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TRANSLATION

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The aids to navigation of the seas washing the shores of the Soviet Union are improving, year by year.

Over 35 new radiobeacon stations, 30 electrically lighted beacons, 150 lighted navigation markers, 18 sound-signal installations, and over 50 lighted engineering structures for various purposes have been placed in service in the past five years.

All of these installations have, as a rule, been built in accordance with type projects, out of materials in use at the present time. Industrial types of reinforced concrete, prefabricated structures, manufactured in factories, were widely used in the construction work.

New, powerful, sector radiobeacon stations, the VRM-5, have been delivered and are included among the operating units included among the navigation installation in the Far East.

The advantages of sector radiobeacons include long range (up to 1,000 miles), increased bearing accuracy (0.2 to 0.5°), and the ability to receive radiobeacon signals using a standard radio direction finder or communications receiver.

The considerable amount of theoretical scientific and experimental work conducted in recent years has made possible a study of the features involved in using these radiobeacon stations and in improving the accuracy with which position is determined. The calculations made to determine errors occurring as a result of the conditions governing radiowave propagation, made use of a generalized methodology for calculating the amplitudes and phases of radiowaves propagated over the electrically discontinuous earth's surface. The results agreed well with experimental data.

Figures 1 and 2 show the results of computed corrections and applied corrections made in advance and as determined by experimental means for the VRM-5 radiobeacons at Terpeniye (fig. 1) and Shumsha (fig. 2). The preliminary correction calculations are a good reflection of the behavior pattern for the changes which occurred as a result of the correction factors determined experimentally for these same radiobeacons.

The result of making the correction factor computation, as shown in figures 2 and 3, was to eliminate systematic errors and to increase bearing determination accuracy three to four times. It was established that the systematic errors in the VRM-5 operating sectors, measured during the seagoing navigation investigations, were time stable and, for all practical purposes, retained their signs and magnitudes at all ranges from the beacon.

A new operating mode for conventional marine radiobeacons, using 360° radiation, was introduced in 1958-1960. This made possible a considerable reduction in the level of the mutual interference such beacons caused each other and made bearing taking more convenient for navigators.

The feature of the new mode was the combining into a group six radiobeacons operating in series at one minute intervals on the same frequency. Accordingly, in a six minute cycle each radiobeacon will function once. This cycle goes on regardless of the weather.

Simultaneously, the old equipment in most of the radiobeacons was replaced by a new type, the KRM-100, which includes in its design the latest achievements in the field of radioelectronics.

The KRM-100 range is 150 miles, with a field intensity at the limit of range equal to 75 microvolts/meter. Its transmitter is in the medium wave band and can operate on quartz oscillator stabilized fixed frequencies, or in a floating band. The tone oscillator modulates the radiobeacon's carrier frequency with one of 11 fixed audio frequencies between 354 and 1052 cycles.

When the beacon is operating with tone-modulated oscillations the call signs and the long dash can be transmitted by broken or continuous radiation of high frequency oscillations. The latter type of operation simplifies bearing taking when automatic RDFs are used because steady readings on the pointer type indicator at the time the call sign is delivered (or picked up) can be provided for.

Semiconductor devices are finding widespread application in beacon type installations, and their use makes it possible to obtain a considerable improvement in operational reliability of the equipment, while, at the same time, making it possible to reduce equipment dimensions.

A new, low-powered, automatic, tubeless radio beacon, type MRM-61 (fig. 3), has been quite widely introduced recently. Its circuitry makes use of semiconductor devices throughout. The equipment is highly operable on its own, and needs no servicing for 4 to 5 months. The radiobeacon's range is between 25 and 35 miles, depending on the type of antenna used. All technical parameters are guaranteed for air temperatures between -20 and +40°, in humidity as high as 98±2%, and in wind velocities as high as 12.

The transmitter weighs 30 kg, operates in the medium frequency band on fixed frequencies which are quartz crystal stabilized. Frequency stability is 0.03%, and output power is almost 1.5 watts.

It is now practise to install two transmitters, the main and a reserve, in order to increase the reliability of operation of the unattended radio beacons of the MRM-61 type set out in areas which are difficult of access and along sections over which navigation is heavy. The reserve unit cuts in automatically when the main unit breaks down. A special device, "Dubler-1A," functions to carry out the switch. The latter also sends out a supplementary signal coded for the radio beacon and this signal is simultaneously warning that the beacon has suffered damage.

Today technicians in all countries concerned with the operation of marine radio beacons are faced with an unusually important problem, that of reducing interference when bearing on radio beacons. Soviet specialists have found new standards of protection against interference. This standards stem, primarily, from the organization of operation of radio beacons and the distribution of the frequencies between the stations.

In the past, a good deal of attention has been given to questions concerned with the building of highly effective sources of supply for completely automated and unattended shore and afloat types of navigation equipment. They must be fully electrified in order to improve their reliability of operation and improve their tactical and technical data. Today, the problem os electrification of unattended navigational aids can be solved successfully by using low powered light sources supplied by 6 to 50 watt lamps. When the flashing mode for the light is considered, daily requirements for these aids are not in excess of 0.25 kw/hour.

Low-powered, wind generator electrical stations, type VES-2M, the wind aggregate in which is storm resistant, as well as galvanic element-storage batteries, are in use for supplying lights set out as part of the buoyage system in areas which are difficult of access.

The introduction of solar batteries to supply power in areas which are difficult of access and for navigational aids which are visited only occasionally, is of particular interest. The conversion of solar energy into electrical energy using silicon photocells is extremely interesting.

The Soviet power supplies which use solar batteries for navigational aids are featured by a high degree of reliability. They can be used in latitudes from 40 to 60° at any time of year, and require no servicing for 12 months.

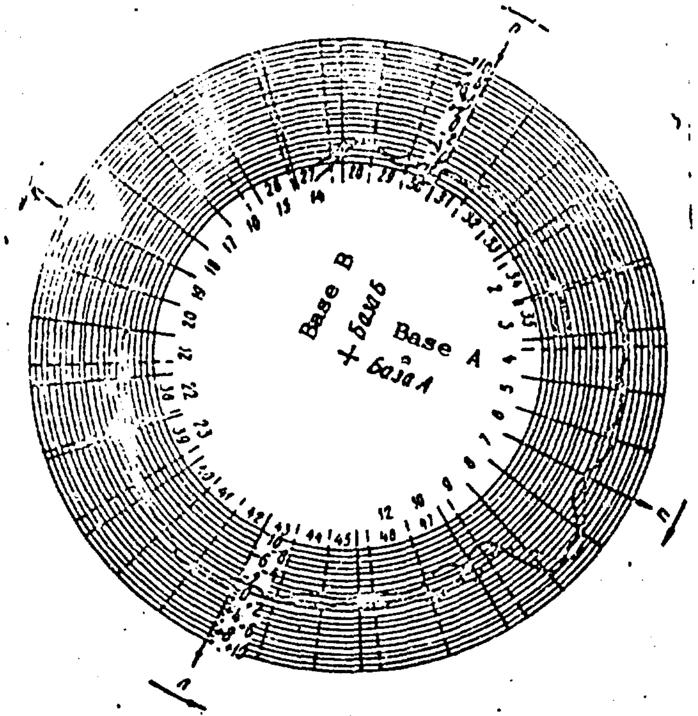

Figure 1.
—— computed corrections; ----- experimental corrections along baseline A; ..... experimental corrections along baseline B

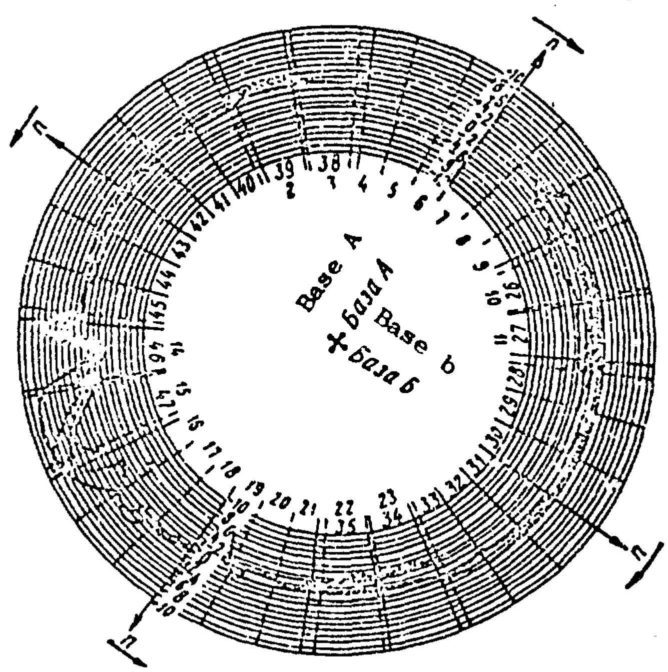

Figure 2.
Legend the same as for Figure 1

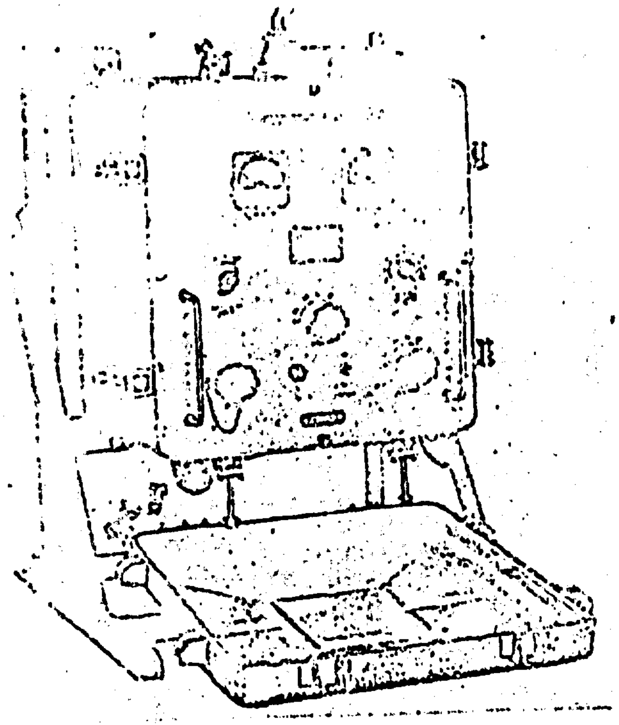

Figure 3.