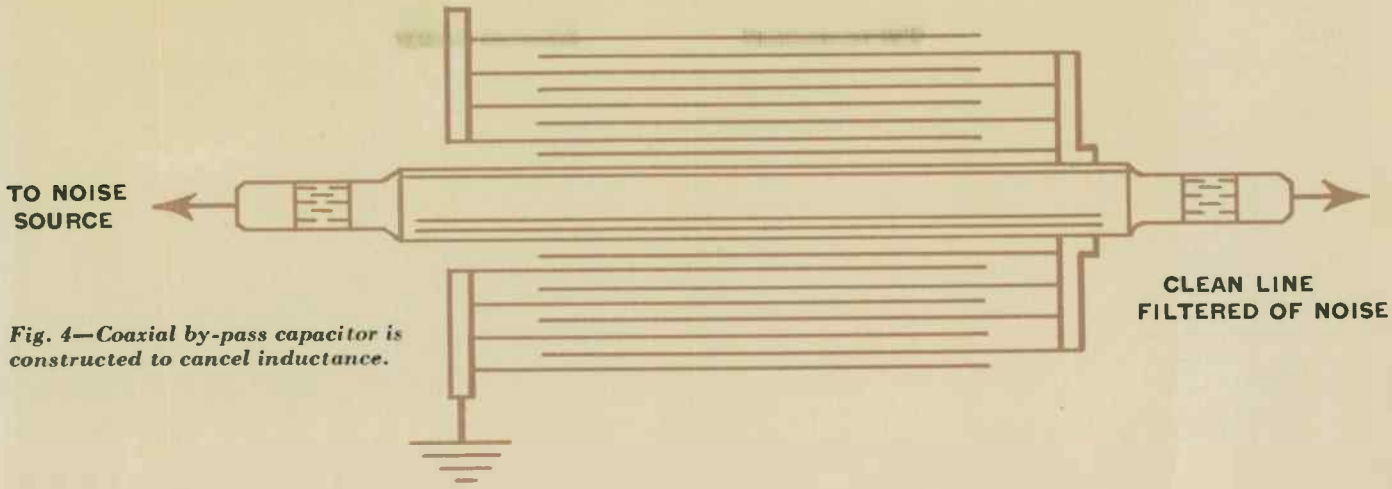


Fig. 4—Coaxial by-pass capacitor is constructed to cancel inductance.

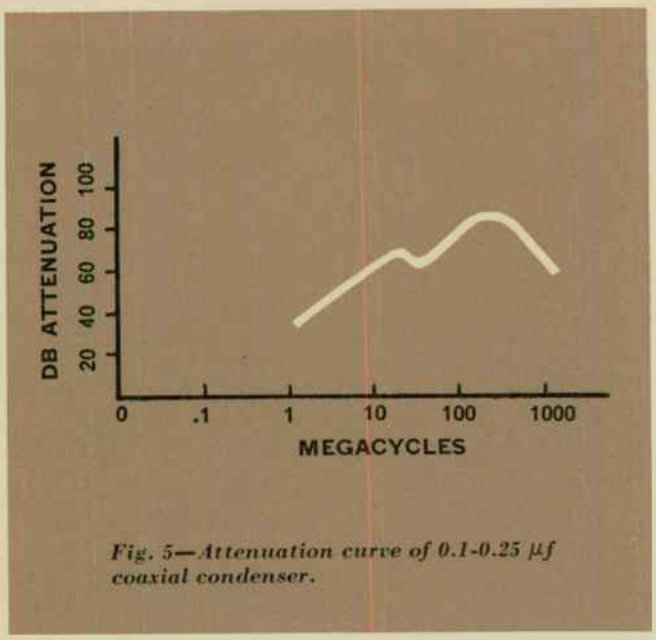


Fig. 5—Attenuation curve of 0.1-0.25 μf coaxial condenser.

sides of armature. When conductor (1) is at point A, it will be carrying current in one direction while conductor (2) at point B will be carrying current in the opposite direction. When armature has rotated 180 degrees, conductor (1) is at point B and current flow is reversed. This reversal (commutation) took place while coil was shorted by brush. Perfect commutation is indicated by line A in Fig. 8. Such linear commutation can be obtained only in a generator designed for unchanging values of voltage and current, operated at uniform speed. Automobile generators operate over wide ranges of speed and are called upon to deliver widely varying currents and voltages. Hence, current value may appear as shown in curve B of Fig. 8. Under such conditions, current value is changed practically instantaneously by as much as 50 per cent of normal value. This produces radio interference.

Correcting Generator Interference

Both noises can be eliminated by using an 0.1 to 0.25 μf coaxial capacitor in generator armature circuit. Mount condenser as near armature terminal as possible. Mount condenser directly on generator frame.

Eliminating "Shaft Static"

During rotation the generator shaft-and-armature assembly, cushioned by an insulating film of lubricant, picks up an electrostatic charge. Potential increases until lubricant breaks down. At breakdown, radio frequencies are generated. Values are determined by size and shape of generator, considered as a cavity resonator. To eliminate this shaft static arrangement shown in Fig. 9 is found effective, especially for

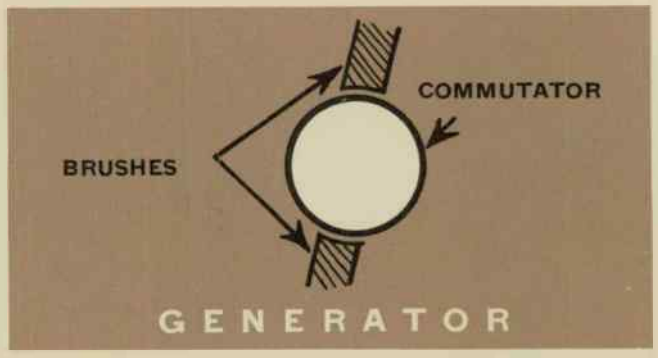
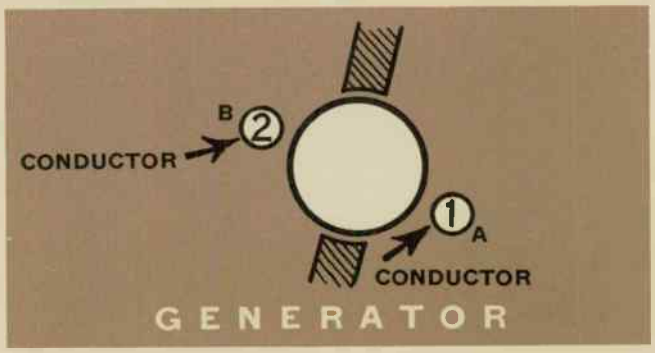


Fig. 6—Arcs between brushes and commutator cause radio noise.

Fig. 7—Rapid reversal of current flow during commutation produces interference.



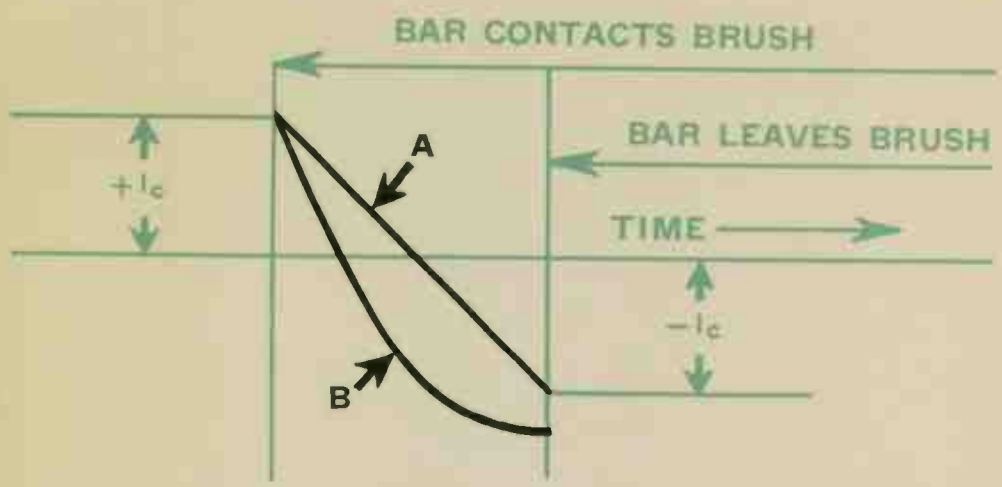


Fig. 8—Linear commutation "A" vs operating conditions of auto generator "B".

radio equipment operating on 150 mc. A brass ring or flange is pressed upon the shaft and grounded by a spring-mounted brush. It must be mounted on the drive end of the shaft.

Regulator Noises

More than any other component in the electrical system the regulator is responsible for interference. Energy-producing regulator noise comes from generator field. Figure 10 shows circuit diagram of generator with that part of regulator causing noise generation. As critical speed is reached, either current or voltage regulator contacts vibrate. During one cycle of vibration, when either set of contacts opens, regulator resistor is placed in series with generator field. This results in instantaneous voltage rise of large proportion, producing radio noise. Since regulator contacts do not have fixed frequency of operation, but open and close at irregular intervals, interference sounds ragged.

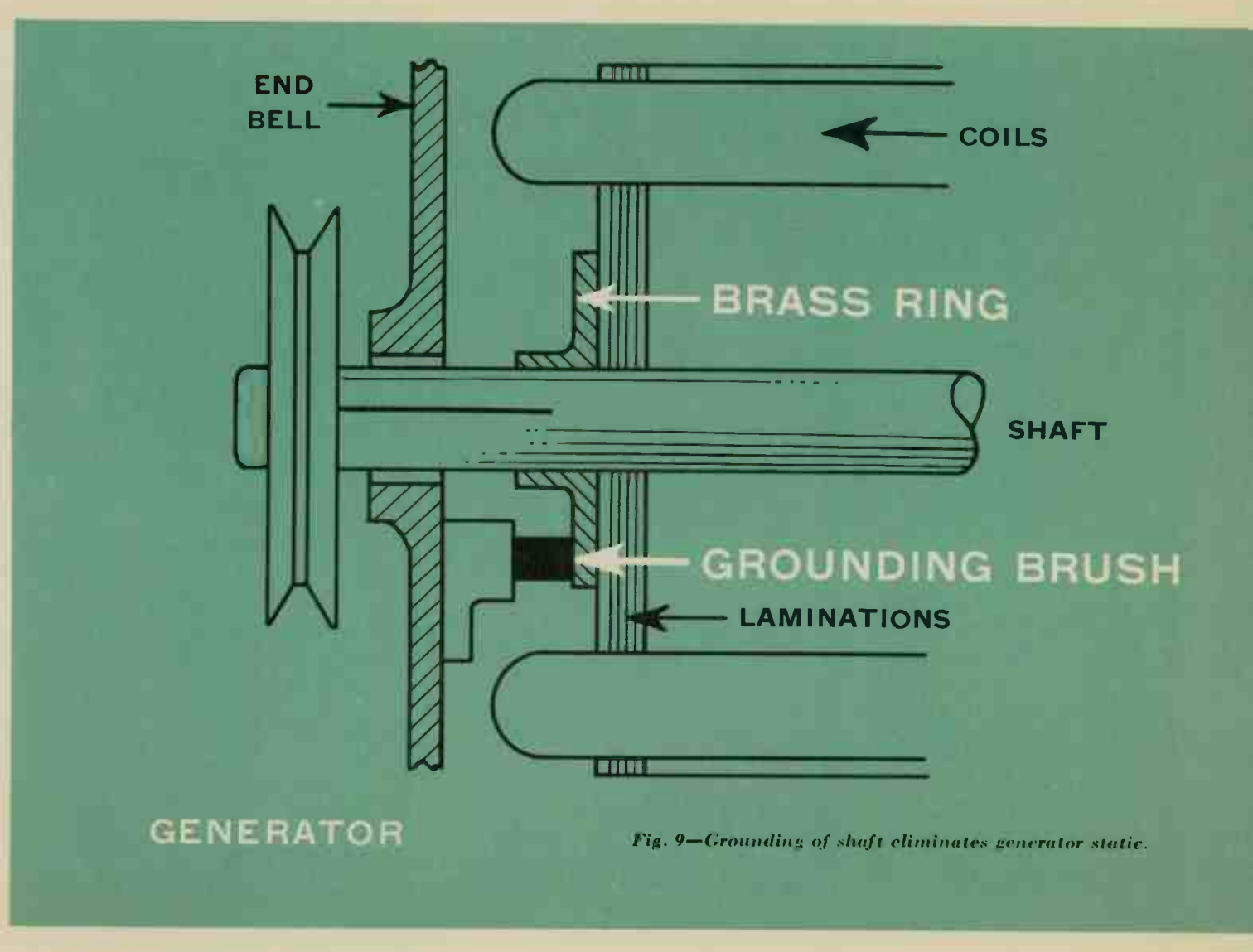


Fig. 9—Grounding of shaft eliminates generator static.

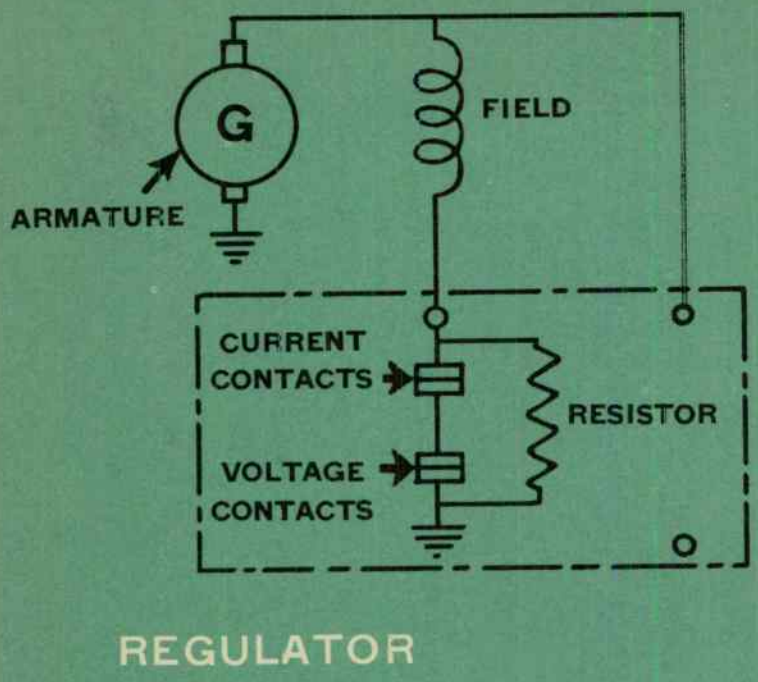


Fig. 10—Circuit responsible for regulator noise.

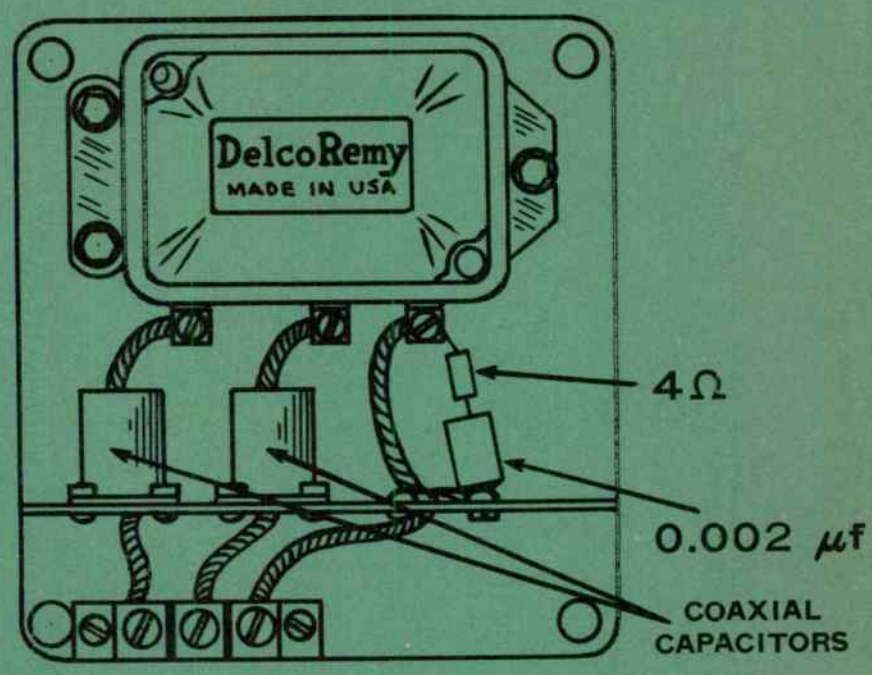


Fig. 11—Installation of by-pass condenser reduces regulator noise.

Reducing Regulator Noise

Two 0.1 to 0.25 μf coaxial condensers and a small resistor capacitor, will rub out the disturbance. Connect one coaxial capacitor between battery and battery terminal of regulator. Connect other coaxial capacitor between armature terminal of generator and generator terminal of regulator. Ground cases of both capacitors. Connect resistor capacitor between field terminal and ground. This consists of 0.002 μf condenser with 4-ohm carbon resistor connected in series —use of capacitor without resistor results in greatly shortened regulator life. See Fig. 11.

Should the foregoing fail to reduce noise sufficiently, use double-braid shielding to cover leads between generator and regulator. Separate these two leads from any others in a group so that the two are carried together. Ground shielding at both ends.

Further quieting can be accomplished by insulating the regulator from the car chassis. In this case, shielding is connected to regulator case at one end and to generator frame at the other. Noise is cancelled because fields generated by h-f currents in armature or field leads are cancelled by field set up by returning current in shielding.

Detecting Cause of Noise

Regulator and generator noises may be isolated by racing engine then cutting ignition switch. All ignition noise immediately stops, but generator and regulator continue to operate until engine has reached "cut-out" speed of generator. Hence, generator and regulator noises continue. Generator noise may be discerned by a somewhat musical whine. Regulator interference produces a rasping, irregular noise.

Ignition noise can usually be recognized by the fact that it varies in repetition rate with engine speed. When most ignition noise has been eliminated, the remainder changes its characteristic, sounding like popping corn and occurring independently of engine speed. At this point, all leads from generator should be removed so that remaining ignition noises may be traced.

Die-Hards

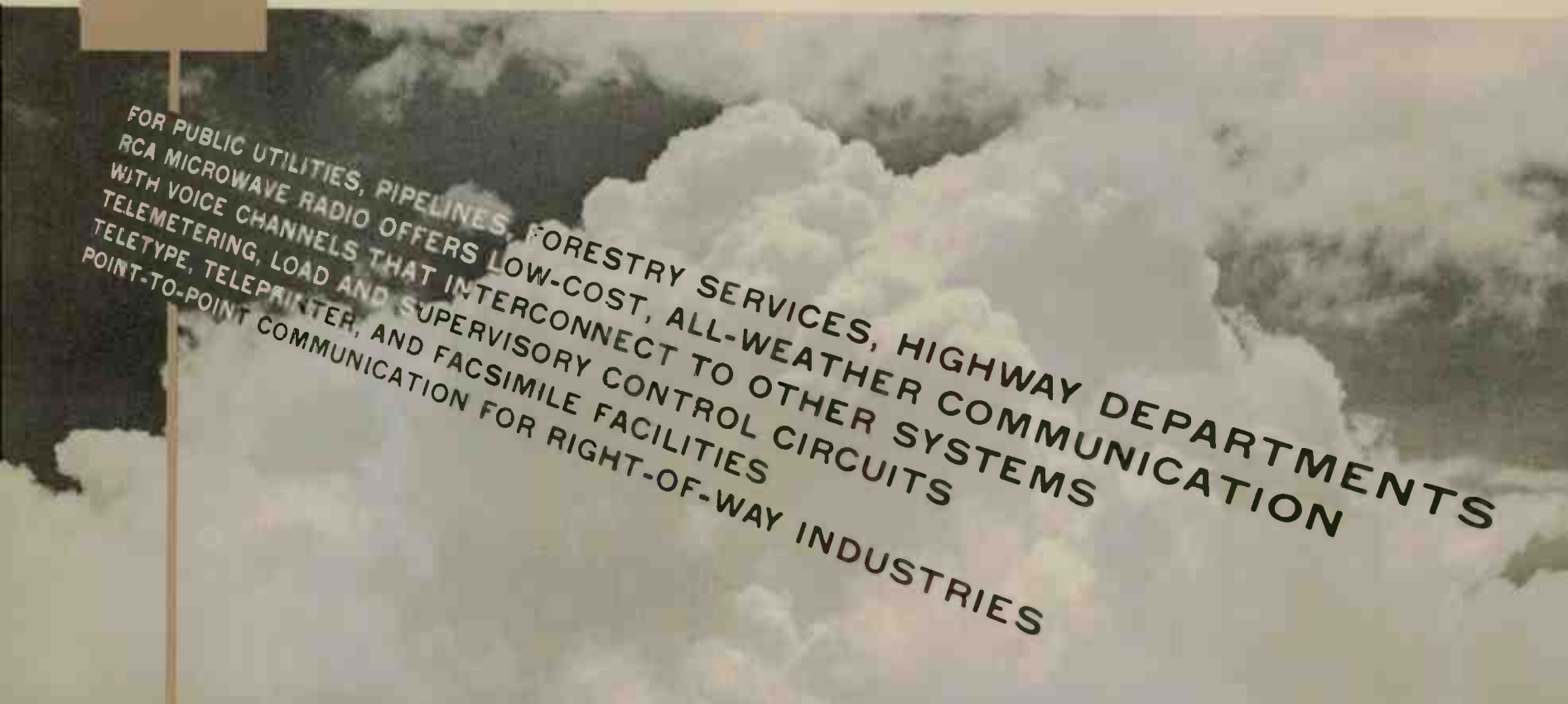
Most radio intallations obtain power at a junction remote from the battery. The lead between junction point and battery has considerable impedance at high frequency. Frequently, the IZ drop in the lead contains high frequency which gets into the receiver by the "back door." To eliminate this trouble, use a separate lead directly from battery to radio.

Should the foregoing possibilities fail to reduce noise to a satisfactory level, electrical gages should be examined as a last resort. Some cars employ gages that cause interference. To eliminate such noise install a small capacitor near the gage-sending unit.

Part 3

by M. G. Staton, RCA Microwave Communications, Camden, N. J.

Make-Up of Terminals, Interchanges and Junctions



MICROWAVE HIGHWAY THROUGH THE SKY

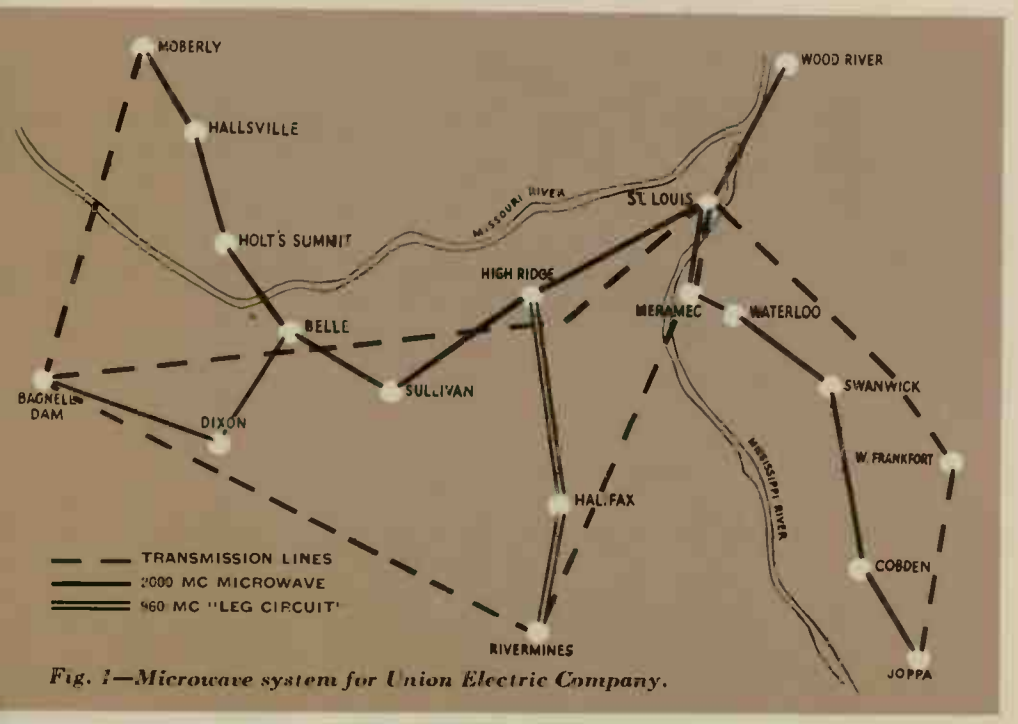


Fig. 1—Microwave system for Union Electric Company.

WE show in block diagram form the arrangement of the several types of stations in the system we have been considering (Fig. 1). Stations are composed of a number of individual units assembled together. Basic units in the stations are identical. All transmitters and receivers, for example, in the 2000 mc portion of the system are identical and interchangeable.

Different kinds of stations are built up of units connected together in varying combinations. For instance, through-repeater stations are identical to drop-repeater stations with the exception of a baseband amplifier.

We now analyze the various stations employed in this typical microwave system.

2000-mc Terminal Station

Figure 2 shows basic units of a Type CW-20 terminal station with standby equipment. When supervision of a system is desired, a terminal service unit is added. At remote unattended terminals a

Fig. 2A—Cabinet-mounted 2000-mc terminal, without standby equipment.

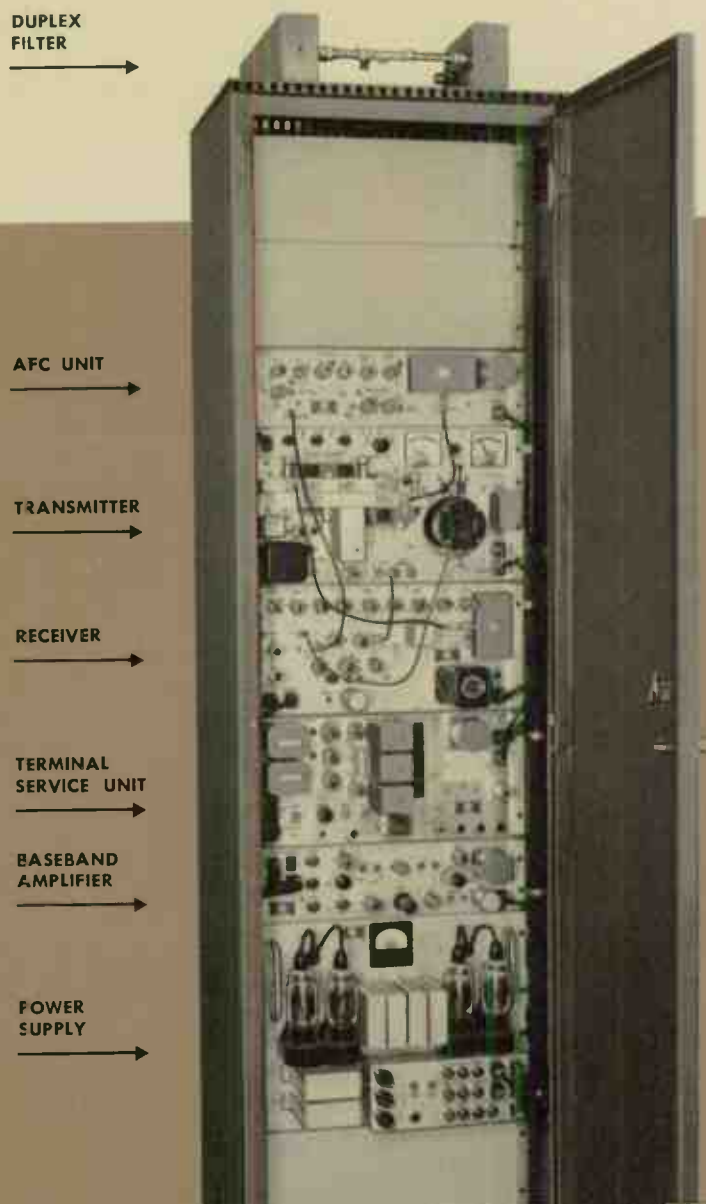
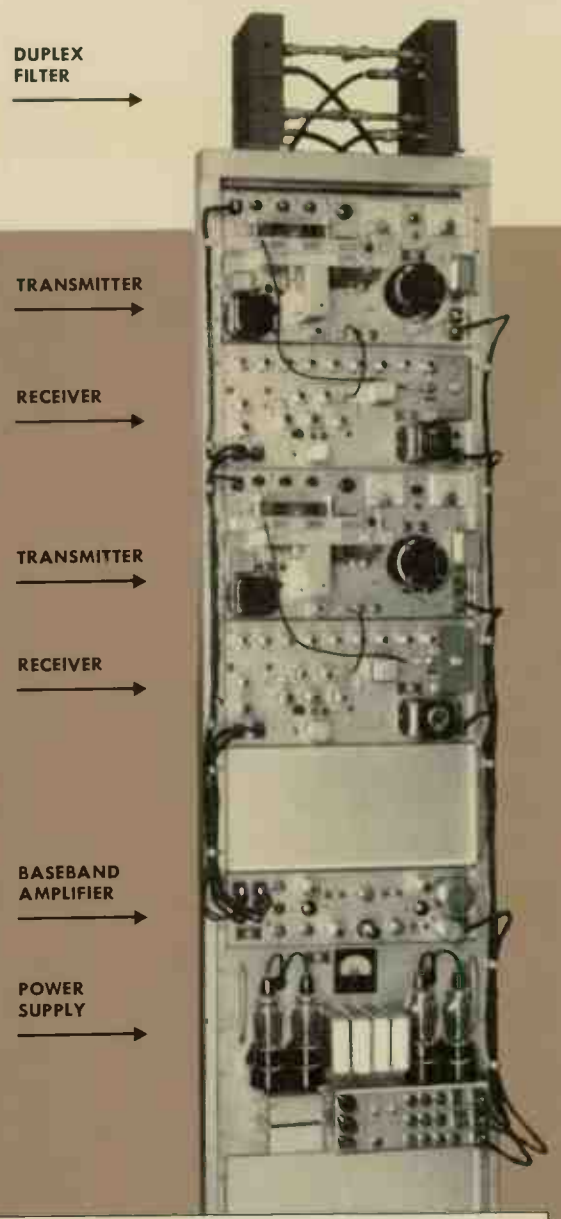


Fig. 3A—Rack-mounted 2000-mc drop-channel repeater, without standby.



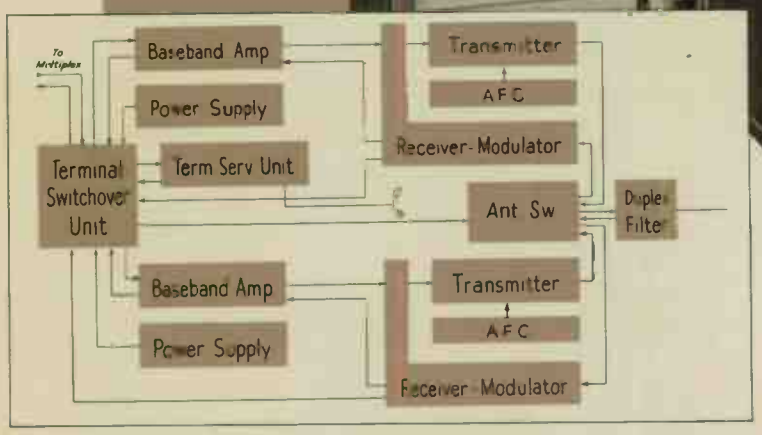


Fig. 2—2000-mc terminal with 100 per cent standby equipment.

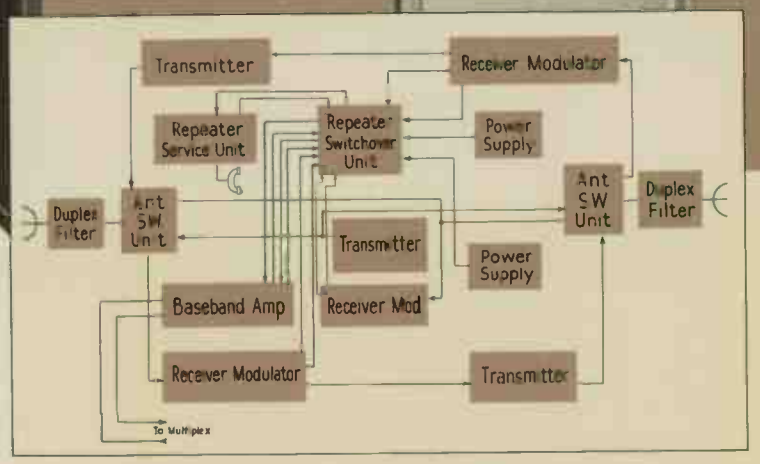


Fig. 3—2000-mc drop-channel repeater with standby.

repeater service unit may be substituted for the terminal service unit so that fault indications can be transmitted.

2000-mc Repeater Station

Figure 3 shows basic units of a Type CW–20 *drop-channel* repeater station with standby. Almost all are common to the units shown for the terminal station. A baseband amplifier is included for the purpose of inserting and dropping multiplex channels.

This station provides an interchange or access point to our microwave highway. When the baseband amplifier is omitted, the station becomes a *through* repeater. Should a through repeater be installed at a certain location and at a later date drop-channel facilities are desired, it is only necessary to add the baseband amplifier and required channel units.

960-mc Terminal Station

Basic units employed in Type CW–5 terminal station with standby are shown in Fig. 4. Repeater service units can be added to the CW–5, providing same kind of fault indication as CW–20.

This 960 mc Type CW–5 equipment is intended for leg circuits or short-haul systems, up to 300 miles, whereas the 2000 mc Type CW–20 is used for long-haul, mainline systems. The 960 mc radio operates on the demodulation-remodulation principle whereas the 2000 mc radio incorporates a heterodyne-type repeater.

Fig. 4A—960-mc terminal without standby.

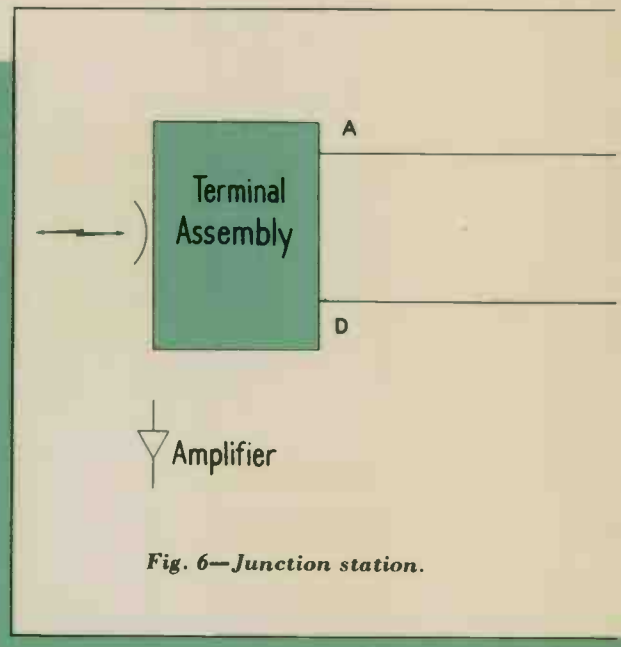


Fig. 6—Junction station.

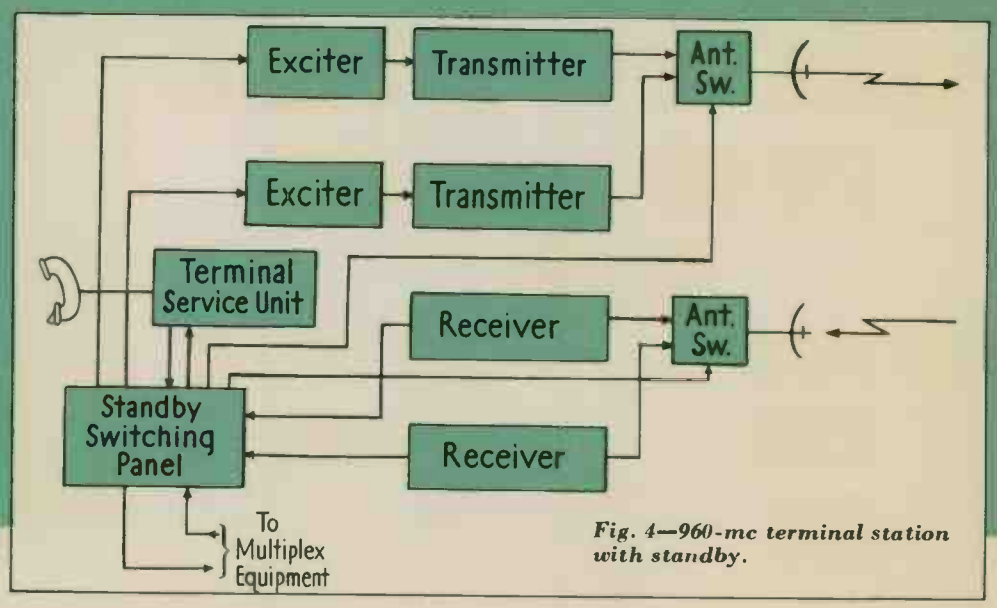


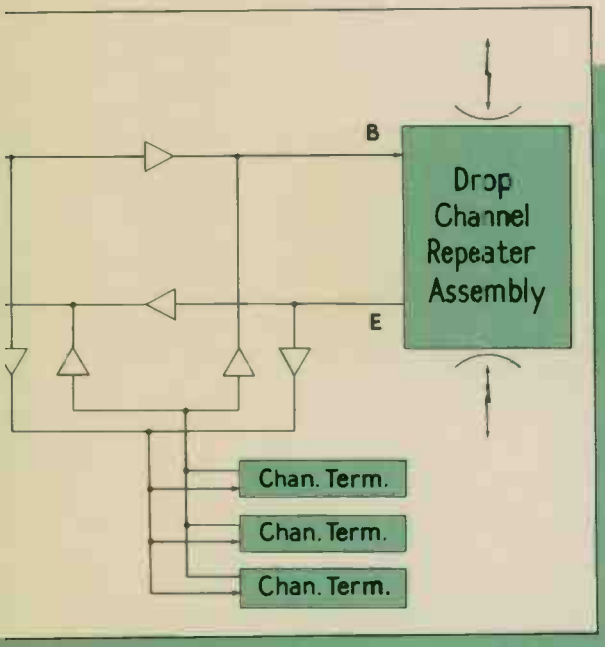
Fig. 4—960-mc terminal station with standby.

960-mc Repeater Station

Figure 5 shows Type CW–5 repeater assembly, utilizing the same units required for the terminal station. Terminal service units with fault indications or repeater service units with fault sending feature may be incorporated in either terminal or repeater stations.

Junction Station

Essential elements of a junction station are shown in Fig. 6. This may be either a 2000 mc leg tied into a 2000 mc repeater, or a 960 mc leg tied into a 2000 mc repeater. The equipment used to interconnect the two and provide multiplex channeling access points is known as a bridging unit. It provides all necessary interconnections for baseband circuits, service channels, and fault indication circuits.



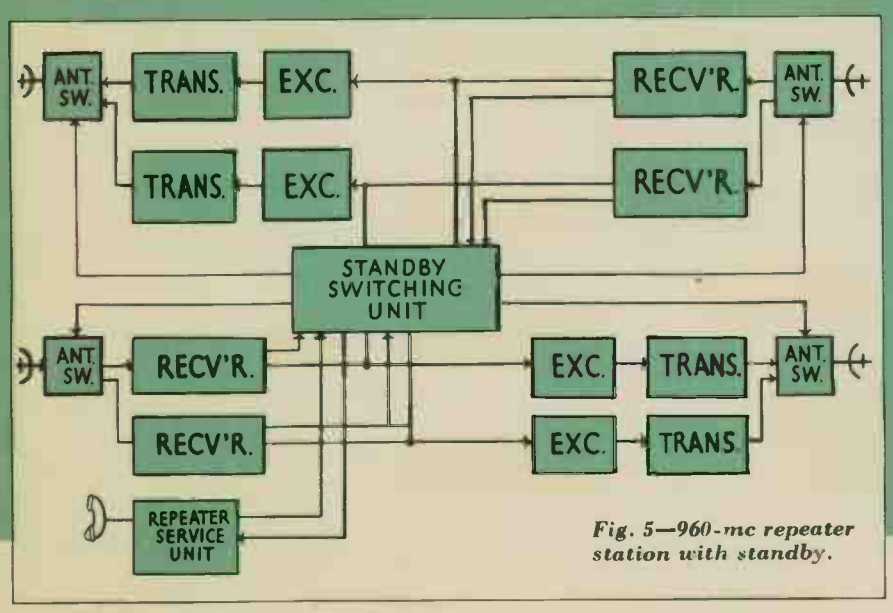


Fig. 5—960-mc repeater station with standby.

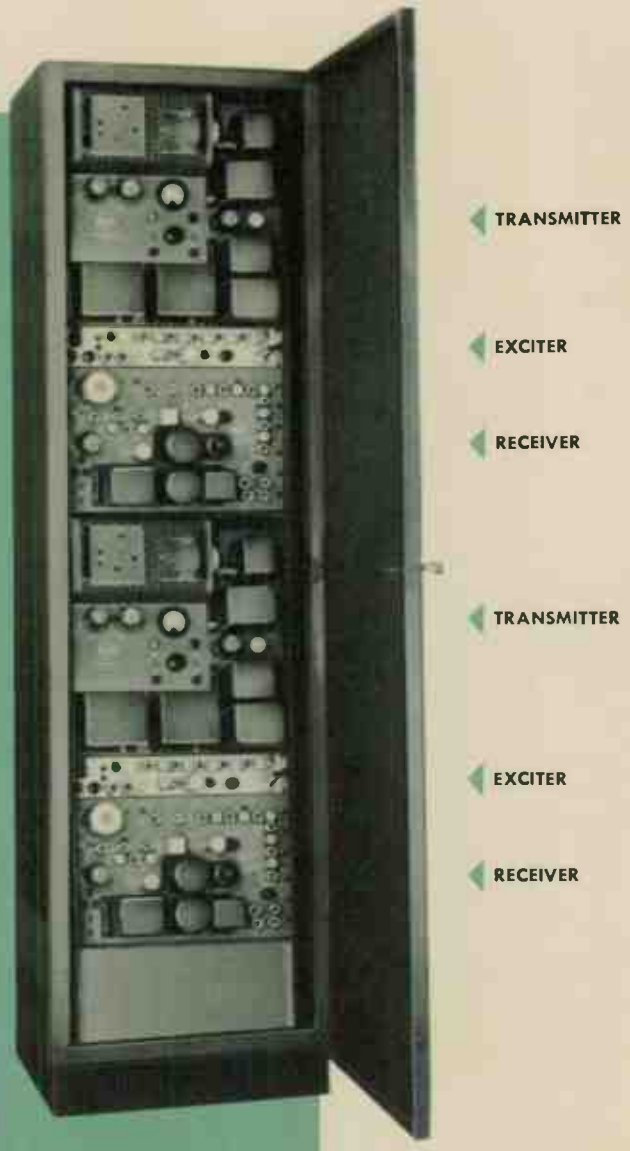


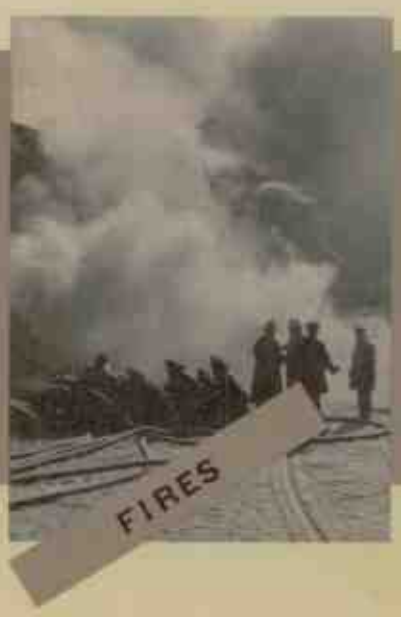
Fig. 5A—960-mc repeater without standby.

Fig. 1—Chief E. P. Grim, Philadelphia Electrical Bureau, and J. C. Fields, RCA, coordinators of the Mobile Unit design and construction.

PHOTOGRAPHS BY W. E. PILGERMAYER

RADIO STATION ON WHEELS FOR DISASTER RELIEF

Eight Transmitters Coordinate Police, Fire, CAP and Amateurs



WHAT would happen if a bomb or flood crippled municipal communications? Would such a catastrophe also destroy relief plans? How could police, fire, civil defense and Red Cross initiate rescue operations?

Facing such realistic questions, Philadelphia engineers designed a completely self-contained mobile communications center. Housed in a vehicle twenty-three feet long by eight feet wide, it embodies radio, telephone, and public address system. Equipped with its own power plant, this emergency van is a completely independent station.

It is planned that this unit will normally be placed somewhere on the perimeter of the city, will use external power and telephone facilities whenever possible, and will be manned by city and civil defense personnel.

Philadelphia Radio System

Two communication networks are employed, one for police, the other for fire. Radio headquarters is located at City Hall where two 250-watt transmitters, controls, and antenna systems are installed. Duplicate facilities have been provided at a point four miles from the heart of the city. Either the master or the duplicate station can be used to dispatch motorized police and fire-fighting equipment. Should one station become inoperative, the other can take over as control center. From the master control at City Hall either of the stations can be operated. By this means headquarters is always in touch with some 150 police, fire and other emergency vehicles.

As part of the civil defense planning, control centers had already been established, but it was recognized that a disastrous atomic bombing could knock out all stationary centers. Realizing that police and fire are two of the most important systems to be in operation during a catastrophe, the mobile center was designed to substitute for the master control station.

Emergency System

The radio van can be employed as an independent unit or used in conjunction with the two fixed stations. Should an emergency arise, it can proceed immediately to the scene of trouble.

The van can be concealed outside city limits, then moved into the city should a bombing attack occur. Were both base stations to be damaged, the van could take over as headquarters station. If normal communications are working, it can proceed to the scene of disaster to relay messages back to headquarters and to direct rescue work.

How It Is Used

The radio van is now being employed by the city's safety services as a piece of emergency apparatus. It reports to all extra-alarm fires and other urgencies. It is kept in readiness to roll at a moment's notice and can go into full operation in a matter of minutes. As soon as the van arrives at the scene of trouble, it is set up as communications center and serves to coordinate all activities.

At large fires the Chief uses the van as headquarters. He utilizes its public address system to direct personnel to advantageous points for fighting the fire effectively. When he moves about the scene of action, the Chief carries a portable radio to keep in touch with the van. His instructions are then relayed over the loudspeaker system. By this means he maintains close control and can move his men around with facility.

Eight Transmitters

Equipment housed in the radio van includes three 60-watt stations. One operates on the fire frequency, another on the police. This permits communication directly with police cars and fire apparatus. The third transmitter is tuned to Civilian Air Patrol frequencies to reach planes overhead in the Phila-

MOBILE COMMUNICATIONS CENTER

FEATURES 8 SIGNALING FACILITIES

- Walkie-Talkie
- Broadcasting
- Police & Fire
- Amateur Radio
- Telephone
- Siren & Lights
- Civil Air Patrol
- Public Address

Fig. 2—Mobile van, 23 by 8 ft., houses communications equipment, power supply, and air conditioning units.

delphia area. Two 30-watt transmitters operate on police and fire mobile frequencies for communications with fixed stations.

Three transmitters operate on the 2, 10, and 75-meter amateur bands. With this equipment the van can contact amateur radio operators having either fixed or mobile stations.

PA and Telephone

A 70-watt public address system is built into the van. Four weatherproof re-entrant horns are mounted on the roof. Directional properties enable the system to be heard one half mile distance.

Installation of sixteen telephones in the van establishes service with existing facilities. A reel containing 150 feet of cable is mounted at the rear. It can be tapped into any telephone trunk line, overhead or underground wires.

Control Room

Space is provided for driver, command officer, and six radio operators. On one side of the room are located the controls for police, fire, and CAP radio equipment. On the other side are the three amateur transmitters and the public address system.

Power Supply

If power is available nearby, the van can plug in; if not, it can generate its own power. Provision is made for external a-c supply using quick-release plugs. A 10-kw, 110–220 a-c, single-phase Onan generator supplies emergency power. This is powered by a gasoline engine equipped for automatic starting. Two gas tanks are carried—thirty-gallon for the truck, ten-gallon for the power plant. Both generator and truck can be run from either tank.

Ten Antennas

Nine spring-mounted antennas are installed on the roof of the van. In addition a 35-foot collapsible antenna designed for the 75-meter band is mounted on the roof. A spare antenna with 100 feet of transmission line and fittings is provided in case additional coverage is needed.

Miscellaneous Equipment

Storage bins inside and outside contain spare parts, portable radios, accessories, and tools. Four 500-watt floodlights, flashing red lights and a siren are mounted on the roof.

All-Weather Design

All radio equipment, except amateur, is located in a separate enclosure insulated from both power plant and control room by heat- and soundproof partitions. This enables the crew to operate under best possible conditions.

The van is equipped with both air conditioning and heating units and is fully insulated for all-weather operation. It is furnished with fibre glass blackout curtains designed by U. S. Signal Corps for night operation under wartime conditions.

RCA built the van to specifications by the Philadelphia Electrical Bureau under direction of Chief Edgar P. Grim. This type van is an invaluable addition to any community for use in time of flood, earthquake, civil defense, fire, riot, or other emergency, to coordinate disaster relief.

Fig. 3—Rear of van contains emergency generator, controls, and mobile transmitters.

Fig. 4—Transmitter room houses police, CAP, and fire radio.

Fig. 5—A. Repirl operates one of three amateur stations in control room.

Fig. 6—D. Upton examines 10-kw Onan emergency power generator.

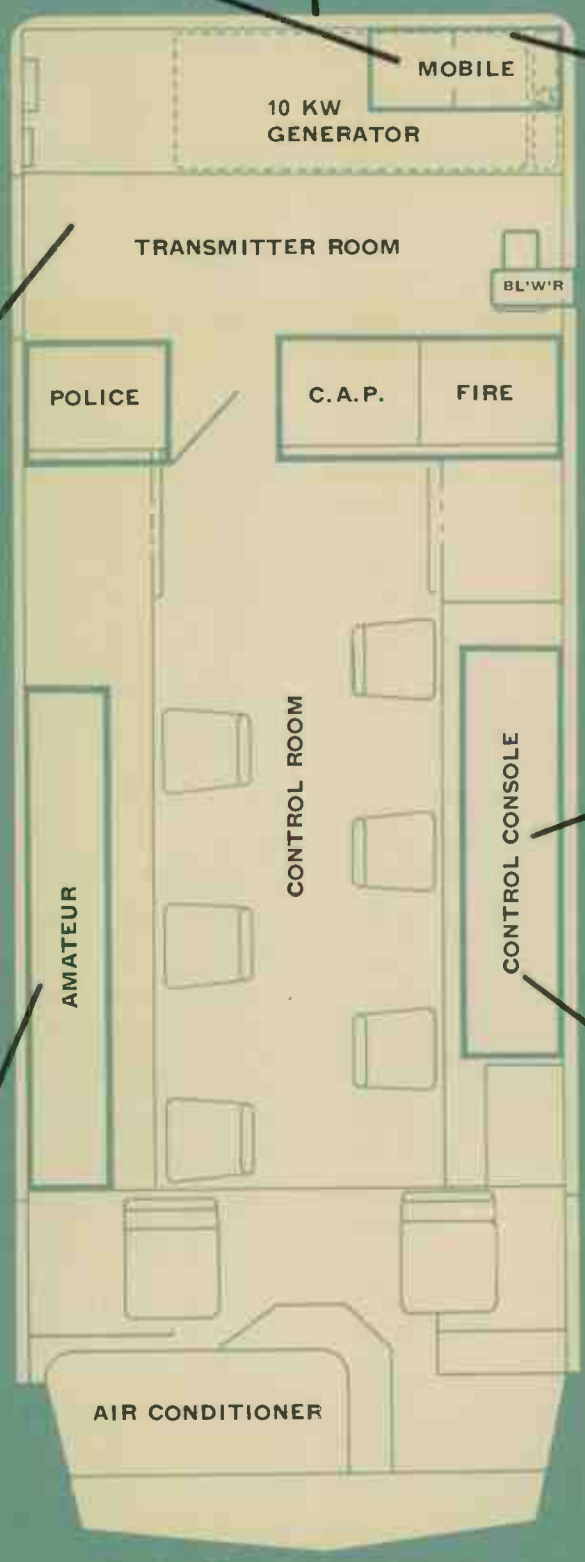


Fig. 10—Van is divided into several soundproof compartments to facilitate operation.

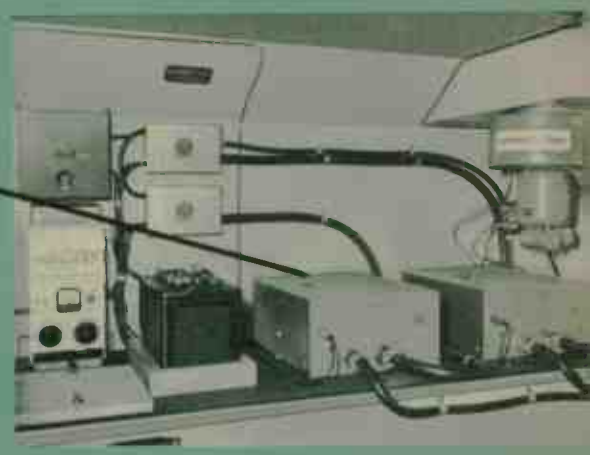


Fig. 7—Two 30-watt Carfone mobile radios contact police and fire headquarters.

Fig. 8—Controls for operation of police, fire, and CAP transmitters.

Fig. 9—Control room accommodates crew of eight.

MOBILE COMMUNICATIONS CENTER
FOR DISASTER RELIEF

MODERNPHONE

by Robert Z. La Terza
R.C.A. Sound Products, Camden, N. J.

A New Telephone-Type Intercommunication System

ORGANIZATIONS employing mobile or microwave radio will find Modernphone an ideal complement. It provides assurance that messages will receive efficient handling *after* they reach the office.

Operation

Based on use of the handset telephone, Modernphone provides means whereby executives and key employees can reach each other directly. Speedy contacts are made by simply lifting handset and pressing button. This sounds buzzer on the called instrument where, to reply, it is only necessary to lift handset. Modernphone means an open channel for internal messages, keeping telephone lines free for outside calls.

Modernphone permits as many simultaneous conversations as there are pairs of instruments in the system. Conference calls may be extended to every station if desired, or two-way conversations can be completely private. No dialing is required and "press-to-talk" buttons have been eliminated. Five categories of equipment may be employed in various combinations to meet needed requirements.

Two to Six Stations

Simplest of the five basic systems is the Minor which permits communication between two to six persons. Operating from a six-volt battery, or

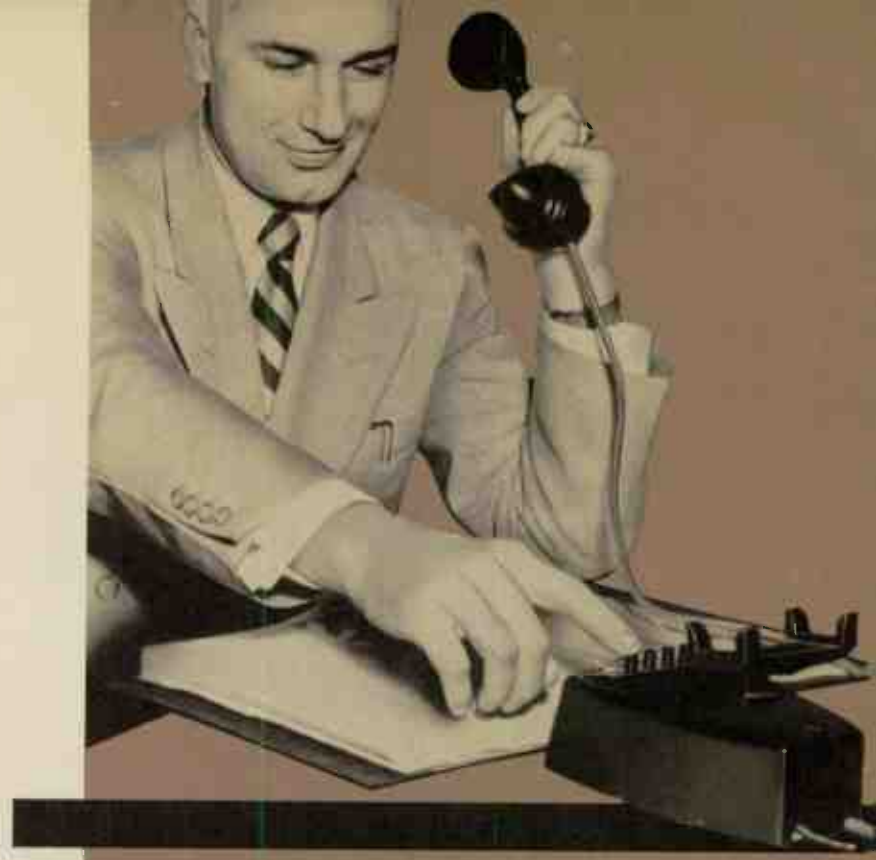


Fig. 2—"Modern Minor" assembled as wall phone. Also available as desk instrument.

Fig. 3—With both hands free, manager can hold private conversations with any member of staff by use of "Executive Master."

Fig. 1—Calls are made on Modernphone simply by lifting handset and pushing button.

Fig. 1—"Standard Intercom" operates as "Switchboard" for 30 handsets. Name strips identify buttons.

rectifier, it fills the need for a high-quality, low-cost system. This lends itself to expansion if requirements are increased. Widely used for confidential intercommunication, it is particularly well suited where requirements call for a small system.

Six to 120 Stations

More extensive coverage is available with the Standard Modernphone. This system offers selective ringing and talking with full trunkage for 6 to 120 intercom stations. Entire staffs are thus linked together and instant communication with remote work stations is possible. Phones are equipped with 5, 10, 15, 20 or 30 buttons. The system is powered by two six-volt batteries or rectifier.

Executive Master

This permits a chief executive to communicate, in complete confidence, with staff stations. No one can break in or overhear. If a handset is in use when the Executive calls, a flash of light tells the staff member that the "boss" wants him. By flicking a key he is put in contact with the executive. The Master is designed to meet the needs of large organizations. It establishes a centralized control for the firm or department head, and makes conferences possible without key personnel leaving their posts.

Modernphone Paging

The unit equipped for this function has a red key and a light. When the red key is depressed, it connects handset to input of an amplifier and loudspeaker system. Simultaneously, light on instrument is illuminated, giving others who have similar paging facilities visual indication that a paging is in progress. Intercommunication between other telephones in the system does not interfere with paging nor does paging interfere with two-way communication.

Tele-Sound

This is a system based on fully intercommunicating telephones plus loudspeakers located at strategic spots. File rooms, stock rooms, etc., can thus be linked to offices. Anyone with Modernphone handset can call stock room; his voice will be amplified and

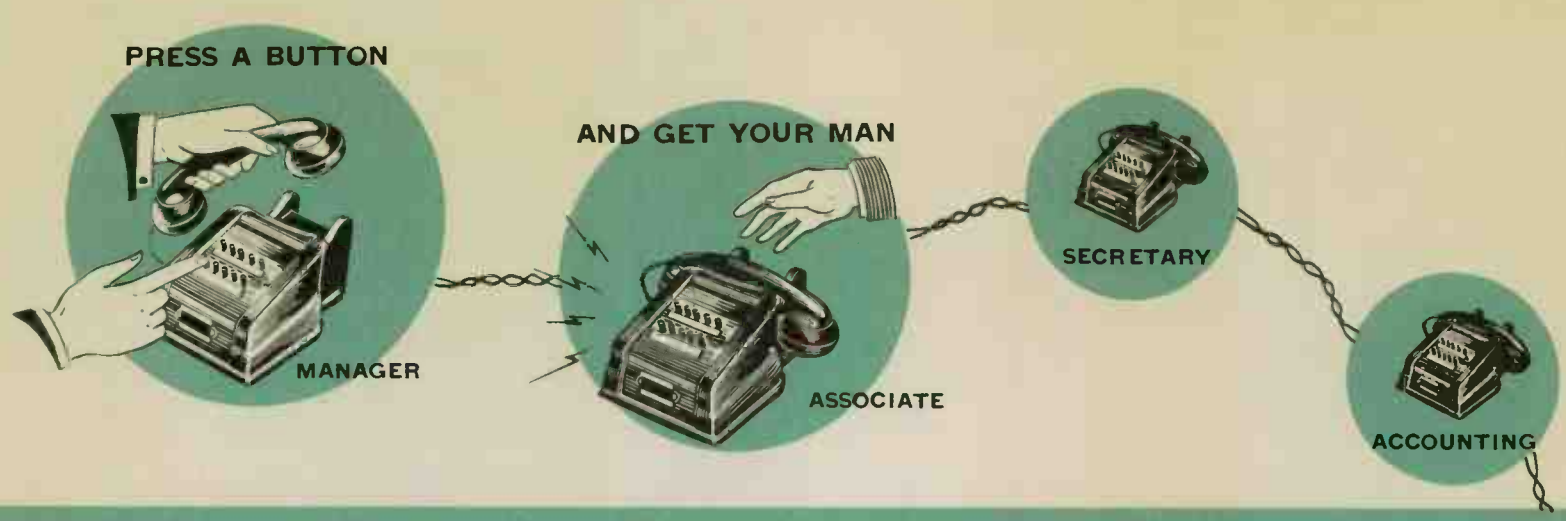


Fig. 5—Typical application of Modernphone. Intercommunication, paging and loudspeaking, and up to 200 stations are possible. Write in your own requirements.

reproduced through loudspeaker; stock room clerk can answer from his working position through loudspeaker to person originating call. Telephone privacy is maintained in office areas where loudspeakers may be objectionable.

Installation and Maintenance

Anyone handy with tools can install Modernphone. One cable—having four common wires plus one additional connected to each unit—is all that is required. The instrument may be placed on a desk or mounted on the wall. Maintenance, without tubes or complicated circuits, is negligible.

Modernphone lessens switchboard traffic and releases telephone lines for external calls. Telephones formerly employed for house calls may either be eliminated or put to more essential use. Modernphone has proved practical for fast, versatile internal communication. More than 100 different systems can be adapted from five basic units. Thus the needs of every size and type of organization can be met.

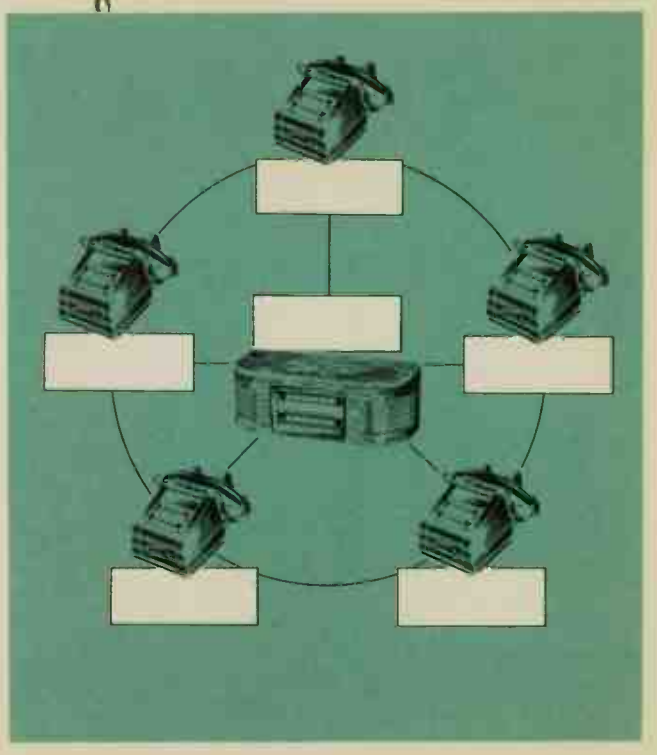


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Fig. 3—"Standard Intercom" operates as "Switchboard" for 30 handsets. Name strips identify buttons.

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The unit equipped for this function has a red key and a light. When the red key is depressed, it connects handset to input of an amplifier and loudspeaker system. Simultaneously, light on instrument is illuminated, giving others who have similar paging facilities visual indication that a paging is in progress. Intercommunication between other telephones in the system does not interfere with paging nor does paging interfere with two-way communication.

Tele-Sound

This is a system based on fully intercommunicating telephones plus loudspeakers located at strategic spots. File rooms, stock rooms, etc., can thus be linked to offices. Anyone with Modernphone handset can call stock room; his voice will be amplified and

Fig. 5—Typical application of Modernphone. Intercommunication, paging and loudspeaking, and up to 200 stations are possible. Write in your own requirements.

reproduced through loudspeaker; stock room clerk can answer from his working position through loudspeaker to person originating call. Telephone privacy is maintained in office areas where loudspeakers may be objectionable.

Installation and Maintenance

Anyone handy with tools can install Modernphone. One cable—having four common wires plus one additional connected to each unit—is all that is required. The instrument may be placed on a desk or mounted on the wall. Maintenance, without tubes or complicated circuits, is negligible.

Modernphone lessens switchboard traffic and releases telephone lines for external calls. Telephones formerly employed for house calls may either be eliminated or put to more essential use. Modernphone has proved practical for fast, versatile internal communication. More than 100 different systems can be adapted from five basic units. Thus the needs of every size and type of organization can be met.