TEKA. COMMISSION OF MOTORIZATION AND ENERGETICS IN AGRICULTURE – 2017, Vol. 17, No. 3, 83-91

System of Registration and Control the Flight of Transportation of Grain Harvest by Vehicles

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Received February 6.2017: accepted May 24.2017

Summary. The study relates to technical means of registration and control of flight vehicles. The technical result is the implementation of the monitoring schedule specified route of movement of vehicles. The system of registration and control of flights moving objects contains controlled moving objects, RFID tags, contains piezocrystal, microstrip transceiver antenna, electrodes, two buses and a set of reflectors, and control. On a movable object installed: pressure transducers, body position, fuel consumption, trip distance, elements, block encoding, the transmitter, the high-frequency generator, phase manipulator, power amplifier, transceiver antenna, a circulator, a high frequency amplifier, phase detector, an adder, a timer and driver code. At the point of control is established: the receiving antenna, amplifier high frequency, the search block, two local oscillators, two amplifiers, two mixers, two amplifiers of intermediate frequency, amplitude detector, two multiplier, a narrow-band filter, low pass filter, panoramic receiver, decoder, registration block, an element of the ban, the shaper pulse duration, two keys, a correlator, a threshold unit, frequency meter, fuel meter, trip meter and an additional unit.

The proposed system relates to the field of technical means of registration and control of flights moving objects and can be used to account for the efficiency of the use of vehicles in an automated warehouse shipment of goods in trade or account the receipt of raw materials, shipment of products in agriculture, during transportation of the grain harvest of crops and bulk cargo.

Of the known systems and devices closest to the proposed is a device for metering flights trucks, which is selected as a prototype.

The known device provides increased noise immunity and selectivity panoramic receiver by suppressing spurious signals (noise) taken on additional channels.

The technical challenge is to expand the functionality of the system by controlling the execution schedule of a specified route in the registration and control of flights transportation of the grain harvest vehicles.

Key words: system, registration, control, flight, transport, vintage, vehicle.

INTRODUCTION

The study relates to technical means of registration and control of flight vehicles [1]. The technical result - the implementation of the monitoring schedule specified route of movement of vehicles [2, 3]. The system of registration and control of flights moving objects contains controlled moving objects, RFID tags, contains piezocrystal, microstrip transceiver antenna, electrodes, two buses and a set of reflectors, and control [4, 5]. On a movable object installed: pressure transducers [6], body position [7], fuel consumption [8], trip distance [9], elements [10], block encoding [11], transmitter [12], high-frequency generator [13], phase manipulator [14], power amplifier [15], transceiver antenna, a circulator, a high frequency amplifier [16], phase detector, an adder, a timer and driver code [17]. At the point of control is established: the receiving antenna, amplifier high frequency, the search block, two local oscillators, two amplifiers, two mixers, two amplifiers of intermediate frequency, amplitude detector, two multiplier, a narrow-band filter, low pass filter, panoramic receiver, decoder, registration block, an element of the ban, the shaper pulse duration, two keys, a correlator, a threshold unit, frequency meter, fuel meter, trip meter and an additional unit [18].

The proposed system relates to the field of technical means of registration and control of flights moving objects and can be used to account for the efficiency of the use of vehicles in an automated warehouse shipment of goods in trade or account the receipt of raw materials, shipment of products in agriculture, during transportation of the grain harvest of crops and bulk cargo [19].

THE ANALYSIS OF RECENT RESEARCHES AND PUBLICATIONS

Of the known systems and devices closest to the proposed is a device for metering flights trucks, which is selected as a prototype [20]. The known device provides increased noise immunity and selectivity panoramic receiver by suppressing spurious signals (noise) taken on additional channels [22].

OBJECTIVE

The technical challenge is to expand the functionality of the system by controlling the execution schedule of a specified route in the registration and control of flights transportation of the grain harvest vehicles.

THE MAIN RESULTS OF THE RESEARCH

The problem is solved in that the system of registration and control of flights moving objects, containing, in accordance with the closest analogue, each controlled movable object sequentially enabled sensor pressure element And a second input coupled with the output of the position sensor body, block coding, second and third inputs connected to the outputs of flow sensor and fuel sensor of the traversed path, respectively, the phase manipulator, a second input coupled to the first output of the high-frequency generator and power amplifier, and the control point consistently included receiving antenna, amplifier high frequency, the first mixer, the second input is via the first local oscillator connected to the output of the search block, the first intermediate frequency amplifier, the second key, the first multiplier, a second input coupled with the output of the low pass filter, narrow band filter, second multiplier, a second input connected to the output of the second key, the lowpass filter and a decoder, the outputs of which are connected by the number of controlled moving objects, the Executive blocks, each of which consists of sequentially connected to the decoder element of the ban, the registration unit and shaper pulse duration, the output of which is connected to prohibit the entrance element of the ban, connected in series to the output of the amplifier high frequency, a second mixer, the second input is via a second local oscillator connected to the output of the search block, the second intermediate frequency amplifier, the correlator, a second input coupled to the output of the first amplifier intermediate height, and a threshold unit, the output of which is connected to the second input of the second key, sequentially connected to the second input of the first oscillator, the first key, the second input of which through the amplitude detector connected to the output of the second key, frequency and additional registration unit, second, the third and fourth inputs of which are connected directly and through the meter fuel consumption and trip meter with the corresponding outputs of the decoder, the frequencies of the local oscillators spaced at twice the value of the intermediate frequency:

$$f_{g2}-f_{g1}=2f_{pr},$$

selected symmetric about the carrier frequency of the main channel:

$$f_1-f_{g1}=f_{g2}-f_1=f_{pr},$$

and rebuilt synchronously, differs from the closest analogue because it is equipped with an RF tag installed at checkpoints along the route of the mobile object which is equipped with a transceiving antenna, a circulator, a high frequency amplifier, phase detector, integrator, and driver code and the timer and to the output of the power amplifier sequentially connected to the circulator, input-output of which is connected with the transmitting-receiving antenna, amplifier high frequency, a phase detector, a second input coupled with the second output of the high-frequency generator and the adder, the second input of which through the shaper code is connected to the output of the timer and the output connected to the fourth input unit of coding, each RF tag is made in the form of piezocrystal coated on the surface of the aluminum thin-film interdigital transducer and reflectors, the interdigital transducer of the surface acoustic wave and contains two comb system of electrodes connected by a tire associated with microstrip transceiver antenna, also made on the surface of piezocrystal.

Block diagram of equipment installed on a movable object represented in Fig. 1. Block diagram of equipment installed on the control point, Fig. 3. Functional diagram of the radio frequency tag depicted in Fig. 2.

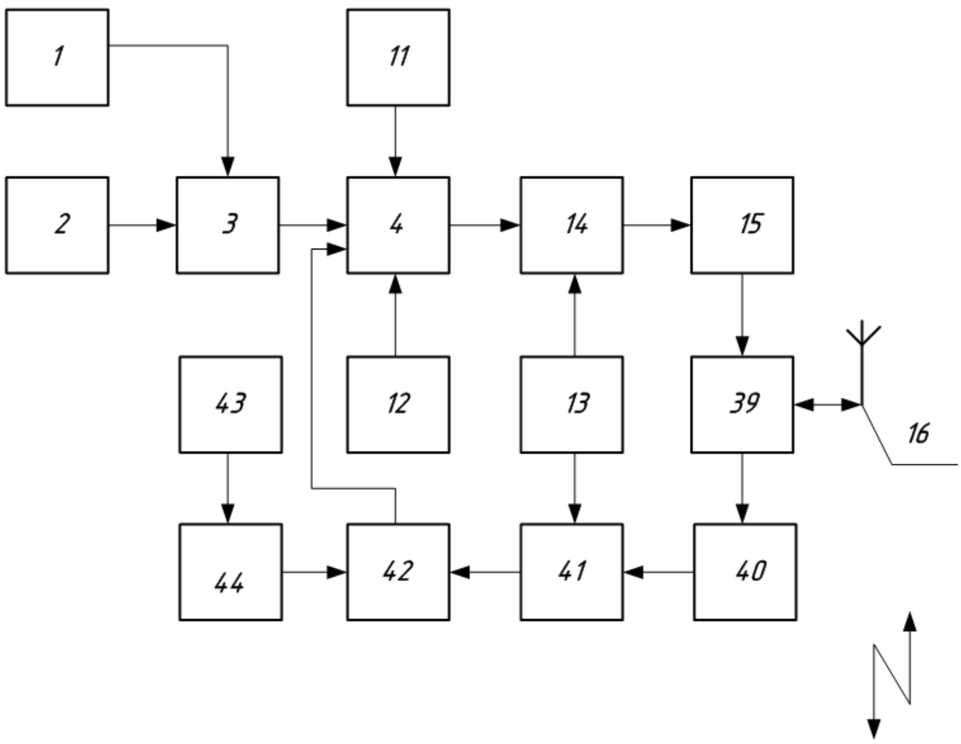

Fig. 1. Registration system for flight vehicles

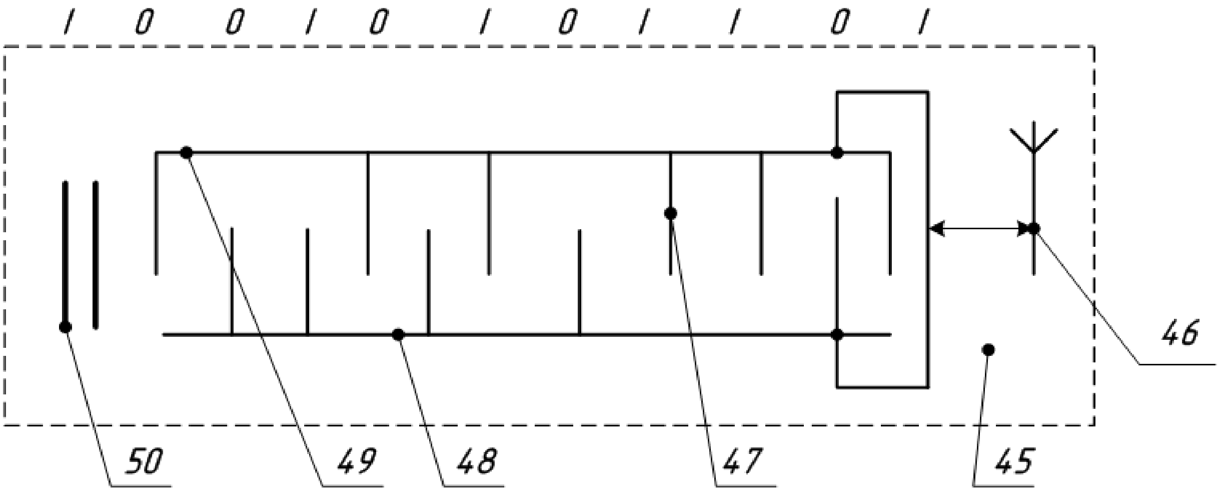

Fig. 2. Control system for flight vehicles

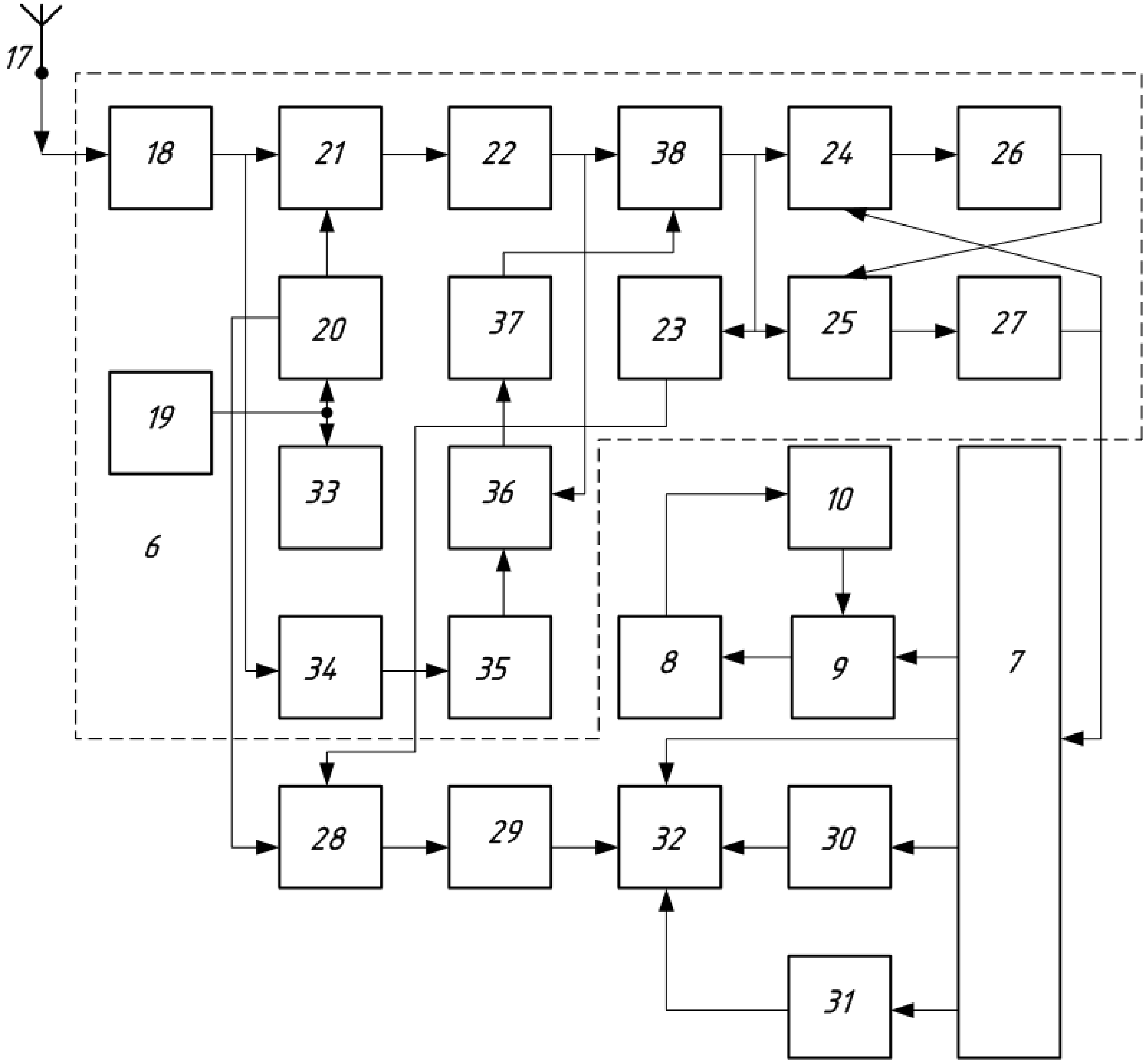

Fig. 3. System of registration and control of flight vehicles

The equipment that is installed on a movable object includes sequentially enabled sensor 1 pressure element And 3, the second input of which is connected to the output of the position sensor 2 body, 4 block coding, second and third inputs connected to the outputs of the sensor 11 of the fuel and the sensor 12 of the traversed path, respectively, of the phase manipulator 14, a second input coupled to the first output of the generator 13 high frequency amplifier 15 power, a circulator 39, the input-output of which is connected with the transmitting-receiving antenna 16, amplifier 40 is a high frequency, the phase detector 41, the second input of which is coupled to the second output of the generator 13 high frequency, and the adder 42, the second input is through the shaper 44 code connected to the output of the timer 43, and the output connected to the fourth input of the unit 4 encoding.

RF tag is made in the form of piezocrystal coated on 45 the surface of the aluminum thin-film interdigital transducer and a set of 50 reflectors. Interdigital transducer (IDT) surface acoustic wave (saw) contains two comb system of electrodes 47, which are connected to each other tires 48 and 49 associated with microstrip transceiver antenna 46, also performed on the surface of the piezoelectric crystal 45.

The equipment installed at the point of control contains consistently included receiving antenna 17, the amplifier 18 high frequency, the first mixer 21, the second input is via the first local oscillator 20 is connected to the output of the block 19 of the search, the first amplifier 22 intermediate frequency, the second key 38, the first multiplier 24, a second input coupled to the output of the filter 27 of the lower frequencies, narrow-band filter 26, a second multiplier 25, a second input connected to the output of the second key 38, the filter 27 of the lower frequencies and the decoder 7, the outputs of which are connected by the number of controlled moving objects, the executive blocks each of which consists of sequentially connected to the decoder 7 item ban 9, block 8 registration and driver 10 pulse duration, the output of which is connected to prohibit the entrance of item 9 of the ban.

The output of the amplifier 18 high frequency sequentially connected to the second mixer 34, the second input of which through the second local oscillator 33 connected to the output unit 19 of the search, and the second amplifier 35 intermediate frequency, the correlator 36, a second input coupled to the output of the first amplifier 22 intermediate frequency, and the threshold unit 37, the output of which is connected to the second input of the second key 38.

To the second input of the first local oscillator 20 connected in series the first key 28, the second input of which through the amplitude detector 23 is connected to the output of the second key 38, a frequency counter 29 and an additional unit 32 of the registration, the second, third and fourth inputs of which are connected directly and through the meter 30 fuel consumption, and the counter 31 of the traversed path with the corresponding outputs of the decoder 7. The system of registration and control of flights moving objects operates as follows.

When lifting the body with the load pressure in the oil line of the lifting body increases, the sensor 1 pressure produces a signal which is supplied to first input of gate 3.

The latter produces a signal only when the second input receives the signal from the sensor 2 position of the body, which produces a signal only when raised to the upper position of the body.

If there are two signals from sensor 1 pressure sensor 2 position of the body element 3 and produces an output signal which is supplied to the first input unit 4 encoding.

The above-described operation of the system corresponds to the case when the mobile object uses the dump truck.

During movement of the dump signal from the sensor 11 of the fuel and the sensor 12 of the traversed path in the form of a series of pulses is received by the second and third inputs of the block 4 encoding.

The encoding unit 4 generates the modulating code $M_1(t)$, where "coded" information about the license plate of the dump truck, the number of the lifting body with load, fuel consumption and distance traveled.

Modulating code M1(t) contains N1 elementary parcels duration TE. The first n elementary parcels are in digital form information on the license plate of a dump truck, m elementary parcels are discharged to the number of lifts of the body with the load, l elementary parcels reported fuel consumption, and z basic assumptions reflect the path of the dump truck (N_1=n+m+l+z).

Modulating code M1(t) output from the encoding unit 4 is supplied to a first input of the phase manipulator 14, to the second input of which is applied harmonic oscillation from the first output of the generator 13 high frequency:

$$U_1(t)=V_1\times Cos(2\pi f_1 t+\varphi_1),\ 0\leq t\leq T_1,$$

where: V_1, f_1, φ_1, T_1 – amplitude, carrier frequency, initial phase and duration of harmonic oscillations.

The output of the phase manipulator 14 is formed a phase-shift keyed (F_{MN}) signal:

$$U_2(t)=V_1\times Cos(2\pi f_1 t+\varphi_{k1}(t)+\varphi_1),\ 0\leq t\leq T_1,$$

where: $\varphi_{k1}(t)=\{0,\pi\}$ – manipulated component phases, reflecting the law of phase manipulation in accordance with the modulating code $M_1(t)$, and $\varphi_{k1}(t)$=const when kTE<t<(k 1)TE and may change abruptly at t=kTE, i.e. at the boundaries between elementary parcels (k=1, 2, ... N_1-1), TE, N_1 – duration and the number of elementary parcels that form the signal duration T_1 ($T_1=N_1$*TE),
which after amplification in the amplifier 15 power through the circulator 39 is received in the transmitting-receiving antenna 16 and is radiated into the ether.

It should be noted that each truck has its own modulating code $M_i(t)$ and carrier frequency:

$$f_i\ (i=1, 2, ..., S),$$

where: S – number of controlled trucks.

With the passage of dump trucks by the control point, which has RF tag, F_{MN}-signal $U_2(t)$ is captured by mitropolski antenna 46, is converted IDT in an acoustic wave which propagates on the surface of the piezoelectric crystal 45 is reflected from a set of 50 reflectors and again converted into a signal with phase manipulation:

$$U_3=V_3\times cos(2\pi f_1 t+\varphi_{k2}(t)+\varphi_1),\ 0\leq t\leq T_1,$$

where: $\varphi_{k2}(t)=\{0,\pi\}$ – manipulated component phases, reflecting the law of phase manipulation in accordance with the topology of IDT $M_2(t)$, which in turn defines the number and location of control points.

Which is radiated microstrip transceiver antenna 46 on the air, is caught transmitting antenna 16 of the dump and through the circulator 39 and the amplifier 40 of high frequency is supplied to the first (information) input of phase detector 41, the second (reference) input of which the reference voltage is served harmonic oscillation $U_1(t)$ from the second output of the generator 13 high frequency.

The result of the synchronous detection output of the phase detector 41 is formed of a low-frequency voltage:

$$U_{H1}(t)=V_{H1}\times\cos\varphi_{k2}(t),\ 0\le t\le T_1,$$

where:

$$U_{H1}(t)=½V_3\times V_1,$$

proportional to the modulating code $M_2(t)$, which defines the number and location of control points.

This voltage is supplied to a first input of adder 42.

The current time output from the timer 43 is supplied to the input of the shaper 44 code which generates the modulating code $M_3(t)$. This code is supplied to the second input of the adder 42, the output of which is formed total code:

$$M_\Sigma(t)=M_2(t)+M_3(t),$$

which is output from the adder 42 is supplied to the fourth input of the unit 4 encoding. The encoding unit 4 generates the simulation code $M_4(t)$, which contains information about the modulating codes $M_1(t)$ and $M_\Sigma(t)$. Modulating code $M_4(t)$ contains N_2 elementary parcels duration TE. [$N_2=N_1+p$, where: p – number of elementary parcels, containing the modulating code $M_\Sigma(t)$].

Modulating code $M_4(t)$ from the output of the encoding unit 4 is supplied to a first input of the phase manipulator 14, to the second input of which is applied harmonic oscillation $U_1(t)$ from the first output of the generator 13 high frequency.

The output of the phase manipulator 14 in this case is formed F_{MN} signal:

$$U_4(t)=V_1\times\mathrm{Cos}[2\pi f_1t+\varphi_{k3}(t)+\varphi_1],\ 0\le t\le T_1,$$

where: $\varphi_{k3}(t)=\{0,\pi\}$ – manipulated component phases, reflecting the law of phase manipulation in accordance with the simulation code $M_4(t)$.

Which after amplification in the amplifier 15 power through the circulator 39 is received in the transmitting-receiving antenna 16 and is radiated into the ether.

On the control point search F_{MN}-signals belonging to different moving entities (trucks), by using panoramic receiver 6.

This block 19 search periodically with period TP by sawtooth law synchronously change frequency f_{g1} and f_{g2} local oscillators 20 and 33.

Taken F_{MN}-signal $U_4(t)$ output from the receiving antenna 17 through the amplifier 18 high frequency is supplied to the first inputs of mixers 21 and 34, the second inputs of which are served voltage of the local oscillators 20 and 33:

$$U_{g1}(t)=V_{g1}\times\cos(2\pi f_{\Gamma1}t+\pi\gamma t^2+\varphi_{g1}),$$

$$U_{g2}(t)=V_{g2}\times\cos(2\pi f_{\Gamma2}t+\pi\gamma t^2+\varphi_{g2}),\ 0\le t\le T_1,$$

where: V_{g1}, V_{g2}, f_{g1}, f_{g2}, φ_{g1}, φ_{g2}, $T_п$ – amplitude, initial frequency, initial phase and the period of repetition (restructuring) voltage of the local oscillators, $\gamma=D_f/TP$ – the rate of change of the frequencies of the local oscillators (speed of viewing a given frequency range D_f).

The frequencies f_{g1} and f_{g2} of the local oscillators 20 and 33 spaced at twice the value of the intermediate frequency:

$$f_{g2}-f_{g1}=2f_{pr},$$

selected symmetric about the carrier frequency f_1 of the primary receiving channel:

$$f_1-f_{g1}=t_{g2}-f_1=f_{pr},$$

and rebuilt synchronously.

This circumstance leads to a doubling of the number of additional receiving channels, but creates favorable conditions for their suppression due to correlation processing channel stress.

At the output of mixers 21 and 34 are formed voltage Raman frequencies. Amplifiers 22 and 35 intermediate frequency are the following voltage:

$$U_{pr1}(t)=V_{pr1}\cos(2\pi f_{pr}t+\varphi_{k3}(t)-\pi\gamma t^2+\varphi_{pr1}),$$

$$U_{pr2}(t)=V_{pr2}\cos(2\pi f_{pr}t+\varphi_{k3}(t)+\pi\gamma t^2+\varphi_{pr2}),\ 0\le t\le T_1,$$

where:

$$V_{pr1}=½V_1*V_{g1},$$

$$V_{pr2}=½V_1*V_{g2},$$

$$f_{pr}=f_1-f_{g1}=f_{g2}-f_1 \text{ – intermediate frequency},$$

$$\varphi_{pr1}=\varphi_1-\varphi_{g1},$$

$$\varphi_{pr2}=\varphi_{g2}-\varphi_1,$$

which represent the complex signals with the combined phase manipulation and linear frequency modulation (F_{MN}-chirp).

These voltages are delivered to two inputs of the correlator 36, the output of which is formed correlation function $R(\tau)$, which is compared to a threshold voltage V_{por} in the threshold block 37.

V_{por} threshold level is exceeded only when the maximum value of the correlation function $R(\tau)$.

Since channel voltage $U_{pr1}(t)$ and $U_{pr2}(t)$ are formed by the same complex F_{MN}-signal $U_4(t)$ taken by the two channels on the same frequency f_1, between the specified channel voltages there is a strong correlation. Correlation function $R(\tau)$ FMN-signals has a distinct main lobe, which exceeds the threshold level V_{por} in the threshold block 37. If the threshold level V_{por} in the threshold block 37 is formed by a constant voltage, which is supplied to the control input of the key 38, opening it. In the initial state, the keys 28 and 38 are always closed.

The voltage $U_{pr}1(t)$ from the output of the amplifier 22 intermediate frequency via a public key 38 is supplied to the first inputs of multiplier products 24 and 25. To the second input of the multiplier 25 is energized from the output of notch filter 26:

$$U_5(t)=V_5\cos(2\pi f_{pr}t-\pi\gamma t^2+\varphi_{pr1}),\ 0\le t\le T_1,$$

the output of the multiplier 25 is formed of a low-frequency voltage:

$$U_{H2}(t)=V_{H2}\cos\varphi_{k3}(t),\ 0\le t\le T_1,$$

where:

$$V_{H2}(t)=½V_1\times V_5,$$

proportional modeling code $M_4(t)$.

This voltage is supplied to the second input of multiplier 24, whose output forms a voltage $U_5(t)$ emitted narrow-band filter 26.

Voltage $U_{H2}(t)$ simultaneously with the output of the filter 27 of the lower frequencies fed to the input of decoder 7, which depending on the code mobile object (dump) generates a signal through item 9 of the ban on the entry of block 8 of the Desk. Unit 8 registration, receiving and memorizing the signal that the flight is made, gives the signal shaper 10, which closes by using item 9 of the ban the input unit 8 registration from the decoder 7 to the minimum time of flight, excluding the false classification of flight in block 8 of the Desk when re-raising the body in the case of material sticking to the wall of the body. In addition, when lifting an empty body sensor 1 pressure produces a signal.

Voltage $U_{pr}1(t)$ simultaneously fed to the input of the amplitude detector 23, the detected video signal which is supplied to the control input of the key 28, opening it. The voltage of the local oscillator 20 via the public key 28 is fed to the input of the frequency meter 29, where the measured carrier frequency f_1 taken F_{MN}-signal.

$$f_1 = fg_1' + f_{pr},$$

where: fg_1' – the frequency of the first local oscillator 20 at a given time.

The measured value of the carrier frequency is fixed by the additional block 32 of the Desk, where both fixed tail number of the movable object (the dump), traveled way, the fuel consumption numbers and the location of control points through which proceeded the dump.

Discussed above the operation of the system corresponds to the case of receiving useful F_{MN}-signals in the main channel at frequency f_1.

If a complex signal (interference) is received by the first image channel at frequency fz_1, the mixers 21 and 34, it is converted to voltage following frequencies:

$$fz_{11}=f_{g1}+\gamma_1 t-fz_1=f_{pr}+\gamma_1 t,$$

$$fz_{12}=f_{g2}+\gamma_1 t-fz_1=3f_{pr}+\gamma_1 t,$$

$$fz_{11}^{(2)}=2f_{g1}+2\gamma_1 t-fz_1,$$

$$fz_{12}^{(2)}=2f_{g2}+2\gamma_1 t-fz_1,$$

where the index of degree refers to second harmonic frequencies of the local oscillators.

However, only the voltage with frequency fz_{11} falls into the bandwidth Δf_1 of the amplifier 22 intermediate frequency. The output voltage of the correlator 36 is zero, the key 38 is not opened and a false signal (interference) taken by the first image channel at frequency fz_1, is suppressed.

For a similar reason suppressed and false signals (interference) taken by the second image channel at frequency fz_2, by the first Raman channel at frequency $f\kappa_1$ and other additional channels.

If complex signals (noise) taken simultaneously by the first and second mirror channels at frequencies f_{31} and f_{32}, the voltage fall within the bandwidth of Δf_1 and Δf_2 of the amplifiers 22 and 35 intermediate frequency. But the key 38 in this case doesn't open. This is due to the fact that different spurious signals (noise) taken at different frequencies f_{31} and f_{32}, so between the two channel voltages there is a weak correlation. In addition, it should be noted that correlation function of noise has a pronounced main lobe, as is the case in complex FMN-signals. The output voltage of the correlator 36 in this case, does not exceed the threshold level V_{por} in the threshold unit 37, the key 38 is not opened and a false signal (noise) taken simultaneously by the first and second mirror channels at frequencies f_{31} and f_{32}, are suppressed.

For a similar reason suppressed and false signals (noise) taken simultaneously by two additional channels.

For transmission of operational parameters of mobile objects (trucks) to the control point using complex F_{MN}-signals with high noise immunity, energy and structural secrecy.

The system provides increased noise immunity and selectivity panoramic receiver. This is achieved by suppressing spurious signals (noise) taken on additional channels, by correlation processing.

Thus, the proposed system is compared with the prototype provides remote control over the implementation timetable for a given route of movement of mobile objects (trucks). This is achieved using control points that have radio-frequency tags on surface acoustic waves.

Fixing the time of passage of mobile objects (trucks) certain checkpoints allows the remote to control the schedule of their movement on a given route and to make timely decisions on the restoration of the rhythm of movement.

The main characteristics of the used RFID tags on surface acoustic waves include the following:

- the average power of the transmitter scanning device – no more than 100 mWt,
- frequency range – 400–420 MHz (900–920 MHz),
- type artificial signal is a complex signal with phase manipulation,
- the number of code combinations is 2^{32}–2^{128},
- dimensions 8×15×5 mm,
- service life - not less than 20 years,

- power consumption is 0 Wt,
- transmission range (distance) is at least 100 m.

The main distinguishing feature of RFID tags on surface waves are small size and lack of power sources. Thereby the functionality of the system expanded.

The system of registration and control of flights moving objects, containing for each controlled movable object sequentially enabled sensor pressure element and a second input coupled with the output of the position sensor body, block coding, second and third inputs connected to the outputs of flow sensor and fuel sensor of the traversed path, respectively, of the phase manipulator. The second input of which is connected to the first output of the high-frequency generator and power amplifier, and the control point consistently included receiving antenna, amplifier high frequency, the first mixer, the second input is via the first local oscillator connected to the output of the search block, the first intermediate frequency amplifier, the second key, the first multiplier, a second input coupled with the output of the low pass filter, narrow band filter, second multiplier, a second input connected to the output of the second key, the lowpass filter and a decoder, the outputs of which are connected by the number of controlled objects, the Executive blocks each of which consists of sequentially connected to the decoder element of the ban, the registration unit of the shaper pulse duration, the output of which is connected to prohibit the entrance element of the ban, connected in series to the output of the amplifier high frequency, a second mixer, the second input is via a second local oscillator connected to the output of the search block, the second amplifier intermediate frequency, the correlator.

The second input of which is connected to the output of the first amplifier intermediate frequency, a threshold unit, the output of which is connected to the second input of the second key, sequentially connected to the second input of the first oscillator, the first key, the second input of which through the amplitude detector connected to the output of the second key, frequency and additional registration unit.

The second, third and fourth inputs of which are connected directly and through the meter fuel consumption and trip meter with the corresponding outputs of the decoder, the frequencies of the local oscillators spaced at twice the value of the intermediate frequency $f_{g2}–f_{g1}=2f_{pr}$ where f_{g2} and f_{g1} frequencies of the first and second local oscillators, respectively, f_{pr} – intermediate frequency, the selected symmetric about the carrier frequency of the main channel of $f_1–f_{g1}=f_{g2}–f_1=f_{pr}$, where f_1 is the carrier frequency and reconstructed synchronously, characterized in that it is provided with a radiofrequency tag, installed at checkpoints along the route of the mobile object which is equipped with a transceiving antenna, a circulator.

CONCLUSIONS

1. At the point of control is established: the receiving antenna, amplifier high frequency, the search block, two local oscillators, two amplifiers, two mixers, two amplifiers of intermediate frequency, amplitude detector, two multiplier, a narrow-band filter, low pass filter, panoramic receiver, decoder, registration block, an element of the ban, the shaper pulse duration, two keys, a correlator, a threshold unit, frequency meter, fuel meter, trip meter and an additional unit.

2. The proposed system relates to the field of technical means of registration and control of flights moving objects and can be used to account for the efficiency of the use of vehicles in an automated warehouse shipment of goods in trade or account the receipt of raw materials, shipment of products in agriculture, during transportation of the grain harvest of crops and bulk cargo.

3. Amplifier high frequency, a phase detector, an adder, the driver code and the timer and to the output of the power amplifier sequentially connected to the circulator, input-output of which is connected with the transmitting-receiving antenna, amplifier high frequency, a phase detector, a second input coupled with the second output of the high-frequency generator and the adder, the second input of which through the shaper code is connected to the timer output, and the output connected to the fourth input unit of coding, each RF tag is made in the form of piezocrystal coated on its surface prokopinsky aluminum interdigital transducer and the reflectors, interdigital transducer of the surface acoustic wave and contains two comb system of electrodes connected by a tire associated with microstrip transceiver antenna, also made on the surface of piezocrystal.

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СИСТЕМА РЕГИСТРАЦИИ И КОНТРОЛЯ РЕЙСОВ ПЕРЕВОЗКИ УРОЖАЯ ЗЕРНОВЫХ ТРАНСПОРТНЫМИ СРЕДСТВАМИ

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Аннотация. Исследование относится к области технических средств регистрации и контроля рейсов транспортных средств. Технический результат это осуществление контроля за выполнением графика заданного маршрута движения транспортных средств. Система регистрации и контроля рейсов подвижных объектов содержит контролируемые подвижные объекты, радиочастотные метки, содержащие пьезокристалл, микрополосковую приемопередающую антенну, электроды, две шины, и набор отражателей, и пункт контроля. На подвижном объекте установлены: датчики давления, положения кузова, расхода топлива, пройденного пути, элементы, блок кодирования, передатчик, генератор высокой частоты, фазовый манипулятор, усилитель мощности, приемопередающую антенну, циркулятор, усилитель высокой частоты, фазовый детектор, сумматор, таймер и формирователь кода. На пункте контроля установлены: приемная антенна, усилитель высокой частоты, блок поиска, две гетеродины, два усилителя, два смесителя, два усилителя промежуточной частоты, амплитудный детектор, два перемножителя, узкополосный фильтр, фильтр низких частот, панорамный приемник, дешифратор, блок регистрации, элемент запрета, формирователь длительности импульсов, два ключа, коррелятор, пороговый блок, частотомер, счетчик расхода топлива, счетчик пройденного пути и дополнительный блок регистрации.

Предлагаемая система относится к области технических средств регистрации и контроля рейсов подвижных объектов и может быть использована для учета эффективности применения транспортных средств при автоматическом учете отгрузки продукции в торговле или учете приемки сырья, отгрузки продукции в сельском хозяйстве, при перевозке урожая зерновых сельскохозяйственных культур и сыпучих грузов.

Из известных систем и устройств наиболее близким к предлагаемым является устройство для учета рейсов автосамосвалов, которое и выбрано в качестве прототипа.

Известное устройство обеспечивает повышение помехозащищенности и избирательности панорамного приемника путем подавления ложных сигналов (помех), принимаемых по дополнительным каналам.

Технической задачей является расширение функциональных возможностей системы путем контроля за выполнением графика заданного маршрута движения при регистрации и контроле рейсов перевозки урожая зерновых транспортными средствами.

Ключевые слова: система, регистрация, контроль, рейс, перевозка, урожай, транспортное средство.