are formed into a beam, a control grid for varying the intensity of the electron beam, a deflection system for deflecting the beam, and a screen. The screen is covered with a fluorescent material that emits light upon impact by the electron beam. The fundamental action of the cathode-ray tube in reproducing a picture consists in the electron beam's moving horizontally and vertically simultaneously so as to cover the whole area of the picture-tube screen.

The control grid of the picture tube controls the intensity of the beam which strikes the screen in exactly the same way that the control grid of an amplifier tube controls the plate current. In this way, each portion of the picture tube has the proper degree of light or shade to reproduce the original scene.

TEST EXERCISES

I. Use the proper words and word combinations:

1. The sound (produces, accompanies) the image. 2. The optical image (is received, is converted) by the television camera. 3. The picture and audio signals are picked up simultaneously (by a single antenna, by several antennas). 4. (The video signal, the sound signal) is reproduced by the loudspeaker. 5. The picture intermediate frequency signal is amplified (by one stage, by several stages). 6. The video signal appears in (the input, the output) of the detector. 7. Colour information is provided (by monochrome transmission, by colour transmission). 8. The electron grid changes the electron beam (density, intensity). 9. The colour television produces programs (both in colour and black-and-white, in colour only).

II. a) Give the proper attributes to the nouns. b) Give nouns to the attributes:

Nouns: components, intensity, gun, information, receiver

Attributes: electron, colour, incoming, video, auxiliary

III. Give as many attributes as possible to the words: signal, circuit, image.

IV. Put questions to the following answers:

1. Colour television was introduced in 1952. . . .? 2. The red, green and blue colour components are applied to the three kinescope electron guns. . . .?

V. Answer the following questions:

1. What is the difference between a monochrome receiver and a colour receiver? 2. Can monochrome TV set receive colour image?

Chapter VI
SPACE COMMUNICATION

In the text below you will read about the Soviet cosmonauts — the first men in space.

§ 1. Space Communication

I. Practise the following words from the text:

ship корабль
Earth [ə:θ] земля, земной шар
altitude ['æltɪtju:d] высота, высшая точка
ve'locity скорость
hour ['auə] час
exact [ɪg'zækt] точный, аккуратный
to watch [wɔtʃ] следить за, наблюдать
via ['vaɪə] через
ton [tʌn]
telemetry ['telɪmətrɪ]

II. Read and translate these word combinations:

1. radio-controlled spaceship; 2. ultra-short waves; 3. short and ultra-short waves; 4. space communication; 5. exact altitude; 6. long waves; 7. exact time; 8. one-way transmitters

III. Translate the following sentences:

1. Modern devices...
   — provide space communication.
   — enable the cosmonaut to communicate with the Earth.
   — show the exact altitude of the spaceship.
2. Two-way radio transmitters...
   — operate on ultra-short waves.
   — enable the spaceship to send signals.
3. The spaceships...
   — travel around the Earth.
   — are equipped with radio-transmitters.
   — travel at altitudes of more than 100 miles.

IV. a) Read and translate the questions. b) Read the text. c) Find answers to these questions in the text:

1. At what altitudes did the first spaceship travel? 2. At what velocity did it travel? 3. With what devices

was it equipped? 4. On what waves did the radio transmitters operate?

TEXT

A new era in space communications opened on April 12, 1961, by Soviet cosmonaut Major Yuri Gagarin—the first man in space.

Yuri Gagarin travelled around the Earth at the velocity of 17,000 miles per hour at altitudes ranging from 181 to 327 kilometres. The radio-controlled spaceship named Vostok was equipped with two-way radio transmitters operating on short and ultra-short waves. These transmitters enabled the cosmonaut to send signals to the Earth.

What was the cosmonaut's pulse, temperature? What were the exact altitudes of the spaceship? Electronic communications received the answers to these questions via radio, radar, and telemetry.

V. Give the English equivalents of the Russian words given in brackets:

1. Modern electronics makes space communication (возможной). 2. The spaceship Vostok travelled around the Earth at the (скорость) of 17,000 miles per hour. 3. At what (высота) did the spaceship travel?

VI. Read and translate the text:

Space Communication

German Titov was the second Soviet cosmonaut, who on August 6, 1961, rode the spaceship Vostok 2 seventeen times around the Earth in 25 hours and 11 minutes. German Titov communicated with the Earth by radiophone. He travelled at altitudes ranging from 178 to 244 kilometres.

§ 2. Meeting in Space

I. Practise the following words from the text:

screen [skri:n] экран
trip поездка, путешествие
to land приземлиться
to cover ['kʌvə] покрывать (*зд.* расстояние)
adjacent [ə'dʒeɪsənt] примыкающий, соседний
as well as так же, как и
film пленка
orbit ['ɔ:bɪt]

II. Read and translate these word combinations:

1. ground station; 2. television network; 3. adjacent orbits; 4. far away orbits; 5. in Moscow as well as in other cities of the USSR; 6. with radio and television as well as with other means of communication

III. Translate the following sentences:

1. The meeting of the two Soviet cosmonauts...
   — took place in space.
   — took place in the adjacent orbits.
2. Spaceships...
   — encircle the Earth.
   — cover millions of miles.
   — make trips round the Earth.
3. Eurovision is the European television network.
4. The two Soviet cosmonauts were named "the heavenly twins".

IV. a) Read and translate the questions. b) Read the text. c) Find answers to these questions in the text:

1. By what means did the two cosmonauts communicate with the ground stations? 2. By what means did the two cosmonauts talk with each other? 3. What is the European television network called? 4. How many orbits did Vostok 4 make? 5. How many miles did the spaceship cover?

TEXT

Andrian Nikolayev was carried into orbit by Vostok 3 on August 11, 1962; by radio he communicated with the ground stations, and he was seen on TV screens as the spaceship made 64 orbits in 94 hours and 10 minutes. His image, picked up and recorded in Moscow, was relayed through television network—so that he was seen in Britain as well as in other parts of Europe.

A day later (August 12) Pavel Popovich was carried into orbit by Vostok 4, and a historic meeting in space took place. From adjacent orbits at the distance of only about five kilometres the two cosmonauts talked with each other by radiophone and saw each other on television while millions of people watched them by television.

Television cameras in the spaceship sent images to Moscow, where these images were converted for telecast

and sent to Eurovision; then—on to London where the pictures were put on kinescope film and sent to New York. Thus, the world watched the historic meeting of the two Soviet spaceships.

Pavel Popovich made 48 orbits in 70.7 hours. The two spaceships landed within six minutes of each other, in Kazachstan; one—after four and the other—after three days of a trip in space. The cosmonauts were named "the heavenly twins", they established a new record in space communication.

V. Give the English equivalents of the Russian words given in brackets:

1. The cosmonauts talked with each other from (соседние) orbits. 2. The cosmonaut's image was seen in the USSR (так же, как и) in other countries of the world. 3. The cosmonauts (установили) a new record in space communication.

VI. Read and translate the texts using a dictionary. Give titles to them:

1

The Soviet cosmonaut Aleksei Leonov became the first man to go out of a spaceship for a twelve-minute "walk" in space. He was attached to the ship by a rope. The Voskhod 2 landed, having made 17 trips around the Earth in 26 hours. Transmissions by television enabled people in Russia and Europe to watch Leonov somersault in space. Telecasts were also made from the spaceship's cabin.

2

Man's destiny in the Space Age prophesied by Konstantin Tsiolkovsky (1857-1935), known as the "father of Russian rocketry", is recorded on an obelisk over his grave in Kaluga: "Man will not stay on Earth forever, but in the pursuit of light and space will first emerge timidly from the bounds of the atmosphere and then advance until he has conquered the whole circumsolar space."

§ 3. From the History of Space Flight

I. Practise the words from the text:

Moon [mu:n] луна
flight [flaɪt] полет
investigation [ɪn,vestɪ'geɪʃn] исследование
observation [,ɔbzə:'veɪʃn] наблюдение
escape [ɪs'keɪp] выход (*из сферы притяжения*)
vehicle ['vi:ɪkl] экипаж
to design [dɪ'zaɪn] проектировать, создавать
to revolve [rɪ'vɔlv] вращаться
to carry out проводить (*процесс*)
to launch [lɔ:ntʃ] запускать
to follow ['fɔlou] следовать за
as to что касается
serious ['sɪərɪəs]
data *pl.* **(datum)**
atmosphere ['ætməsfɪə]
satellite ['sætəlaɪt]
mathematical [,mæθɪ'mætɪkəl]

II. Read and translate these word combinations:

1. space flight; 2. Earth satellite; 3. satellite space station; 4. space vehicle; 5. vertical direction; 6. horizontal direction; 7. astronomical observation; 8. mathematically based investigation; 9. manned vehicle; 10. unmanned vehicle; 11. ability to revolve; 12. ability to follow the vehicle; 13. ability to launch the vehicle; 14. as to the spaceships; 15. as to the Earth satellite; 16. as to the unmanned satellites

III. Translate the following sentences:

1. The principles of space flight were first investigated by K. E. Tsiolkovsky.
2. As to the first space rocket, it...
   — was launched in a vertical direction.
   — was soon followed by other space vehicles of different design.
3. Space vehicles...
   — are launched from the Earth.
   — may return to the Earth.
   — are launched from satellite space stations.
   — may be manned or unmanned.
   — are designed to collect astronomical information.
   — have the escape velocity of 7 mi/sec.
4. As to manned vehicles, they have a larger data collecting ability than unmanned vehicles.
5. As to Earth satellites they...
   — revolve around the Earth.
   — are designed to serve as relay stations.
   — are designed to serve as a base for astronomical observations.

IV. Mind the difference in the meanings of these word combinations:

1. high altitude; 2. high altitude rocket; 3. communication relay; 4. communication relay station

V. a) Read and translate the questions. b) Read the text. c) Find answers to these questions in the text:

1. Where are space vehicles launched from? 2. Where was the first space rocket launched from? 3. What type of space vehicle was used first? 4. By what type of vehicles were the first vehicles followed? 5. By what means do unmanned spaceships transmit their data to the Earth? 6. By what means does the first rocket collect and transmit information?

TEXT

The first man to carry out a serious and mathematically based investigations on space flight was K. E. Tsiolkovsky, who was born a hundred years before his country launched the first Earth satellite.

Nowadays spaceships may be launched from the Earth and return to it, or they may be launched from the Earth and not return to it. They may also be launched from a satellite space station.

The first spaceship was a high-altitude sounding rocket which was launched from the Earth in a vertical direction, passed through the atmosphere into space, and returned to the Earth. During the flight information on space was collected and transmitted to the Earth by telemetry.

As to the Earth satellites, they are designed to revolve around the Earth. The Earth satellites are used as communication relay stations, or as a base for astronomical observation.

Vehicles designed to collect information on space have a very high escape velocity from the Earth: it is about 7 mi/sec.

Lunar vehicles are space vehicles designed to investigate the Moon. They go closely by the Moon and return to the Earth, or land on the Moon,

In addition to the usual space information to be collected and returned to the Earth, such as temperature, radiation, meteoric impact, television is used to send back visual information.

Nowadays both unmanned and manned vehicles are used for space flights; of these, unmanned vehicles were used first. They were followed by manned ships with much larger data collecting ability.

VI. Give the English equivalents of the Russian words given in brackets:

1. (Что касается) the first high-altitude vehicle, it returned to the Earth. 2. The principles of space flight (исследованы). 3. The USSR (запустил) the first Earth satellite. 4. Mathematically based (исследование) on space flight was carried out about fifty years ago in Russia by K. E. Tsiolkovsky.

TEST EXERCISES

I. Choose the proper words and word combinations. Translate the sentences into Russian:

1. The transmitters enable the cosmonaut (to send, to receive) signals. 2. The spaceship travelled at (the velocity, the altitude) of 17,000 miles per hour. 3. The first high altitude rocket was launched in a (vertical, horizontal) direction. 4. (Manned, unmanned) satellites use telemetry. 5. Lunar vehicles are designed to investigate (the Moon, space). 6. The cosmonauts talked with each other from (far away, adjacent) orbits. 7. The meeting of the spaceships took place at the distance of four (miles, metres).

II. About whom is the text? Give the names of the cosmonauts:

A historic meeting in space took place. From adjacent orbits the two cosmonauts talked with each other by radiophone and saw each other on television. Millions of people on the Earth watched them by television.

III. a) Give the proper attributes to the nouns. b) Give nouns to the attributes:

Nouns: spaceship, network, station, vehicle
Attributes: exact, adjacent, high-altitude, ultra-short

Chapter VII
TELEGRAPHY

§ 1. Morse Key and Sounder Circuit

I. Practise the following words from the text:

sounder клопфер
dot точка
dash тире
key [ki:] ключ
message ['mesɪdʒ] сообщение
'lever рычаг
spring пружина
bar [ba:] стержень, брусок
click щелчок, удар
release [rɪ'li:s] разъединение, освобождение
'lower нижний
'upper верхний
either ['aɪðə] любой
to consider [kən'sɪdə] рассматривать
to fix укреплять, закреплять
to reduce [rɪ'dju:s] сокращать
to arrange [ə'reɪndʒ] располагать, устраивать
to strike, struck, struck ударять, наносить удар
armature ['a:mətjuə]
alphabet ['ælfəbɪt]
code [koud]
interval ['ɪntəvəl]
to signal ['sɪgnəl]
so that

II. Read and translate these word combinations:

1. dot signals; 2. dash signals; 3. simple form; 4. complex form; 5. lower stop; 6. upper stop; 7. key and sounder circuits; 8. complex key and sounder circuits; 9. electrically controlled device; 10. earth connection; 11. close sounder

III. Translate the following sentences:

1. The bar of the key and sounder circuit...
   — is fixed to the armature.
   — strikes the lower stop.
   — strikes the upper stop.
2. Intervals for dots and dashes...
   — are different.
   — follow one another.
   — enable the operator to read the message.
3. In a Morse key and sounder circuit...
   — the letters of the alphabet are reduced to a simple form.
   — simple combinations of dots and dashes are used for the most frequent letters.

IV. a) Read and translate the questions. b) Read the text. c) Find answers to these questions in the text:

1. What kind of circuit is considered in the text? 2. What element connects the sounder to the line? 3. When does the bar fixed to the armature strike the lower stop? 4. When does the bar strike the upper stop? 5. What is the difference between intervals for dots and dashes? 6. What do these intervals enable the operator to do? 7. What combinations are used for the most frequent letters? 8. In what way is the length of time required for a message reduced?

TEXT

A simple Morse key and sounder circuit operate in the following way.

When the keys on the circuit do not operate the levers are held against the back contact by a spring connecting the sounder to the line so that either station is able to receive signals. When either key is operated the circuit is completed via the Earth connection, the distance sounder is operated and the bar fixed to the armature strikes the lower stop. Upon the release of the key the circuit is broken and the bar strikes the upper stop. A dot signal produces two clicks one after another, while for a dash the interval between the clicks is longer. These intervals enable the operator to read the code and thus the message.

Thus, Morse in developing his telegraph system, reduced the way of writing the letters of the alphabet to a very simple form, so that they could be written by an electrically controlled instrument. In arranging the combinations of dots and dashes to be used for each letter Morse used the shorter and simpler combinations for the most frequently used letters, thus reducing the length of time required to signal a message.

V. Give the English equivalents of the Russian words given in brackets:

1. (Любая станция) can receive signals. 2. The bar fixed to the armature is seen (ударить) the lower stop. 3. A (точка) is produced by two clicks. 4. The period of time for signalling a message (сокращен) by using short combinations for (самые употребительные) letters.

VI. Read and translate the text using a dictionary:

Morse Receiving Perforator and Printer

The signals sent by a Morse automatic transmitter can be received and recorded by a receiver as dots and dashes on a tape, the signals normally being transmitted too fast

to be read by ear. They may also be received on a receiving perforator, an instrument which perforates a tape of a similar form to the perforated tape used at the transmitter. This tape may then be used to forward the message to one or more additional places by running it through an automatic transmitter, or it may be passed into a Morse printer which will produce a printed text corresponding to the Morse signals.

The use of a receiving perforator allows the signals to be recorded as they come in. When several messages have collected on the tape this can be taken to a Morse printer. The printer feeds the tape through the reading head, letter by letter.

VII. Read and translate the following questions and answers. Compose a description of the device:

"What parts does a Voice Frequency Telegraph equipment include?"

"It includes the following parts: oscillators, modulators, filters, amplifiers, and amplitude limiters."

"What type of oscillators are used in the device?"

"Oscillators used in the device contain either electron valves or transistors. They are designed to supply 1 to 6 modulators."

"What types of modulators are used in the device?"

"They are of usual types. Usually relay modulators with polarized telegraph relays are used. FM modulators are also used, which combine diode circuits and oscillators."

"And what filters are used?"

"The so-called differential filters are used."

"And what about the amplifiers?"

"Amplifiers are transformer-coupled. They are supplied either with triodes or with constant or variable pentode. Nowadays in some equipments transistorized amplifiers are employed. Usually separate amplifiers are provided for each channel. As to the amplitude limiters they are used in one-source FM equipments."

§ 2. Radiotelegraph Systems

I. Practise the following words from the text:

channel ['tʃænəl] канал
interruption [ˌɪntə'rʌpʃn] перерыв, прерывание
to locate [lo'keɪt] располагаться
direct прямой
pulse [pʌls]
centre ['sentə]

II. Read and translate these word combinations:

1. radiotelegraph communication; 2. teleprinter apparatus; 3. radio service centre; 4. amplitude-modulated system; 5. frequency-modulated system; 6. telegraph channels; 7. amplitude-modulated voice frequency

III. Translate the following sentences:

1. The transmitter of the system...
   — is directly controlled.
   — may be controlled by telegraph channels.
2. The two types of the amplitude keying are...
   — interruption of the radio carrier.
   — amplitude modulation by the radio waves.

IV. a) Read and translate the questions. b) Read the text. c) Find answers to the questions in the text:

1. What elements does radiotelegraph communication include? 2. Where are those elements located? 3. How is the transmitter controlled in an amplitude-modulated system? 4. How else may it be controlled? 5. What are the two types of amplitude keying? 6. What are the equipments of the radio service centre?

TEXT

Radiotelegraph communication includes the following elements: the radio transmitters and radio receivers and the teleprinter apparatus. These elements are located in radio service centre. The transmitter may be directly controlled by the telegraph pulses in an amplitude-modulated or frequency-modulated system. It may also be controlled by a number of telegraph channels in AM or FM system.

The amplitude keying may be of two types: interruption of the radio carrier, or of a type where an amplitude-modulated voice frequency is carried by radio waves. The equipments of the radio service centre are generally high-speed Morse and mosaic apparatus.

V. Give the English equivalents of the Russian words given in brackets:

1. Telegraph (каналы) are used to control the transmitter. 2. Radio service centre (расположен) at some distance. 3. An amplitude-modulated voice frequency is carried by (радиоволны).

TEST EXERCISES

I. Choose the proper words and word combinations. Translate the sentences into Russian:

1. The bar of the circuit is (fixed to, separated from) the armature. 2. This bar strikes the (upper, lower) stop. 3. A (dash, dot) is produced by two clicks. 4. Amplifiers are supplied (with triodes only, both with triodes and pentodes). 5. The transmitter is (directly, indirectly) controlled by the telegraph pulses.

II. a) Give the proper attributes to the nouns. b) Put nouns to the attributes:

Nouns: signals, relay, amplifiers
Attributes: one-source, frequency-modulated, voice

III. Put questions to these answers:

1. The letters of the alphabet are reduced to a simple form. ...? 2. Transistorized amplifiers are employed in some equipments. ...?

IV. Answer the following questions:

1. When was the telegraph invented?
2. By whom was it invented?
3. What elements does radiotelegraph communication include?

Part II

DEVICES USED IN COMMUNICATION

Part II includes descriptions of different devices used in the sphere of modern communication.

CABLE AND LINE FAULT TRACER TYPE P5

In the description of a fault tracer the following data are given:
a) the purpose of the device,
b) its advantages as compared with other models,
c) its use,
d) its operation.

Accordingly, in the text below you will find answers to the following questions:

1. What is the device designed for? 2. What are its main advantages? 3. What is the device used for? 4. What types of lines are tested by the device? 5. What are possible faults in the lines? 6. What is the principle of operation of the device? 7. How is measurement carried out? 8. How should the device be kept?

Description

Cable fault tracer type P5 is designed for measuring the distance to the fault in cable power transmission and communication lines. Its advantage as compared with other models is that cable fault tracer P5 is used for testing lines of many types. These are:

1) high-voltage power transmission lines up to 300 km,
2) steel wire communication lines up to 80 km,
3) high-voltage three-phase cable lines up to 10 km,
4) lines of other types and purposes.

Possible faults in the lines are:

1) a break with or without a leakage,
2) a short circuit,
3) a contact between conductors in a multi-wire system, or a combination of the above faults.

The tracer uses the pulse measurement method. Good results are obtained using this method when the pulse propagation speed in the line or the line length is known.

Usually, it is sufficient to make measurements at one end of the line only. The pulse method allows measuring the distance to the fault in the line and determining the nature of the fault.

The principle of operation is the echoing of short-voltage pulses transmitted into the test line from the point of fault. The fault point is shown on the screen of a cathode-ray tube. The distance to the fault in the line is determined by the time required for the pulse to travel from the device to the fault point and come back. The wave propagation speed in the line is known and the distance is measured by the travel time.

Measurement

All the measurements on a power transmission line should be carried out with the line disconnected at both ends, measurement on a communication line should be carried out with all the communication devices disconnected.

The instrument is connected to the line by means of a lead plugged into socket "common input". The sheathing output terminal should be grounded. Measurement consists in locating on the instrument screen the echo from the fault and determining the time interval between the

transmission of the main pulse into the line and the reception of its echo.

In case of long line and the fault being detected at the end of the line, it is recommended to carry out measurements from the other end of the line.

Regular observation of the lines by means of the cable fault tracer should be carried out when the lines are not in operation.

Long operation practice has shown that with such training, incorrect measurements are reduced to a minimum and measurement speed increases too.

Measurement by the Energy Transfer Method

This is used mainly on communication lines to locate points of low transfer attenuation between the circuits. The pulse generator is connected to one circuit while the amplifier input is connected to the other. The distance to the point of power transfer is determined as in ordinary pulse measurement.

Maintenance, Storage and Transportation

Cable fault tracer P^5 should not be kept without its housing. The instrument should be stored at an ambient temperature from $+5$ to $+30°$ and a relative humidity not more than 80 per cent. During local transportation the instument should be protected against shaking.

The general service ability and main characteristics of the instrument should be checked at least once every six months.

Checking should be carried out at an ambient temperature of $+20\pm5°$ and a relative air humidity not (more) exceeding 70 per cent. Devices producing strong magnetic or electric fields should not be placed near the cable fault tracer.

Probable Troubles and Their Remedy

1. With the instrument switched on, the pilot lamp remains dark and the meter pointer does not deflect.

The cause is: the mains fuse has burnt out.

2. With the instrument switched on the pilot lamp remains dark while the meter pointer is alive.

The cause is: the pilot lamp has blown out.

3. With the instrument switched on, the pilot lamp goes on while the meter pointer is motionless.

The causes are: no supply on the valve voltmeter (190 V); faulty circuit of the valve voltmeter.

4. Poor zero stabilization.

The causes are: break in the stabilization circuit as a result of shaking; deterioration (damage) of insulation of the charge circuits; heavy leakage in the valve.

The remedies: heat the instrument for a continuous time to dry insulation.

5. The instrument fails to operate.

The cause is: faulty trigger circuit.

The remedy: check the voltages of the valves. If they are normal, then, supplying a signal from the pulse generator, check its path with the aid of the pulse meter through the trigger circuit, i. e. through the grid of the valve, the resistor and the grid of the valve.

6. The instrument fails to stop.

The cause is: faulty stopping circuit.

The remedy: check the voltages of the valves. If they are normal, then, with the aid of the pulse meter, check the stopping signal supplied from the pulse generator.

SHIP'S TELEPHONE, NON-BATTERY (SOUND-POWERED) TYPE

In the description of a ship's telephone the following data are given:

a) the purpose of the device; conditions under which it operates,

b) its advantages as compared with other models of the same type,

c) its power supply,

d) the functions and characteristics of the elements of the telephone system.

Accordingly, in the text given below you will find answers to the following questions:

1. What is the device used for? 2. What are its advantages? 3. Under what conditions does it operate? 4. What is its power supply? 5. What type of lines does the telephone serve in? 6. What are the functions and characteristics of the elements of the telephone system? 7. Under what conditions are the elements used?

Description

Telephone exchanges are used aboard ships for two-way communication. Its advantages as compared with other models of sound-powered telephone are:

1. The telephone is of a non-battery type and operates without a special D.C. current source.

2. It is capable of operating both in two-wire and

three-wire circuit or systems without the use of a special D.C. current source.

The circuit of the telephone is powered by the ship's 60-cycle. A.C. supply of 220, 127, 110 or 24 V. If the ship has no A.C. supply, the call signal is produced by means of a hand-operated A.C. inductor.

The sets of the system have special protective devices.

The telephone sets are of the same design so that they may serve in either two-wire or three-wire communication lines.

The function and characteristics of the elements of the telephone system are given below:

Elements	Functions	Conditions
Microtelephone	used in telephone sets for transmission and reception	used in rooms with noise level up to 90 decibels
Microtelephone with shount filter	used in telephone sets for transmission and reception	used in rooms with noise level exceeding 90 decibels
Additional earphone	used in telephone sets for better hearing	used in all rooms

Use of Sound-Powered Telephone

The ship's sound-powered telephone system is designed for use in ships. The length of the telephone cable does not exceed 300 m. The apparatus may be used with different sets. The sets of the sound-powered (non-battery) telephone system may be connected in the following ways:

1. The separate exchange circuit to connect one number with another through the switch.
2. The two-way communication circuit to connect two-telephone sets.
3. The round-the-ship connection circuit to cut in one command set and several other sets into a three-wire-line.

The telephone system and operational circuits are designed to carry out the following functions:

1. To provide telephone communication both in two-way and round-the-ship connection.
2. To send a call signal from any telephone set to the exchange or to another number.

3. To send a call signal to other exchanges.
4. To send a call simultaneously to twelve (receivers) sets—if the call signal is powered by the ship's supply—or to eight (receivers) sets—if it is inductor-powered.
5. To send a call signal with the help of the neon light to the exchange from the line switch that is in the "on" position.

RADIO SETS

The description of radio sets includes the following data:

a) type of the receiver,
b) its range of operation,
c) power supply,
d) its antennas,
e) technical data.

Accordingly, in the text below find answers to the following questions:

1. What type of receiver is Sport? 2. How many transistors does it use? 3. For what type of broadcast stations is it designed? 4. How many subranges has it? 5. What is its power supply? 6. What are its frequency bands?

RADIO-RECEIVER SPORT

Description

Radio-receiver Sport is a portable superheterodyne. It uses transistors and two semiconductor diodes.

The receiver is designed for reception of radio broadcast stations operating in the long, medium, and short wave bands and has four subranges: LW, MW, SW2, SW1.

For reception of broadcast stations two built-in ferrite rod antennas are used.

Power is supplied from a battery consisting of four cells, type 316 or 316T.

Battery voltage is 6V.

Technical Data

Frequency bands:
LW — not narrower than 150 to 408 kc/s
MW — not narrower than 525 to 1605 kc/s
SW2 — not narrower than 3.95 to 7.3 Mc/s
SW1 — not narrower than 9.5 to 12.1 Mc/s
intermediate frequency — 465±2 kc/s

Tuning

Tune in by rotating the tuning knob. Use the knob for fine adjustment in the SW1 and SW2 bands.

Switching over the Bands

Turn band selector to switch over the bands. The inscription on the knob facing the mark on the case will point to the band switched on.

Tone Control

Select the desired tone of sounding by shifting the slider of tone control to the right or left.

Telescopic Antenna

Reception in SW1, SW2 bands is effected by using a telescopic antenna; it is connected in SW3 band.

Replacing of Exhausted Cells

Open the cover of the power supply compartment. Remove and disconnect the cell holder. Take off the slip cover, replace the exhausted cells by new ones, put on the slip cover, connect the cells holder to the block. Place the cell holder into the compartment and close the cover.

Delivery Set

Radio receiver	1 pc
Operating instructions	1 copy
Receiver carrying strap	1 pc
Packing case	1 pc

RADIO-RECEIVER VEGA 402

The description of radio-receiver Vega 402 provides the following data:

a) type of the receiver,
b) its range of operation,
c) power supply,
d) technical data,
e) construction of the receiver: its elements and their connections,
f) directions for use.

Description

Radio receiver Vega 402 is a portable superheterodyne. It is used for reception of broadcast stations operating in the ranges of LW and MW. They are received by internal magnetic antenna.

The receiver is fed from two type 3336Z connected in-series batteries of six type 316 cells. Supply voltage is 9V.

Technical Data

Ranges of received waves (frequencies):

long waves (LW)	2000 — 735m
medium waves (MW)	571 — 188m
sensitivity, not worse than, mV/m	
in the range of LW	2.5
in the range of MW	1.5
selectivity, not worse than	db 26
intermediate frequency Hz	465±2

Radio receiver Vega 402 is provided with seven transistors and two semiconductor diodes.

The input circuits use magnetic antennas and have an inductive coupling with frequency changer. When the receiver operates in the range of LW, the MW antenna coil 121 is parallel-connected with capacitor. When operating in the range of MW, the LW antenna coil L3 is short-circuited.

Frequency changer is provided with one transistor. The heterodyne uses four inductance coils.

Intermediate frequency amplifier is a two-stage unit and includes two transistors. The first stage is a resonant circuit. The coupling with the second stage is accomplished through a coil. The second stage is aperiodic.

Directions for Use (Supply Batteries Installation)

Open the battery compartment cover.

Connect batteries to the contact plate ensuring that the polarity be correct.

Load batteries in battery compartment of the receiver and close the cover.

Battery type Krona or storage batteries type 7-D-0.1 should be connected to special jacks on the contact plate.

Switching-on and Tuning

Turn the volume knob slightly clockwise, and the receiver will be switched on with a faint click. Turning it further in the same direction will advance desired volume of sound.

Push the band selector knob slightly to position so that your desired band mark comes. Turning the tuning

knob, tune to the desired station. For the best reception it should be necessary to turn the receiver to-and-fro for finding out the clearest receiving point and richest volume.

Turn the volume knob counterclockwise, and the radio receiver will be switched off.

TELEVISION SET

The description of television set УЛПТ-61-11 provides the following data:

a) operating instructions,
b) types of TV set,
c) characteristics of the main parts,
d) adjustment,
e) switching on and off.

In the text below find answers to the following questions:

1. Is УЛПТ-61-11 a colour or a monochrome TV set?
2. What type of kinescope do the TV sets use?
3. What is the difference between the two versions of the TV sets?
4. With what facilities are the TV sets provided?

Operating Instructions

УЛПТ-61-11 are modern high-quality tube-transistorized black-and-white TV sets. The TV sets use an implosion-proof kinescope with the angle of beam deflection of 110° and screen diagonal size 61 cm. The TV sets are produced in two versions:

models with the UHF block,

models without the UHF block but with all the elements providing for its installation.

Depending on the television standard the TV sets are produced of the Soviet (C), West-European (E) or American (A) standards.

The TV sets without the UHF block enable TV programs to be received within the following VHF ranges:

48-100 and 174-230 MHz for Soviet standard;
47-68 and 174-230 MHz for West-European standard;
54-88 and 174-216 MHz for American standard.

The TV sets with the UHF block, in addition to the above ranges, enable TV programs to be received in the following UHF ranges:

470-790 MHz for Soviet standard;
470-790 or 470-86 MHz for West-European standard;
470-890 MHz for American standard.

The TV sets are provided with facilities for connection of wire remote control of brightness and volume;

connection of a tape recorder for recording the sound;

listening to the sound by the earphones with the loudspeakers either switched on or off.

The TV sets employ:

automatic gain control providing for stable picture;

stabilization of horizontal and vertical picture sizes with power fluctuations from —10 to +6 per cent from the nominal;

automatic adjustment of frequency and line scanning phase, reducing interference to the minimum;

limiting the kinescope beam current.

Switching on and Adjustment

Read the text and answer the following questions:

1. Which knob of the TV set should be turned to switch it on?
2. Which knobs should be adjusted 3 to 5 min after?
3. By what means can horizontal or vertical scanning be synchronized?
4. What is advisable to do if the signal is weak?
5. Which knob should be turned to obtain the best picture and sound?
6. Which button should be depressed to receive TV programs in the UHF range?

Switch on the TV set, turning the knob "Brightness — Mains" (яркость — сеть) clockwise until a click is heard.

3 to 5 minutes after switching on, operating the appropriate knobs, adjust brightness, picture contrast and volume as required.

In accordance with the TV program, adjust sound quality, operating the knobs "LF Tone" (тембр НЧ) and "HF Tone" (тембр ВЧ).

Horizontal or vertical scanning can be synchronized, if necessary, by means of the knobs "Horizontal Hold" (частота строк) or "Vertical Hold" (частота кадров).

If the signal is weak or interference excessive in the VHF range, the heterodyne frequency automatic control may prove ineffective, in which case passing over to the manual control is advisable. Put the change-over switch "Heterodyne Automatic Control"—"Heterodyne Manual Control" to the position "Manual Control". Turning the heterodyne manual control knob obtain the best picture and sound.

To receive TV programs in the UHF range depress the UHF range switching-on button and by means of the knob for the gradual control of the UHF tuner set the required program.

To return to the VHF range again depress the UHF range switching-off button.

Connecting Wire Remote Control Desk

To use the remote control desk (RCD) take the contact plug out of the TV set socket used for connection of the RCD and insert the desk plug instead. Put the desk brightness and volume controls to the maximum brightness and volume. Then operating the "Brightness — Mains" knob adjust the tonal graduation to the maximum and by means of the volume control set the volume to the maximum.

Switching off

The TV set should be switched off, when not used. To switch off the TV set, turn the knob "Brightness— Mains" counterclockwise until a click is heard.

Part III

TEXTS FOR READING

PROGRESS IN RADIO ENGINEERING IN THE USSR

Read the text and say, which devices of those mentioned below are referred to in the text:

1. crystal radio set; 2. superheterodyne radio set; 3. valve radio set; 4. phono-radio; 5. TV set; 6. telephone; 7. telegraph; 8. radar set; 9. transmitter; 10. transmitting radio station.

A crystal set is the simplest type of a radio receiver. It can be assembled without much difficulty, however, it only receives local powerful radio stations over the telephone. It can be used in regions where there is no electricity, since it operates without a battery.

Programmes of distant radio stations are received by means of valve radio sets. The current induced in their antenna is amplified hundreds of times using the energy of dry cells or lighting mains.

Just as in crystal sets, the main component in valve radio sets is an oscillatory circuit with its variable capacitor. A radio set is tuned to a station by a control knob.

The device for playing records is also familiar to you. The needle of the pick-up travels along the groove of a disc. An audio-frequency current arising in the pick-up is amplified in the valve amplifier and is fed through the loudspeaker, which reproduces sounds recorded in the disc.

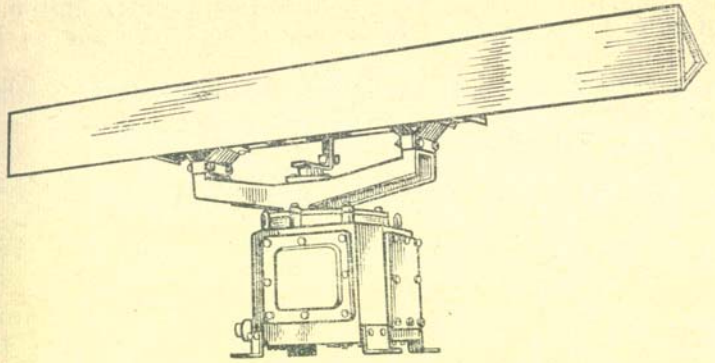

Fig. 9. A radar.

Various radio engineering apparatus are extensively used in industry for control of machines and production lines, in transport and in agriculture for communication purposes, in medicine for treating a number of diseases.

The progress made by Soviet radio engineering ensured reliable radio contact with spaceships.

Radio is employed not only for transmitting and receiving audio-signals over great distances but also for transmitting images and films. This branch of radio engineering is called television. Today we have a large number of TV stations throughout the country linked up into a single network. People in various parts of the Soviet Union watch the TV programmes broadcast from Moscow. Some of them are relayed to Western Europe.

If a narrow beam of radio waves is sent out in a certain direction, it will be reflected by an obstacle and returned in the form of a "radio echo". Having received the reflected signal, a distance to the obstacle can be found. Operation of a radio locating apparatus, called

radar, is based on this phenomenon. Aircraft and ships are equipped with radar sets to help them orientate when visibility is poor (radio waves penetrate fog, clouds, rain and snow). Radar sets installed on aircraft prevent collision of planes during landing and take-off.

Soviet scientists probed Venus with a radar beam which brought back valuable data about the planet. This was quite an achievement considering that the signal sent to the planet hit it and returned to Earth a mere millionth of a watt strong. Nevertheless it was received on the Earth.

Born in Russia, the radio serves the cause of communist construction.

POWER FAILURE IN THE USA

In the text below you will read about the power failure in the USA. By what figures is it characterized?

The largest power failure in history began at approximately 5. p. m. on November 9, 1965 and lasted till 6 p. m. November 10, 1965. In some areas short power failure took place while in other areas there was a complete loss of electric power for varying periods up to 13 hours.

New York City and a large area in the Northeastern United States and the province of Ontario, Canada, were blacked out. Some 30 million people in an 80,000 square mile area were affected by the power failure, and were put into darkness.

In some areas when power failed, the generators were started and in approximately 30 seconds were supplying the additional power.

New York City received the most paralyzing effect from the power failure. Thousands of buildings were blacked out. Radio network stopped operating and was put into operation only when protective power generators were used. Some services stopped operating due to failure of both A. C. and D. C. power services, water supply system and heating system among them. Of the broadcast system only 21 broadcast stations were operating during the blackout. 74 broadcasting stations began operating only when protective power generators were applied.

The electric power failure affected the television broadcast stations and caused a blackout of all television receivers.

The history of power supply for many years has never shown a similar situation where both A. C. and D. C. sources failed simultaneously.

POWER SYSTEM IN THE MOUNTAIN

Read the text and answer the following questions:

1. What two parts does the text consist of? 2. By what figures is this power system characterized?

A large one million kilowatt power system was constructed in the USA. It provides electric power for lightning five million street lights.

Its tunnels and powerhouse were built inside a mountain, near the town of Northfield. In order to build this power plant, more than three miles of underground tunnels were drilled. This plant is the first underground plant.

— How does the hydro-electric complex work?

— Through the underground tunnels, more than three miles in length, four pump-generators pump water from the Connecticut River 800 feet up to a 300-acre manmade lake at the top of the mountain. When power is produced, water falls back down a 1,100 feet long pressure shaft to turn each of 250,000 kW turbines used in the system.

ELECTRIC CURRENT

Read the text and answer the following questions:

1. Which part of the text deals with substances with different degrees of conductivity?
2. What substances are called semiconductors?
3. Which part deals with types of current?
4. What is the difference between the types of current?
5. What is the difference between an open circuit and a closed one?

In the 17th century it was discovered that many substances can be electrified by friction. In 1756 the great Russian scientist M. Lomonosov made the theoretical analysis of electrical phenomena.

Nowadays the nature of electric current is explained by the electron theory. In most cases, an electric current is described as a flow of electric charges along a conductor.

Two things are necessary to cause an electric current

to flow; first—a complete circuit, and second—a driving force called the electromotive force (e. m. f.).

Current will flow more readily in some substances than in others, that is, various substances offer lesser or greater resistance in the flow of current. The practical unit of resistance is the ohm. An application of Ohm's law tells us that an e. m. f. of 1 volt will produce a current of 1 ampere in a wire which has a resistance of 1 ohm.

Symbolically, Ohm's law is often written:

$$R=\frac{V}{I}, \text{ or } \text{resistance}=\frac{\text{potential difference}}{\text{current}}$$

Such substances, as porcelain, ebonite, rubber and glass, having extremely high resistance, are known as insulators.

Substances whose properties lie between those of conductors and insulators are called semiconductors. Let us name but a few most widely used at present; they are germanium, silicon, selenium and copper oxide. The importance of semiconductors in our life is great.

An electric current which flows in the same direction through a conductor or a current which does not change its polarity is called a direct current (D. C.) or a continuous current. An alternating current (A. C.) flows first in one direction and then in the other.

An electric circuit is a path through which an electric current flows. This is a complete path along which electrons can transmit their charges. An electric circuit includes a battery, generator, or magnetic means for producing current flow. Some portion of the circuit is made to do useful work.

The circuit is said to be open when no charges can move due to a break in the path. The circuit is said to be closed when no break exists—when switches are closed and all connections are properly made.

Special symbols are used to show electrical systems. There is a wide range of these symbols.

SOME SOURCES OF POWER

Read the text and say, what other sources of power, besides those mentioned in the text, are used in the modern world.

The industrial progress of mankind is based on power: power for industrial plants, machines, heating and lighting system, transport communication.

At present most of the power required is obtained mainly from two sources. One is from the burning of fossil fuels, i. e. coal, natural gas and oil. The other is

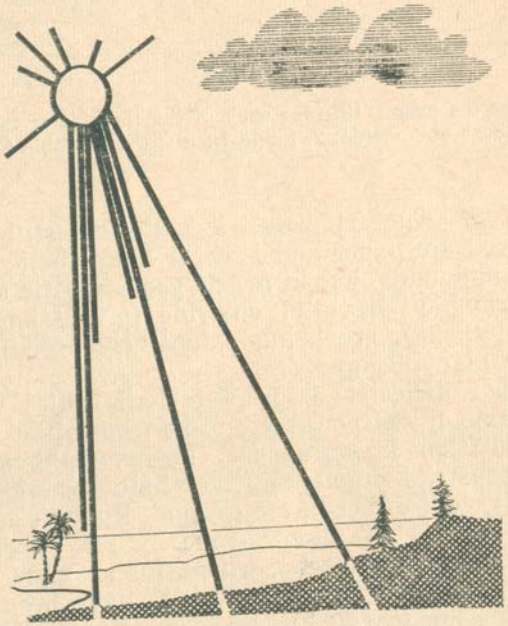

Fig. 10.

by means of generators that get their power from water turbines. Electricity produced in this way flows through transmission lines to houses, industrial plants, enterprises, etc.

Much thought is given, however, to other means of producing power. One of them is the use of ocean tides. The first station in the world using this principle operates in the Soviet Union on the Barents Sea.

The Sun is a great source of power. The amount of heat which it radiates every minute is equivalent to the power generated by burning 11,600 million tons of coal. The energy which the Earth receives from the Sun may