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THE TECHNICAL EQUIPMENT OF COMPUTERIZED CONTROL SYSTEMS (SELECT--ETC(U)
JAN 79 O V GOLOVANOV, V N OBOLENSKIY

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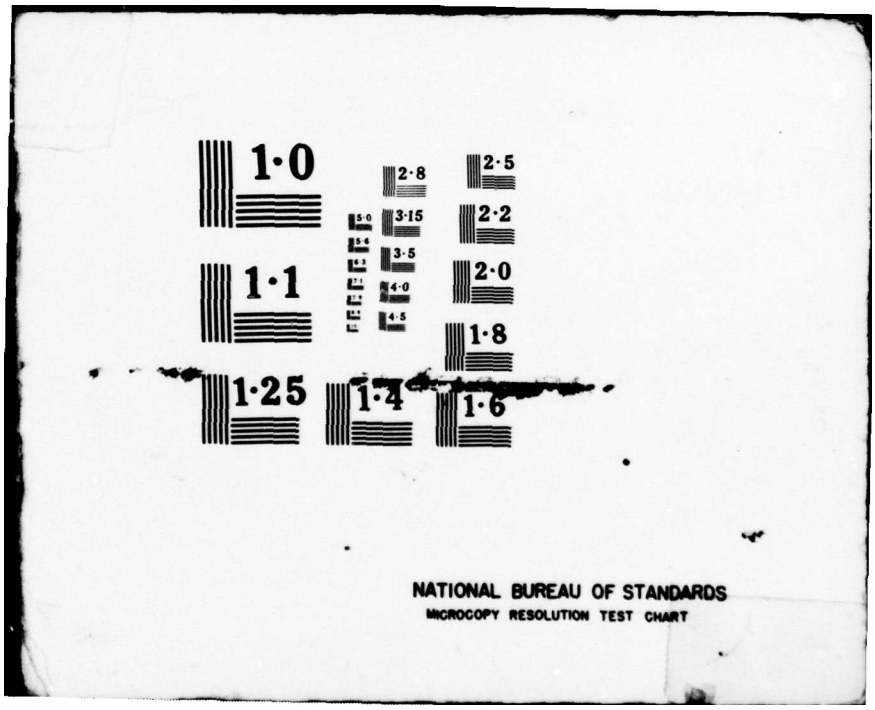
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FOREIGN TECHNOLOGY DIVISION

THE TECHNICAL EQUIPMENT OF COMPUTERIZED CONTROL SYSTEMS
(SELECTED PAGES)

By

O. V. Golovanov, V. N. Obolenskiy, et al

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

UNEDITED MACHINE TRANSLATION

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TRANSLATION DIVISION
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The composition of equipment means ASUPP, their tactico-technological characteristics to high degree depend on a series of ambient conditions and requirements.

1. Location of objects of control and direction relative to TsPU. It is possible to isolate three forms of location of the objects:

with the concentrated location of the parameters; to similar by objects they are related the chemical and petrochemical technological installations on which the sensors of the controlled/inspected parameters are separated from TsPU up to distances to 300 m and is permissible the teletransmission of their signals;

with the concentrated location of the parameters, but the territorial separated objects, distant behind TsPU at distances from 300 m to 5 km; in this case it is expedient and economically profitable the application/use of telemechanical transmission media of information;

with the mixed location of the parameters with which occur both of the conditions indicated; in this case the system of means must ensure both the remote and telemechanical transmission of information.

2. Necessary high speed and connected with it application/use of different methods of modulation of sensor signals during telemechanical transmission.

3. Degree of complexity of algorithms, realized in system (algorithm of supervisory control of automated or automatic operational control).

4. Requirement for authenticity of information. An increase in the degree of the authenticity of transmission and to information processing is reached both because of its redundancy and because of the object of technical equipment by the control devices and correction. The authenticity of the transmission of information depends substantially on the quality of the utilized communication channels. The uses of the chosen physical pair in telephone cable to a considerable degree decrease the authenticity of transmission in comparison with that case when transmission is realized along the

specially laid communication channels.

The effect of these conditions for the structures of ASUPP can be traced during the equipment realization of the automated systems of control of the type "cascade/stage"[KASKAD].

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During the creation of these systems one way or another, were conducted the ideas of an increase in the degree of reliability and effectiveness of the functioning of ASUPP, after conforming to the technical capabilities of the entering it equipment.

The structure of ASUPP, in which is used teleinformational system TIS-1 with TsVM [digital computer] "Ural-11B", is given in Fig. 4 [1. 4, 5]. The information-carrying system TIS-1 includes 12 decks of the transceiver equipment for the type BTTsP 1/1K. On the controlled/inspected point/items in the shops of plant to subassemblies KP, are connected the sensors of the analog parameters Yes whose signals for transmission are modulated with the aid of time-pulse converters VIP, the sensors of the discrete signals of the state of technological equipment Дд and the sensors of information in the digital form DTsI, connected through the commutator of sensors KD. The instructions of the remote control TRK are put out by the

parallel binary-coded decimal code from the trigger register of subassembly KP of BTTsP 1/1K, while the instructions of remote control TU - from the contacts of relay.

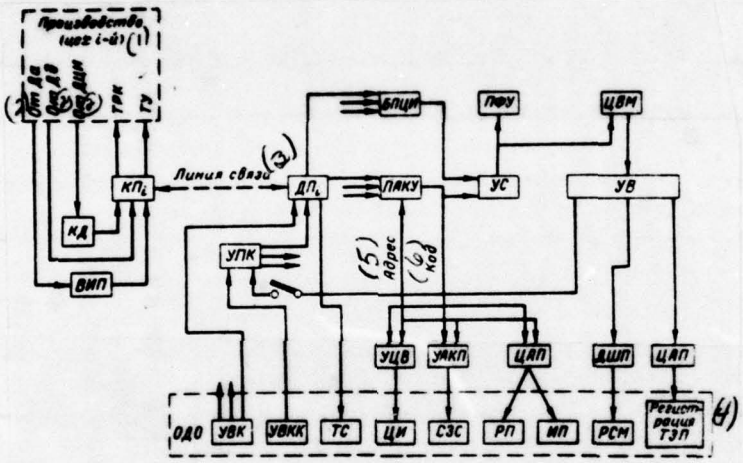

Fig. 4. Structure of ASUPP with teleinformational system TIS-1 and TsVM "Ural-11B".

Key: (1). Production (shop of the i-th). (2). From. (3). Communication line. (4). Recording. (5). Address. (6). Code.

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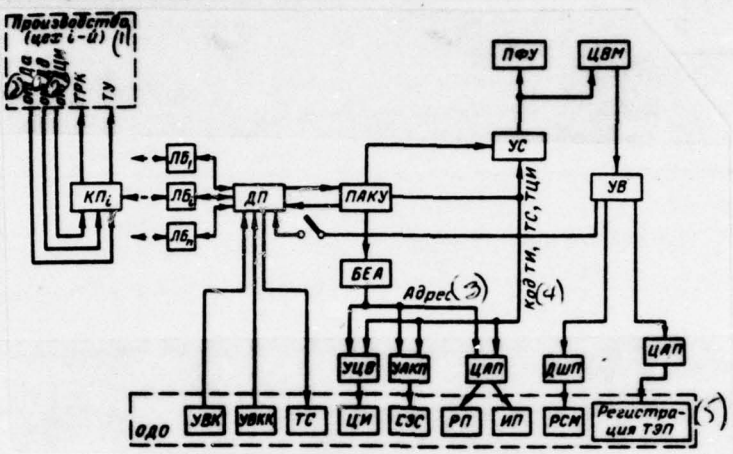

Fig. 5. Structure of ASUPP with teleinformational system "Akkord" and TsVM "Potentsial".

Key: (1). Productions (shop of the i-th). (2). from. (3). Address. (4). Code. (5). Recording.

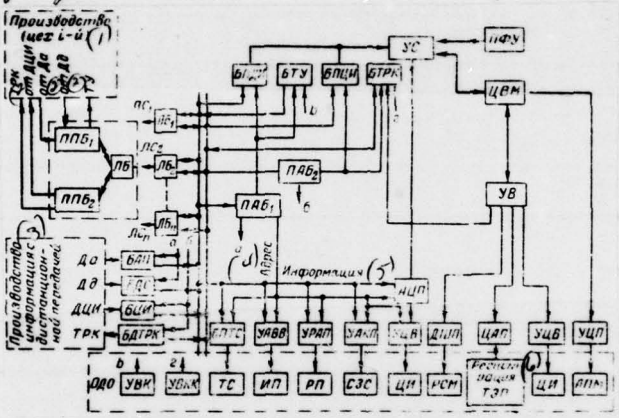

Fig. 8. Structure of ASUPP with informatiopal systea "Informator" and ASVT.

Key: (1). Productions (shop of the i-th). (2). from. (3). Production information with teletransmission. (4). Address. (5). Information. (6). Recording.

The converter of alternating current into the standardized signal of a direct current of the type VPT-4 consists of current transformer to input of which is fed alternating current with nominal value 5a, rectifying bridge and ρ-section filter. The application/use of current transformer provides a small dependence of conversion factor on the resistance/resistor of the load (secondary

circuit of transformer works in the conditions/mode of the forced current). The adjustment of conversion factor (during it is individual adjustment) within limits of $\pm$20o/o through every 0.5o/o, is realized by coming from the opposite directi or concordant start consecutively with the fundamental for a second time winding of four supplemental windings.

Power converter of electrical energy of alternating current of the type SVPA-2. The operating principle of this converter consists in the use of a multiplier, instituted on a change in the duty factor of periodic momentum/impulse/pulses, proportional to one cofactor (current strength in the controlled/inspected circuit), and the amplitude of these pulses, proportional to the second cofactor (voltage in the controlled/inspected circuit) [1. 16]. Input values for a converter are alternating current, obtained from current transformer and alternating voltage, obtained from voltage transformer of power circuits. By plant "Elektropul't" (Leningrad) are released two types of the converters: SVPA-2 and SVPR-2. The first of them serves for the transformation of active, and the second - the reactive power of one circuits of triphase alternating power current.

(1) Основные технические характеристики

	ВПН-4	ВПТ-4	СВПА-2
(2) Входной сигнал напряжения переменного тока, *в*	100	—	100
(3) Входной сигнал переменного тока, *а*	—	5	5
(4) Выходной сигнал постоянного тока, *ма*	0—5	0—5	0—5
(5) Основная погрешность, % . .	0,5	0,5	1
(6) Время переходного процесса, *сек*	0,3	0,3	0,15
(7) Пульсация выходного сигнала, %	0,15	0,15	0,15
(8) Рабочий диапазон окружающего воздуха, °С	−10÷+40	−10÷+40	−10÷+40

Key: (1). Fundamental technical characteristics. (2). Input voltage signal of alternating current, V. (3). Input signal of alternating current, A. (4). Output signal of direct current, mA. (5). Fundamental error, %. (6). Transit time, s. (7). Pulsation of output signal, %. (8). Operating range of surrounding air, °C.

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Chapter Four.

TRANSMISSION MEDIA OF INFORMATION.

8. Basic concepts.

By means for the transmission of information, are understood the devices (including the communication channels), with the aid of which is realized its transfer from places of origin to users. Depending on the method of obtaining and the selected carrier of data of the device of transmission, they can be hydraulic ones, pneumatic ones and electrical ones.

Devices the hydraulic and pneumatic due to the limited possibility transmissions of signals to large distances without essential errors are applied in essence in the systems of local automation and regulation (ASUTP [automated system of technological process control]).

The devices in which as the data carrier are utilized electrical signals, are subdivided into the transmission systems of near and

long-range. In the systems of near operation the parameter of signal is either the strength of the current or voltage (continuous measurement), or of presence (transmission of value 1) or absence (transmission 0) of electrical signal (discrete report/communication) in the communication line. The transmission of value 1 and 0 can be carried out also by the current pulses or voltage of different polarity. The information-carrying systems of the near operation sometimes in the literature are called remote. For each channel of measurement in such systems, is required the two-wire circuit of communications, while for the transmission of discrete report/communication - one conductor to digit 1 or 0 and one conductor common/general/total. In the devices of near operation (remote) the transmission of information is carried out by those electrical signals which are obtained on output terminals of its sources.

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As an example of this system of near operation, it is possible to give the informational system, which transmits on two-conductor line the instantaneous values of the parameter from sensor with the standardized electrical signal of direct current. Such sensors are designed for the load to 2 kiloohm, from which the part can fall on the communication line, and other - for payload.

For purpose of the realization of the transmission of information to large distances with the use of one communication channels for many report/communications, are applied the telemechanical systems in which the electrical sensor signals are converted into other electrical signals, convenient for transmission, and also is carried out the distribution of these signals according to the groups of the report/communications in the specific sequence.

The distribution of transmission media to the systems of near and long-range, generally speaking, conditionally, since in certain cases is technically expedient the application/use of telemechanical systems for the transmission of information to very insignificant distances, for example for control and direction of underwater objects, on the other hand, the most technical possible solution of the transmission of the values of one-two parameters for the distance of 10-20 km without the transformation of the sensor signals.

The application/use of one or the other method of transmission is determined by economic advisability under the condition of providing for the preset accuracy and authenticity of the transmitted information, and also the necessary high speed and reliability of equipment.

For the territorial seperated objects of the production when distances from the sources of information to control post exceed 0.5 km, becomes advisable and economically advantageous the application/use of means with the telemechanical method of transmission. In this case the sources and the receivers of information are banked and their output and input circuits are connected to the common/general/total receiving-transmitting telemechanical system.

The telemechanical systems of the transmission of information are intended to fulfill the following functions: remote control (TU), remote control (TR), telesignalization (TS) and telemetry (TI). Devices TU, TR in the general case transmit director information.

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These devices make it possible in comparison with remote connections to reduce the number of connections, to make it considerably less than a number of transmitted instructions via the send operation of special (coded) signals. Devices TS and TI transmit indication information about the state of the controlled/inspected objects and continuous series of the values of the technological parameters. In

the produced by industry telemechanical systems they are usually combined entire or part of the functions pointed out above.

The controlled/inspected physical quantities which must be transmitted to distance, are either the continuously changing parameters or discrete (for example, object is included or switched off). The continuously changing parameters quantize, i.e., they represent analog quantity by a finite number of solved values (levels) distant from each other for finite intervals. For the transmission of these levels in telemechanical systems, are applied analog and discrete signals.

In the case of use for the transmission of the information of analog signal, its parameter is the single-valued continuous function of the controlled/inspected value. To such signals pertain mainly the signals, modulated on time/temporary (ShIM and FIM), on amplitude (AM) and on frequency (ChM) parameters.

During use for the transmission of the information of discrete signals, form/shape the groups of pulses, which are distinguished by any sign/criterion (parameter of modulation), for example on amplitude, length, etc. The group of pulses, comprised into the specific combination, is called the code. Each code combination is the numerical value of the controlled/inspected quantity.

Application/use in telemechanical system for the transmission of the information of one or the other signals is caused by the preset accuracy and reliability. For providing these assigned magnitudes, the vital importance has a selection of device of communication. The selection of coupler is determined, of course, by the first of all necessary number of channels, directions, a distance between the point/items of reception and transmission, the possibility of using the existing communication lines, etc. But in this case accuracy and reliability of the transmission of information must be considered first of all.

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Thus, for instance, for the transmission of information to very large distances, where are possible substantial changes in the parameters of the communication line and the operation of powerful disturbances, are applied, as a rule, code-pulse systems of telemechanics as most noise-proof.

In telemechanical systems, they are intended for the transmission of information within limits of the industrial enterprises where as the communication channel usually is utilized

wire pair, in essance for transmission, are applied the analog modulated signals.

Depending on the method of the distribution of the cell/elements of signal accepted are distinguished the telemechanical systems with time/temporary and frequency distribution. The time sharing of signals is realized by means of the simultaneously changed over distributors on the point/item of transmission and the point/item of the reception of information. The synchronization of distributors can be cycle-by-cycle and step-by-step. In the first case of synchropulse from one point/item to another, is sent once in the cycle of the work of distributor, the secondly - on each cycle/stroke of distributor. During the frequency distribution of the cell/elements of signal, its each cell/element is transmitted by the strictly fixed/recorded frequency.

9. Transmission media of information for the systems of the supervisory control of production.

The first stage of the introduction of central control in power engineering, in the field of transportation and industrial enterprises before the appearance of computers was their dispatcher system. In connection with this were develop/processed the transmission media of information with the aid of which by an

operator (dispatcher) were realized the control and direction of production processes at a distance.

Wide acceptance received the telemechanical systems of the transmission of information for the centralized dispatcher control and direction in power systems, in electrical equipping of the electrified railroads, and also for a supervisory control of energy- and by the water supply industrial enterprises.

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For the supervisory control of the objects of the powering of industrial enterprises, successfully were applied the telemechanical systems, the transmissions of information of the type VRT-53, RST, UTM, UTB-3, developed for control and direction of the concentrated objects of power systems [1. 18].

Unidirectional device VRT-53 intended for a work with the mimic diagrams of the dispatch boards of any types allow/assumes the signal reproduction according to the schematic of "dark" or "light" panel. Device is performed in four modifications by the volume of the information: TU - from 15 to 39 objects, TR - to 9 objects, the call of telemetry (VTI) - from 7 to 14 parameters and TS - from 21 to 47 objects of signaling.

Devices of the type UTV-3 are carried out on noncontact cell/elements and are intended for the same target/purposes, as VRT-58. Devices are released in three modifications on the layout of the communication lines:

UTB-3 - unidirectional (one PU and one KP).

UTB-3r - has one PU, also, from two to four KP, connected with PU by the radial channels of communications.

UTB-3tr - has one PU, also, from two to four KP, connected with PU by the transit communication channel. The total capacitance of equipment PU:TS - 80 capacities and 20 instructions of the call of the telemetry of the analog parameters (VTI) for their transmission on the individual line of communications.

The noncontact devices of transmission TU - TS of type RST-1 and of RST-2 are also intended for the supervisory control of the concentrated objects of industrial enterprises and are manufactured in two modifications, the first - on 20 TS and 16 TU (VTI) and the second - on 46 TS and 42 TU (VTI).

The equipment for transmission of type TM-1 is related to the class of the combined devices, which ensure the duplex transmission of discrete information with the distributive method of selection and amplitude pulse sign/criterion. Device has block structure and is released in 12 modifications by capacity and according to functions: TU - to 33 objects, TS - from 14 to 42 objects, VTN - to 24 parameters.

Subsequently won acceptance the noncontact duplex devices of the transmission of information TU - TS of the general-purpose designation/purpose of the type BTTsP 1/1, BTTsP 1/1K, BTTsP 1/10. In these devices is utilized the distributive method of selection by transmission on the line of communication of the current pulses of different polarity.

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Instructions of TU can be utilized for the connection of the sensors of the analog parameters to the individual line of communications (VTI). Device BTTsP 1/1 is released in three modifications by the volumes of the transmitted information: BTTsP 1/A is designed for the transmission of eight instructions TU - TR - VTN and ten signals TS, BTTsP 1/B-18 of instructions TU - TR - VTI and 20 signals TS, BTTsP

1/D . 58 instructions of TU - TR - VTI and 60 signals TS. The synchronization of the distributors of subassemblies PU and KP is carried out from the grid/network of commercial frequency. In a device of the type BTTsP 1/1K, the synchronization of distributors PU and KP is realized from autonomous cadence generators, thanks to which it can work with the telemetering multichannel time-pulse attachment of the type MVT, which provides transmission along the common channel of communication of several analog parameters. Devices BTTsP 1/1 and BTTsP 1/1K unidirectional.

Device BTTsPU 1/10 is intended for dispatcher control of ten concentrated objects of industrial enterprises along the common channels of communication of arbitrary layout.

For the supervisory control of the objects, distributed over large areas, are utilized the telemechanical systems of transmission with the frequency and frequency-distributive method of the selection the type BChST-1/16, TChR-61, etc. The device of transmission TU-TS of the type BChST-1/16 is utilized for control of the distributed objects (petroleum and artesian holes, pumping plants, etc.). The deck of device includes common/general/total equipment PU, also, to 16 KP. The communication channels can be radial ones and those branched (dendritic). BChST-1/16 provides the fulfillment of the following functions: remote control by two-position objects,

including the transmission of the continuous instructions of remote control, the transmission of single-position instruction (telephone call, demand of signaling), of automatic signaling of state or position of the controlled/inspected object.

A device of the type TChR-61 is intended for control of the distributed objects of the irrigational installations, arrange/located along the branched line, or the objects of those distributed by area (petroleum- and gas industry, etc.).

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The collection of the production-statistical information if necessary for its processing in the periods, which approach real time, can be realized by telemechanical systems of data transmission, such as, for instance, device of the type BTI, APD, the ensuring transmission alphanumeric information from punched tape to punched tape on the switched circuits of in-plant ATS.

Besides the telemechanical transmission media of information in the systems of dispatcher control and direction, are applied also the devices of the selector and loud speaker connection and device of industrial television.

For control/checking and industrial control (in essence control/checking and temperature control) of aggregate/units and sections and the shops of industrial enterprises are applied the machines of the centralized control and direction (MTsKU). The machines of the centralized control/checking are performed with wired program and limited number of functions, which correspond to the special requirements of this section of production.

For an example Fig. 10 gives the structural scheme of the used in system supervisory control of the telemechanical system of the transmission of report/communications of the discrete signals: the instructions of remote control of production plants TU, the instructions of remote control TR and of instructions of the call of the telemetry VTI.

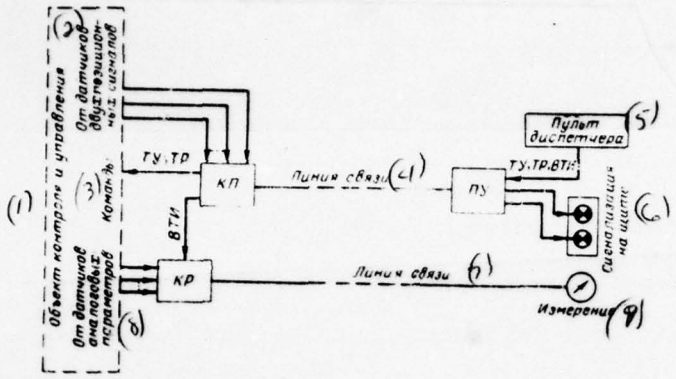

Fig. 10. Structural scheme of telemechanical system.

(1). Object of control and direction. (2). From sensors of two-position signals. (3). Instructions. (4). Pine of connection. (5). Console dispatcher. (6). Signaling on panel. (7). Communication line. (8). From sensors of analog parameters. (9). Measurements.

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The call of the necessary telemetry is carried out with the aid of commutating by the relay KR, by which the communication line is connected to output of one of the sensors with the electrical continuous signal of direct current or the pulse signals of direct current, which are changed in frequency. In the first case at the output of the line of communication is connected moving-coil instrument, and the secondly - frequency meter. Instructions TU, TR and VTI are transmitted from console operator - dispatcher with the aid of gates, knob/buttons, etc.

Discrete signals from the objects of signaling in subassembly PU are memorized in the cycle of run (if equipment/device of cyclic operation) or to the onset of the new state of the objects of signaling (during sporadic transmission). Memory elements (flip-flops, relays with blocking) switch on the panel of the dispatcher of the tube of signaling, usually built in into the cell/elements of mnemonic device, which reflect the state of the objects of signaling.

With the aid of this equipment/device the dispatcher can: to control production plants at a distance;

to monitor the fulfillment of the transmitted to them instruction;

to monitor occurring for any reasons cutoffs or switchings of production plants;

to monitor on call the value of the measured parameter at the rate of technological process;

to control controlled parameter, after connecting with the aid of VTI instrument to the sensor of this parameter.

10. Transmission media of information for the automated control systems of continuous production.

The development of the automated control systems of continuous production processes with the application/use of digital computers advanced a series of substantially new requirements for the transmission media of information the main things from which consist in following:

transmission considerably greater than during supervisory control, information flows both by the capacity and in the number of functions;

the automatic without intermediate carriers loading according to the specific program of the required quantity and forms of information into TsVM;

the automatic according to program or on demand input of the necessary quantity and forms of information into equipment/devices of processing and representation to its dispatcher;

transmission to the controlled/inspected point/items of the controlling interactions of recommended TsVM.

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To accomplish of the enumerated requirements with the aid of equipment/devices of the transmission of information, used for a supervisory control, is not impossible. The conditions of the transmission of information, output circuits in such equipment/devices are adapted for the care of a man-dispatcher whom assigns, within the limits of their informational possibilities and store/adding up situations in production, necessary programmed work.

Thus, was determined the need for the development of composite multifunctional equipment/device of the transmission of information, which on specific algorithm to program could satisfy all requirements enumerated above. This equipment/device, besides programmed part, must contain the necessary converters for input of information into the form accepted in equipment/devices of processing and representation to its dispatcher.

Is developed at present a series of the composite multi-function equipment/devices, capable of realizing the exchange of analog and discrete information between the objects of production, the dispatcher and the computer according to the necessary programs in conditions of industrial enterprise [19-21]. Is given below the description of the developed in the TsNIIKA equipment/device of the transmission of information for ASUPP of the type "cascade/stage", in which are most fully reflected the special feature/peculiarities of equipment/devices of this class.

GENERAL PRINCIPLES OF THE CONSTRUCTION OF EQUIPMENT

As was mentioned in Chapter 1, the special feature/peculiarities of informational flows into ASUPP and considerations by the realization of maximally possible functional independance (for an increase in the informational reliability) defined the advisability

of the functioning of equipment/device of the transmission of information as the complex of two subsystems: the subsystem of the transmission of the signals of analog and discrete indication information and signals of steering commands of two-position objects (first subsystem) and the subsystem of the transmission of information in digital form (second subsystem).

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Each subsystem works according to autonomous program with the use of a method of separation of signals in time with the aid of the simultaneously changed over distributors. Synchronization of distributors it is carried out by send operation with PU on KP of the timing momentum/impulse/pulses by the length of 1 ms. Realized thus cycle-by-cycle synchronization is more reliable during the use of system lines of communication of small extent, than the complex method of synchronization on cycles.

The transmission of the values of the analog parameters by the first subsystem is carried out also as in system [19, 20], by short-term signals with the pulse-position modulation with simultaneous modulation in the length of reference pulses for the transmission of discrete information (signaling). This method makes it possible considerably to simplify and to decrease the capacity of

equipment on KP in comparison with the systems in which is applied the code-pulse method of modulation with approximately equal high speed. The cycle/strokes of distributor KP are out of phase relative to the cycle/strokes of distributor PU on 4 ms. Thus, the time of each cycle/stroke of distributor is divided into two parts less of which it is utilized for the transmission of the timing momentum/impulse/pulse and control signal of the two-position object, and large - for the transmission of the signal of discrete information and the instantaneous value of the analog parameter with the pulse-position or frequency modulation. The deviation of modulation of signal through length is located in limits of 5-15 ms, where the time τ=5 reflects the conditional of zero measurements [22].

Frequency signals are transmitted by the decks whose length is equal to 20 ms.

In the second subsystem the transmission of information occurs by the consecutive send operations of code command and indication report/communications.

The selection of the repetition frequency of clock pulses of the distributors of the first and second subsystems and their phase shift is determined by the method of the transmission of the values of the

analog parameters and by the length of the signals, transmitted by the communication line which are characterized by the following values:

Clock momentum/impulse/pulses for switching of distributors KP - 1 ms.

Momentum/impulse/pulse of start of work of distributors KP - 7 ms.

Momentum/impulse/pulse of director information - 3 ms.

Pulse-"labels" of the pulse-position telemetry and the momentum/impulse/pulses of indication information in digital form - 1 ms.

Pulses of signals of the state of equipment by 3 - ms.

So, for the first subsystem the repetition frequency of clock momentum/impulse/pulses is selected as being equal to 40 Hz with the period of cycle/stroke, equal to 25 ms from which 4 ms are utilized for transmission of the timing momentum/impulse/pulse and signal of instruction, but 21 ms - for the transmission of the signals of analog telemetry (TIA) with the pulse-position and frequency

modulation also of signals TS.

For the second subsystem is selected the higher repetition frequency of clock momentum/impulse/pulses, equal to 160 Hz with the period of one cycle/strokes 6.25 ms, from which 4 ms are used for transmission of the timing momentum/impulse/pulse and signal of the digit of code instruction, but 2.25 ms - for the transmission of the bit of the digital code of indication information. The cycle of work of distributor PU of the first subsystem consists of 33 cycle/strokes from which 12 are utilized for the transmission of official information and 21 for transmission TU, TS, TIA (with FIM and ChM), while the cycle of the work of distributor PU of the second subsystem - of 32 cycle/strokes.

The distributors of the first subsystem of the transmission of information work with the repetition frequency of timing momentum/impulse/pulses 160 and 40 Hz. At frequency 150 Hz, are transmitted the signals of official information, while at frequency 40 Hz, - signals of steering commands of two-position objects and signals of the values of analog and discrete indicating information. Per cycle of work of distributor PU of the first subsystem the distributor of the second subsystem, it makes accurately three cycles, which assures their synchronization in the joint operation of two subsystems.

Figure 11a depicts the distribution of the sequence of the clock momentum/impulse/pulses of the distributor of the first subsystem on zones. In zone I (C_1, C_2 and 1) is transmitted the official start command of the work of distributor KP.

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In zone II on KP, is transmitted the assignment for connection for transmission of one of the three groups of the analog parameters and discrete signals, while in zone VII with KP, enter the signals of the execution of this assignment. In zone III (cycle/strokes 4 and 5) is transmitted the signal of the character of process/operation of TU, in zone IV, - number of the object of control, while in zone V, - a signal for execution of command. In zone X (27th cycle/stroke of distributor KP) is transmitted on PU signal - "receipt", confirmatory is correct instruction part of cycle. On the cycle/strokes of distributor KP of zones VIII and IX, are transmitted the values of the analog parameters and discrete signals of the state of the objects of signaling. Several cycle/strokes in the cycle of distributor KP or all cycle/strokes in one of the three cycles can be used for the transmission of signals from sensors with frequency output signal (23, 24 and 25-1 cycle/strokes). In zones VI and XI,

are transmitted official signals for the inspection of the work of distributors PU and KP. On one and the same cycle/strokes of zones VII and of IX distributor, can be transmitted three groups of 21 values of the analog parameters and three groups of signals from the objects of signalings on 22 TS in each.

The attachment of the cycle/strokes of distributors for the transmission of signals from sensors with current-operated and frequency output is carried out by both the whole groups and parts in one of the groups. The objects of control on each KP are rigidly fixed to the appropriate cycle/strokes of distributors and therefore TU they can be transmitted with any group of the analog parameters.

The transmission of information in digital form is carried out with the aid of distributors of second subsystem, that work with clock frequency 160 Hz. Indication and director information is transmitted in the different cycles of the work of distributors. Figure 11b shows three cycles of the work with distributors PU and KP of the second subsystem. In the first cycle is shown the transmission of indication information in digital form (TTsI), in the second cycle - the director information of code remote control (TRK). In zone I, are transmitted command pulses of the beginning of the work of distributor KP of the second subsystem; in zone II - signal-"sign/criterion", according to which is carried out the

reconstruction of logic circuits KP to transmission of TTsI or method TRK, while in zone III with KP on PU, is transmitted the confirmation of the execution of this process/operation. In zone IV, is transmitted the word TTsI; into V - signal of last/latter sensor in the program of the datum KP, into VI - signal, which supplements a quantity of signals in send operation to odd number; in zones VII and VIII, are transmitted the signals, which confirm the synchronous working of distributors.

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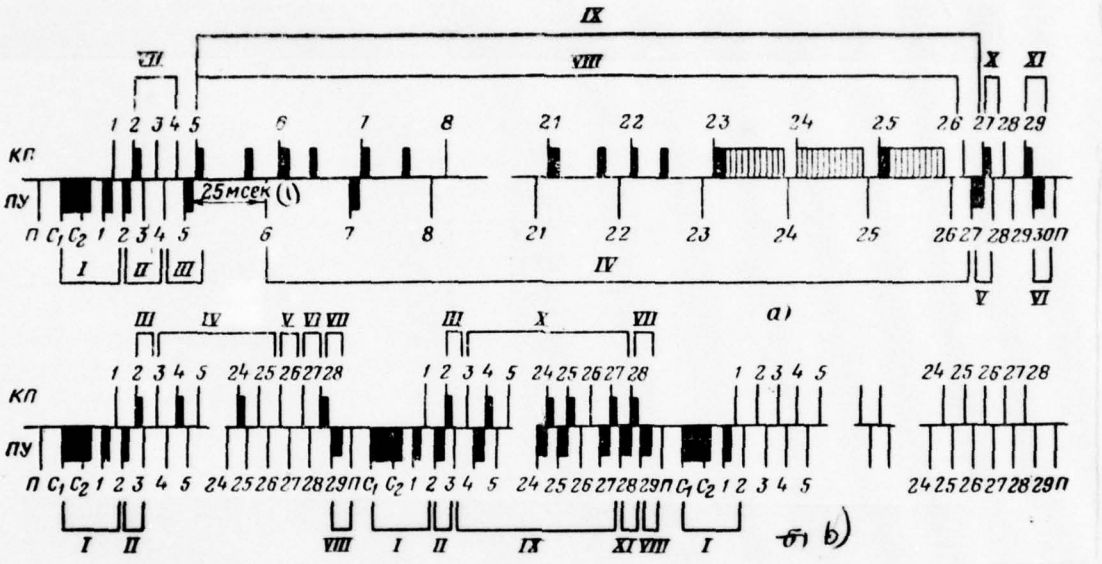

Fig. 11. Diagram of distribution into zones of cycle/strokes of distributors.

Key: (1). ms.

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The transmission of the instructions of code remote control is carried out with the application/use of informational feedback, i.e., the instruction code, transmitted from PU in zone IX, completely it is relayed from KP in zone X of the same cycle of distributors. In

zone XI with PU on KP, is transmitted the signal of resolution for execution of command.

Common/general/total assemblies of both of subsystems they are: clock pulse generator, linear units and lines of communication. Transmission and preliminary information processing by the first subsystem is carried out cyclically according to predetermined program; the second subsystem works in single cycles on demands from TsVM or on orders to the transmission of code instructions. On demand of TsVM to the transmission of digital indication information, the second subsystem, running its program, can work with all KP furthermore, with which at the given instant works the first subsystem. In this case the second subsystem passes into the conditions/mode of waiting to the release by the first subsystem of required by it directions. Within the second subsystem first of all, is transmitted indication information. Thus, the exchange of information with each single KP is carried out on the following fixed order:

1) the transmission of indication analog, discrete information and instructions of TU;

2) the transmission of indication information in digital form;

3) the transmission of the director information of remote control.

Programmed-address units of subsystems (PAB_1 and PAB_2) realize control of the work of equipment/devices on KP, they will agree and synchronize all equipment/devices, entering the informational part of ASUPP, than they provide fulfillment of programs of the exchange of information. Figure 12 depicts the structural scheme of PAB of the first and second subsystems. The common/general/total for both of subsystems generators GTI_1 and GTI_2 create clock momentum/impulse/pulses by frequency 1 600 Hz which after the frequency dividers DCh_1 and DCh_2 (1/10) enter the input of gates K_1 and K_2. These gates with help of timer RV provide the start of spare generator. Momentum/impulse/pulses by frequency 160 Hz from gates are fed on the input of divider DCh_3 (1/4), clock drivers and control assemblies of distributors with one and another of subsystems UUR_1 and UUR_2.

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The control assembly UUR_1 controls the first distributor and clock driver (FTI_1) so that initial seven and last/latter five cycle/strokes of the distributors of the first subsystem on PU and KP would be changed over with frequency 160 Hz, but 26 cycle/strokes -

with frequency 40 Hz. The first distributor controls the work of batch counter of measurements SGI and of counter of the controlled/inspected point/items SKP_1, but also the impulse shaper of the beginning of the work of distributor KP. With the aid of distributor, batch counter and controlled/inspected point/items, are realized all programs of the work of the first subsystem on the exchange of information. Setting field NP_1 serves for the assignment of the necessary quantity of groups of measurements on each KP, and the coefficient unit of groups BZG - for their successive connection on KP during telemechanical transmission.

Demand entire analog information enters from TsVM into batch counter of measurements and counter of the controlled/inspected point/items.

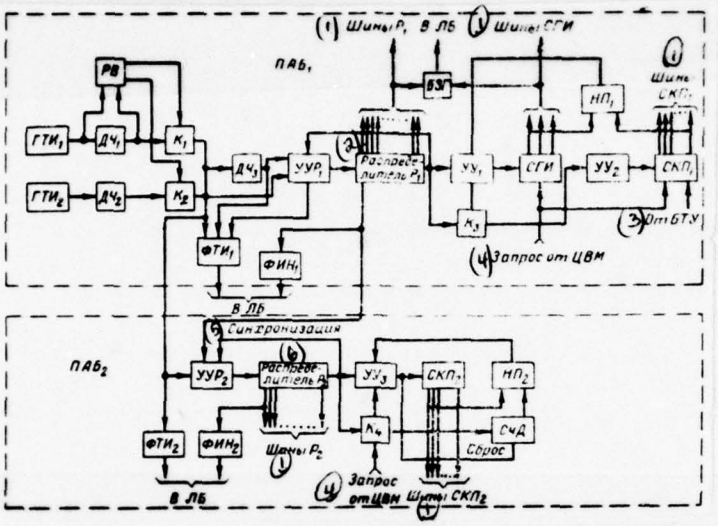

Fig. 12. Diagram of programmed-address units (PAB) of the first and second subsystems.

Key: (1). Busbars. (2). Distributor. (3). From. (4). Demand from TsVM. (5). Synchronization.

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On this signal the latter are reconstructed for the consecutive request of analog information, beginning with the first group first KP. Order to the transmission of the instruction of control by two-position object is put out by block of remote control (BTU), on

signal of which SKP connects to it the linear unit of the required direction.

Programmed-address unit PAB_2 consists of distributor R_2 of the counter of controlled point/items SKP_2 and of counter of the sensors of information of digital form SchD. Distributor R_2 works with clock frequency 160 Hz and is controlled from UUR_2. Synchronization R_2 is carried out one time in three cycles of its work from R_1.

With the aid of the setting field of NP_2, is assigned a quantity of sensors of digital information on each KP after request of which UU_3 changes over SKP_2 to the following position. Distributor R_2 works as circular counter, and SKP_2 is included in work only with demand from TsVM whose instruction enters gate K_4, in this case, on instruction from UU_3 SKP_2, it is changed over from the zero position into the first, establish/installing connection with first KP, and SchD records the request of the first sensor of digital information. On termination of the request of all sensors of the given KP SchD, it is dumped into the zero state, and SKP_2 is changed over into the next position.

The transmission of code instructions TRK is carried out only with the aid of distributor R_2.

CONTROL POST.

The transmission of information is illustrated by Fig. 13. Programmed-address units of the first and second subsystems, satisfying their programs, control the diagrams of I_1-I_3, with the aid of which within the transmitting assemblies of linear units LB is establish/installed the connection with the equipment for the controlled/inspected point/items.

Transmission of steering commands of two-position objects. Entered from the console dispatcher BTU instruction is stored in it before confirmation about its method on KP. To order of BTU PAB of the first subsystem, establishes connection with required KP, to which through ILI_1 and I_1 are transmitted timing the momentum/impulse/pulse and the signals of instruction. Simultaneously to this same KP is transmitted assignment for the connection of the first group of measurements, which is accepted in the same cycle of distributors.

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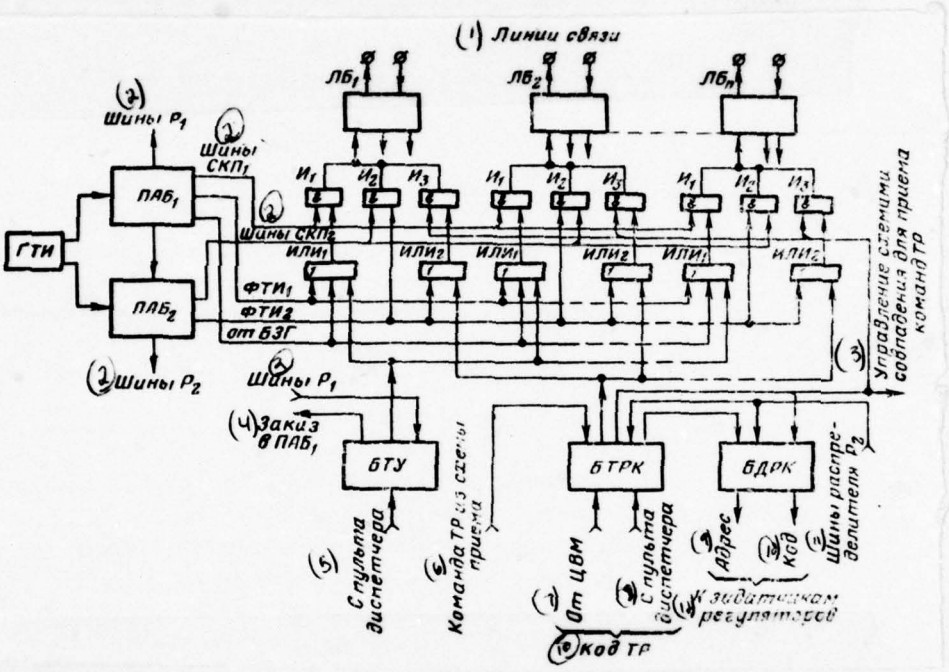

Fig. 13. Structural scheme of receiving-transmitting equipment on PU.

Key: (1). Lines of communication. (2). Busbars. (3). Control of coincidence circuits for instruction part of cycle TR. (4). Order to. (5). From console of dispatcher. (6). Instruction TR from diagram of method. (7). From. (8). From console dispatcher. (9). Address. (10). Code. (11). Busbars of distributor. (12). To controllers of regulators.

After the completion of process/operation on the transmission of instructions PAB_1, automatically it passes to the cyclic request of information for equipment/devices of processing.

Transmission of the instructions of code remote control (TRK). Instructions code TR enter unit BTRK from TsVM from the console dispatcher. After the deciphering of the address part of the instruction into BTRK, are form/shaped control signals of cell/elements I_3 and the diagrams of transmission and reception of the information (description of the latter is given below, cm of Fig. 14). Timing momentum/impulse/pulse and discrete signals of the code instruction through the diagrams ILI_2 and I_3 enter the transmitting assembly of the linear unit of the selected direction. The transformation of the code from parallel into consecutive into BTRK is carried out with the aid of distributor R_2.

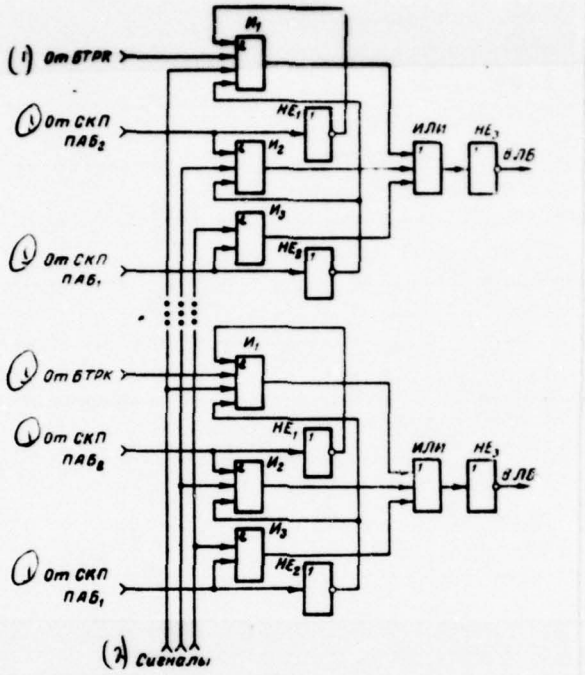

Fig. 14. Functional diagram of the assemblies of the transmission of linear unit.

Key: (1). From. (2). Signals.

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The transmitted on KP instruction code in the same cycle of distributors is relayed on PU and enters BTRK for testing of the authenticity of transmission.

Remote control of the controllers of regulators is realized through the unit BDRK which in the program of the unit of code remote control is considered as one of KP. The transmission of instructions TR in this case is carried out on main-line busbars in the tracking of the address of the controller of regulator.

Figure 14 gives the functional diagram of the assemblies of the linear units, which are determining the order of the transmission of information. After the admission of the resolving potential of high level to diagram I_3 from SKP PAB_1 of the first subsystem of diagram I_1 and I_2, are closed through the inverter NE_2; in this case, the transmission of code instructions and the reception of information in digital form in this direction is carried out cannot. If the resolving potential of high level enters from SKP PAB_2, then inverter NE_1 forbids transmission of TRK through the diagram I_1.

Reception of information. The reception of all forms of information, the sequence of its transformation for an introduction into equipment/devices of processing is carried out according to the programs of PAB_1 and PAB_2 with the aid of the groups of diagrams and of series of the special-purpose functional boxes whose interconnections are represented in Fig. 15.

Reception of the values of the analog parameters. PAB_1, open/disclosing according to program to transmission and reception of the signals of diagram I_1, establishes two-way connection between PU and KP. In this case, from PU to KP, are transmitted the timing momentum/impulse/pulses for switching of the distributor of the first subsystem KP and of the instruction of the successive connection of the groups of the sensors of the analog parameters. On PU the signals of telemetry are headed along parallel channels into analog-digital converter (ATsP) and equipment/devices of processing and representation of information on ODO (UKAP, UAVV, URAP). In ATsP the signals of telemetry enter a strict sequence, determined by the program of the loading of analog information into TsVM, while into UAKP UAVV and URAP - in the tracking of address which is form/shaped of combination of momentum/impulse/pulses SKP, SGI and R_1 of a programmed-address unit of the first subsystem. The units of the reception of analog information BAI-f and BAI-I from sensors with the teletransmission of signals in the program of PAB_1 are considered as single KP and to ATsP they are connected on his instructions. The commutation of signals from sensors in units BAI is carried out by the transistor keys.

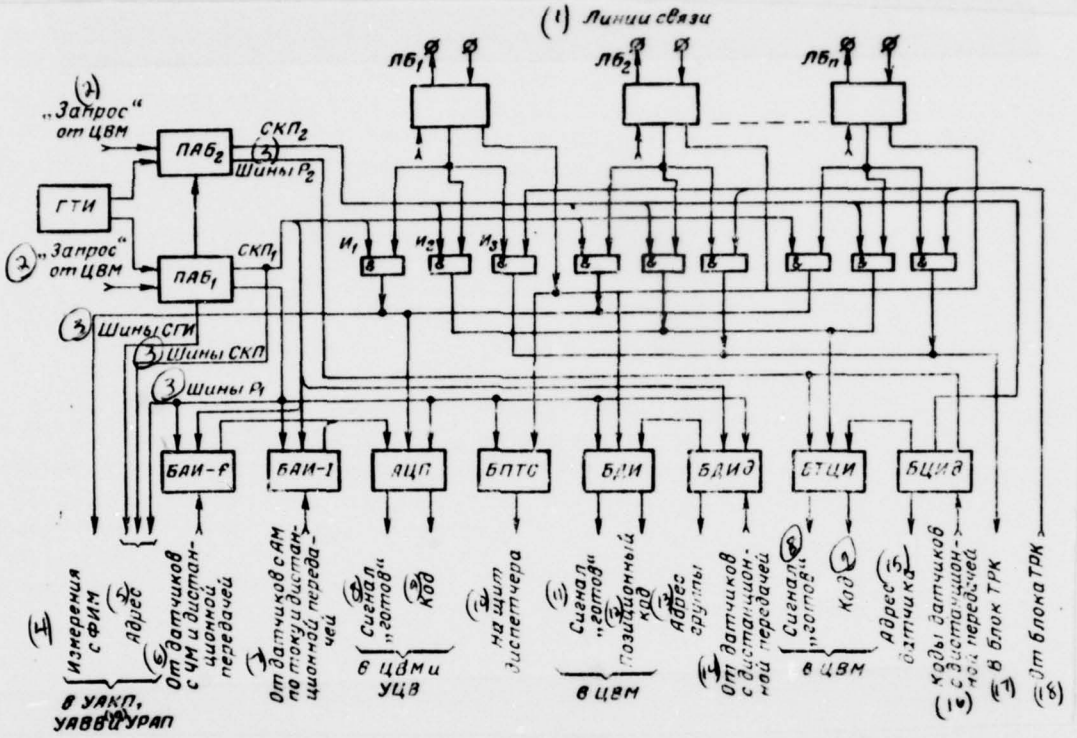

Fig. 15. Block-structural schematic of receiving equipment on PU.

Key: (1). Communication lines. (2). Demand from TsVM. (3). Busbars. (4). Measurements with FIM. (5). Address. (6). From sensors with ChM and teletransmission. (7). From sensors with AM on current and teletransmission. (8). Signal "is ready". (9). code. (10). To dispatcher's panel. (11). Signal "is ready". (12). Positional code. (13). Address of group. (14). From sensors with teletransmission. (15). Address of sensor. (16). Codes of sensors with

teletransmission. (17). In unit TRK. (18). From unit TRK. (19). and.

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Reception of discrete signals from the objects of signaling. The signals of discrete information are filtered out in receiving assemblies LB from more narrow pulses the pulse-position TI and they are headed along parallel channels for the storage unit of TV signals BPTS which controls the cell/elements of signaling on dispatcher's panel, and the unit of the reception of the discrete information BDI. Discrete information into BDI is converted into the parallel positional code and on signals "is ready" it is read in TsVM in a strict sequence, by predetermined program of input/introduction. Discrete signals from sensors with teletransmission enter BDId by groups along main buses and are set in register BDI, from which they are read into the TsVM. Block BDId according to the program PAB_1 form/shapes the signals of the addresses of the groups of sensors for their connection to main-line busbars. In BDId is provided the input/introduction of 15 groups, which consist of 22 discrete signals of each. The signals of the sensors, transmitted on PU by remote method, the cell/elements of the signaling of dispatcher's panel enter in parallel BDId without any transformations.

Reception of information in digital form. PAB_2 on demands from

TsVM establishes alternately, according to predetermined program of input/introduction, connection with the equipment for the second subsystem KP. For this, are open/disclosed the schematics I_2 to transmission and reception of signals in the selected direction. With PU on KP, are transmitted the signals of the beginning of the work of the distributor of the second subsystem KP, the timing momentum/impulse/pulses by frequency 160 Hz and signal the "sign/criterion" of the demand of information in digital form. With KP on PU in each cycle of distributor R_2, is transmitted one word of digital information which through the schematic I_2 will be brought in into the register of the unit of the reception of the digital information of BTTsI. The reading of the digital code from the register BTTsI to input busbars of TsVM is carried out on ready signals after testing of the authenticity of transmission.

Digital information from sensors with the remote method of transmission on main-line busbars is received as the unit BTsId which in the program of PAB_2 is considered as single KP. The unit BTsId form/shapes in each cycle/stroke of distributor R_2 signal (address) for connection to the main-line busbars of the next sensor of digital information.

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Therefore in the cycle of the work of distributor R_2 it is possible to accept 28 words which alternately will be brought in into the register of the unit BTTsI, whence they are read to input busbars of TsVM. With the reception of digital information from sensors with the remote method of transmission, the counter of sensors PAB_2 counts the groups of the sensors, taken in each cycle of distributor R_2.

CONTROLLED POINT

Equipment for the first subsystem. Equipment KP to admission with PU of the momentum/impulse/pulse of the beginning of work and timing momentum/impulse/pulses is located in the standby mode. Filtered by discriminator in length trigger pulses enter the assembly of the starting/launching of distributors UZR which depending on the combination of two momentum/impulse/pulses open/discloses control assembly of the distributor UUR of the first or second subsystem. During the combination of two momentum/impulse/pulses τ=7.25 ms and τ=3 ms is started the distributor of the first subsystem, while during the combination of momentum/impulse/pulses τ=7.25 ms and τ=1 ms distributor of the second subsystem.

Figure 16 gives the structural scheme of the receiving-transmitting equipment, which relates to the first subsystem of the transmission of information. Linear unit LB and

assembly of the starting/launching of distributors UZR is conditionally referred in the schematic of the first subsystem, in general they are common/general/total part of both of subsystems. Into content of equipment KP of the first subsystem, it enters: distributor R_1, the coefficient unit of the numbers of the groups of analog measurements and of discrete signals BZG with setting field NP, from one to three (in the diagram are shown two) group time-pulse converters VIP [22], from one to three units of the transmission of the analog parameters from sensors with frequency output signal BP-f the unit of the transmission of discrete signals BPDS the unit of instruction part of cycle of remote control by the two-position objects BPTU. The transmission of the values of the analog parameters, discrete signals and instruction part of cycle of control can be carried out simultaneously in one cycle of the work of distributor. After the starting/launching of distributor on its first two cycle/strokes, enters the instruction of the demand of the number of the group of the analog parameters and of discrete signals, which on these cycle/strokes by return duct is transmitted on PU for confirmation.

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In BZG this instruction will be decoded and enter into the setting field NP, with the aid of which is determined a quantity of

cycle/strokes of distributor R_1, the intended for a commutation sensors with output current-operated signals in group. Thus the cycle/strokes of three cycles of distributor R_1 can be divided on two parts of which one is utilized for the commutation of sensors with outputs by current-operated etc. - with frequency signals in all proportions within the limits of 60 parameters. Unit BZG controls also connection to main-line busbars to three groups of the sensors of the discrete signals which in the unit of the transmission of discrete signals BPDS with the aid of distributor R_1 are converted into the sequence of momentum/impulse/pulses for transmission on the communication line. Sensors with output frequency signals are connected to the unit of the transmission BP-f whose signals are switched by distributor R_1 in accordance with the number of group, which enters from BZG. Frequency signals in the intended cycle/strokes of distributor R_1 are transmitted by the decks which are form/shaped with gate K. All signals enter which transmits assembly LB through the OR gate.

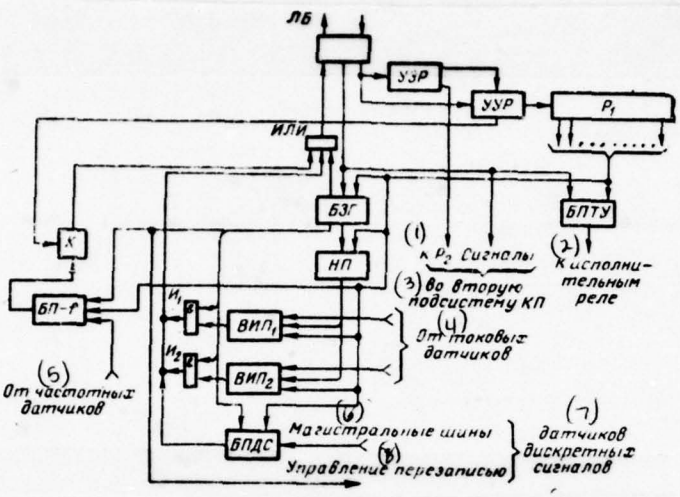

Fig. 16. Block-structural schematic of the equipment for the 1st subsystem KP.

Key: (1). To R_2 signals. (2). With individual point relay. (3). In second subsystem KP. (4). From current-operated sensors. (5). From frequency sensors. (6). Main-line busbars. (7). sensors of discrete signals. (8). Control of rerecording/retranscription.

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The signals of instructions of TU by two-position objects, that enter from receiving assembly LB through coincidence with the appropriate cycle/strokes of distributor R_1 will be brought in into register BPTU. After checking of authenticity, the instruction accepted is put out to individual point relays.

The equipment for the second subsystem consists (Fig. 17) of distributor (R_2) with the assembly of its control UUR, assembly of the identification of the sign/criterion UOP, unit of the transmission of information in digit form of BTTsI, counters of the sensors of digit information SchD, unit of instruction part of cycle of the code remote control BPTRK and unit of the reverse/inverse checking BOP of instruction code in PU. After the admission of resolution from UZR (see Fig. 16) control assembly of the distributor of UUR on the cadence signals, arriving from PU, form/shapes the momentum/impulse/pulses of switching distributor R_2. The clock momentum/impulse/pulses of distributor R_2 enter all units for propagation of signals in time during their transmission to the communication line and for the transformation of the consecutive codes, taken from the communication line, into parallel ones.

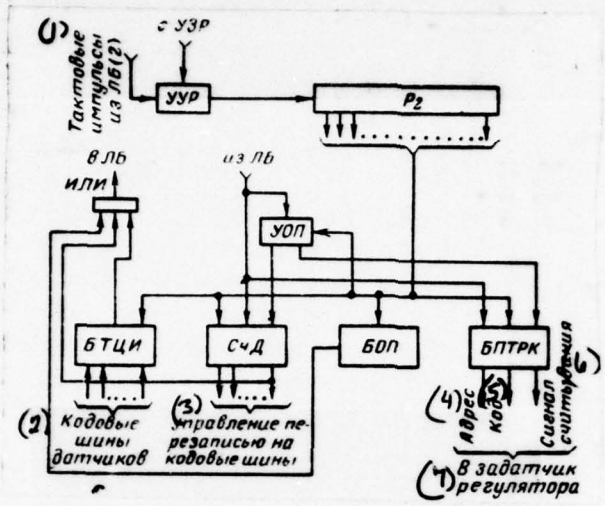

Fig. 17. Block diagrams of the equipment for the 2nd subsystem KP.

Key: (1). Clock momentum/impulse/pulses from LB. (2). Code busbars of sensors. (3). control of rerecording/retranscription to code busbars. (4). Address. (5). Code. (6). Reading signal. (7). In controller of regulator.

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Transmission of information in digital form (TTsI). The signal of the sign/criterion of the transmission TTsI is identified in UOP, and into the counter of sensors is built-in first unity. At the first output of SchD appears the resolving potential and to main-line code busbars is connected the first sensor of digital information. Rewritten from busbars into register BTTsI the digital code of the

first sensor by the clock momentum/impulse/pulses of distributor R_2 is converted into the consecutive send operation which through the OR gate enters the transmitting assembly of the linear unit (see Fig. 16). Each subsequent signal of the sign/criterion of PTsI, accepted from PU, through UOP is built-into SchD and BTTsI into order by the provided program of the introduction, are connected all sensors of the digital information of the given KP. With the connection of last/latter sensor (within limits of 48) through the OR gate is sent the signal of the last/latter sensor on which on PU SKP of the second subsystem it is changed over to the request of sensors following KP.

Instruction part of cycle of code remote control. After admission from the communication line through the receiving assembly LB of the signal of the sign/criterion of the transmission of the instruction of the code remote control of UOP, is closed the input of SchD and permits the passage of signals to input of BPTRK. Recorded into register BPTRK in each previous cycle/stroke of distributor R_2 the signal of the digit of instruction is transmitted on PU subsequently cycle/stroke by the unit of the reverse/inverse checking of BOP. After checking of the transmitted word of TRK on PU, into BPTRK in the same cycle of distributor enters the signal of execution of command, on which is form/shaped the reading signal of the code of TRK to the input of the controller of regulator. The instruction codes of remote control the controllers of regulators enter on

main-line busbars. The address of each instruction is form/shaped with the decoder of the address part of the code send operation into BPTRK.

ANALOG-DIGITAL CONVERTER.

Analog-digital converter (Fig. 18) is intended for transformation into the digital waveform of the analog parameters, transmitted by the communication channels with pulse-position and frequency modulation. To input of ATsP from receiving assemblies LB during the telemechanical transmission and from the units of the reception of the analog information, transmitted by remote method, in each cycle/stroke of distributor R_1 enter either the momentum/impulse/pulses of the "label" of measurements with pulse-position molulation or the decks of the signals of measurements with frequency molulation.

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Measurements with FIM according to their "sign/criterion" are converted by converter P into the momentum/impulse/pulses with ShIM, which control the high-stability generator GSCh by frequency 100 kHz. Thus, GSCh puts out the decks of the generated by it momentum/impulse/pulses whose number is proportional to the measured

parameters. Since modulation of momentum/impulse/pulses in time-pulsed converter on KP is carried out with deviation 5-15 ms, where the time τ=5 ms exists conditional of zero measurements, its the exception/elimination occurs in the unit of subtraction zero BVN, which is the binary-decimal counter which after the miscalculation of the first 500 momentum/impulse/pulses of each measurement guides remaining in deck a quantity of momentum/impulse/pulses into the control unit of the coding counters BUSch.

Momentum/impulse/pulses from sensors with output signal changing in frequency, enter the tracking of their sign/criterion into the shaping unit of decks BFP from receiving assemblies LB or from units BDL-f (with the remote method of transmission) (see Fig. 17). Decks in BFP are form/shaped with the aid of standard cell of time which from the front of the first momentum/impulse/pulse of the frequency sensor finish reals time τ=12.5 ms.

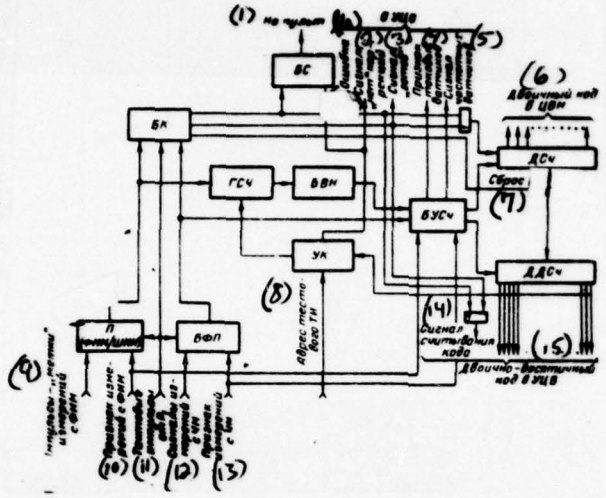

Fig. 18. Structural scheme of ATsP.

Key: (1). To console. (1A). "error". (2). Signal "metal" of corrections. (3). Signal "is ready". (4). Sign/criterion of current sensors. (5). Signal of frequency sensors. (6). Binary code. (7). Jettisoning. (8). Address of test TI. (9). Pulses-"labels" of measurements with FIM. (10). Criterion of measurements with FIM. (11). Clock momentum/impulse/pulses from R_1. (12). Signals of measurements with ChM. (13). Sign/criterion of measurements with ChM.

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The pulse frequency of the signal of frequency sensors varies within the limits of 4-8 kHz; therefore in deck for time $\tau = 12.5$, ms at frequency 8 kHz is contained 100 momentum/impulse/pulses, and at

frequency 4 kHz, - 50 momentum/impulse/pulses, i.e. to a change in the parameter from 0 to 100o/o corresponds a change of the quantity of momentum/impulse/pulses in deck from 50 to 100. Bursts of pulses from the output of BFP enter also into the control unit of coding counters BUSch.

Thus, in BUSch enter bursts of pulses whose quantity in them during the transformation of analogous signals from sensors with the output signal of direct current varies from 0 to 1000, and from frequency output transducers, - from 50 to 100. The control unit of the coding counters according to the entering simultaneously to its input sign/criteria of the signal of sensor (f or I) controls coding the binary DSch and binary-coded decimal DDSch counters as follows. The bursts of pulses, which enter from BVN, are headed BUSch for the coding counters without change, in this case, the coding of the values of the analog parameters is carried out with resolution by 0.1o/o. A quantity of momentum/impulse/pulses in the decks, which enter from BFP from frequency output transducers, into BUSch is doubled by the way of the differentiation of their front and section/shear, but coding counters DSch and DDSch are controlled in such a way that during a change in the parameter to 0 from 100o/o its digital code varies from 0 to 100 unity with an error in the coding into 1o/o. The authenticity of the analog information adopted is checked in the control unit BK for the parameters with FIN to the

parity of the momentum/impulse/pulses of "labels" for the cycle/stroke of distributors, and for the parameters with ChM to the continuity of the sequence of momentum/impulse/pulses in leck. After checking to the authenticity of the value of the analog parameter accepted BK form/shapes either the signal of the "realiness" of the code which is healed in TsVM [digital computer] as strobe pulse for DSch and as the read pulse of the code from DDSch for UTsV or signal of "error". On signal "error" DSch and DDSch first are dumped into the zero state, but after delay to 100 μs it is utilized for the gating/strobing of the code in TsVM and as the reading momentum/impulse/pulse of the code into UTsV.

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The signals of the sign/criteria of sensors with output current-operated and frequency signal from BUSch enter TsVM for the formation of the files of information, which require different subroutines for processing.

The values of the analog parameters, entering DTsP from sensors with output current-operated signal, are corrected in the assembly of the correction of UK on the test measurement which is transmitted in the beginning of each group of the parameters, converted by the group of VIP on KP or in the unit of reception BAI-1 at teletransmission.

On address momentum/impulse/pulse UK carries out the comparison of test measurement (with standard conditions and exact equipment for all transformations and circuit of transmission) with the value, obtained at each moment of time under the changing operating conditions and in state of equipment. Correction is carried out during the divergence of the measured value of the test parameter within limits of ±2o/o and is realized by an interaction on oscillatory circuit GSCh which changes within these limits its frequency for the period of the coding of the values of all parameters of this group. With this method are corrected the comprising errors, introduced by the group of VIP on KP, by the circuit of transmission and GSCh, the appearing from change ambient temperatures, voltage of feeding sources, and also time/temporary drift of component values. Because of the application/use of the method of correction indicated an error in the transmission of the analog parameters with respect to the output sensor signal does not change in time and is within the limits by ±1o/o. During the onset on any reasons for error more than to ±2o/o UK puts out in TsVM the signal "there is no correction". Simultaneously this signal enters the unit of signaling BS, where also they enter and other signals, form/shaped into BK and other units. BS controls signal lamps and sound communication on the console operator.

PROTECTION.

For an increase in the degree of the authenticity of information, is used a series of protection.

During the transmission of measurements with pulse-position modulation, is carried out the control in terms of the parity of momentum/impulse/pulses as the cycle/stroke of distributors and the comparison of the number of the requested and taken group of TIA; at the transmission of TIA of the parameters with frequency modulation, is realized the control by the comparison of the number of the requested and taken group and the control of the continuity of the sequence of momentum/impulse/pulses in the deck of frequency signal.

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Report/communications from the objects of signaling are shielded by the selection of momentum/impulse/pulses on duration and by odd-parity check in each send operation. The digital codes of indication information are shielded by odd-parity check of momentum/impulse/pulses in send operation. Remote control by two-position objects is carried out by the transmission in one send operation only of one instructions and by checking the synchronism of the distributors, in the cycle of work of which is transmitted

command send operation. The code instructions of remote control are shielded by the method of informational feedback.

The passive methods of the protection of the transmission of information, besides the instructions of code remote control, are selected on the basis of experience in operation for three years of system TIS-1, which works on the specially laid cable lines.

CONNECTION WITH THE COMPUTER COMPLEX.

The connection of the information-carrying system with the computer complex is realized through input-output units (UVV). Figure 19 shows the structural scheme of the coupling of transmission system with TsVM (for example ASVT). Input unit - conclusion/derivation fulfills the following functions:

it will match the signal levels of informant's devices (signals of the system of cell/elements "spectrum") with the signal levels of devices ASVT (signals of the system of cell/elements "peace/world");

are converted code report/communications from transmission system to eight-digit words (bytes);

organizes the exchange of information between the transmission system and the coupling device 2V according to the algorithms of their work.

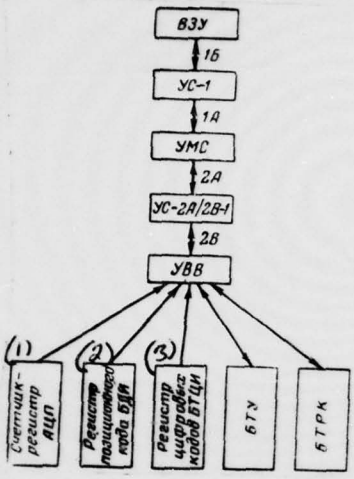

Fig. 19. Structural scheme of coupling of transmission system with the computer complex of ASVT.

Key: (1). counter-registor of ATsP. (2). Registor of position code of BDI. (3). Registor of digital codes of BTTsI.

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Through UVV into the device of coupling 2V, is put out the following information:

the values of the analog parameters in the binary code from sensors with current-operated and frequency output signal, which enter from ATsP with its sign/criterion;

the positional code of the signals of the state of equipment, which enters from the register of the unit of the reception of the discrete information of BDI;

digital binary codes from the unit of the reception of the digital information of BTTsI.

From the devices of coupling 2V through UVV into transmission system, they are put out:

instruction IU to the two-position objects into BTU;

code instructions to the controllers of regulators into unit BTRK.

UVV is connected to the coupler US-2A/2V-1, which makes it possible to organize connection according to principle demand - answer/response and to match the work of devices with different high speed. In turn, the US-2A/2V-1 is connected to output circuits of the device of the multiplexor connection of UMS, which uses for organizing the exchange of information between the internal memory unit of VZU and input units - conclusion/derivation. The device of multiplexor connection is also converter for the devices of coupling 1A and 2A and vice versa. The exchange of the information between UMS

and UVV is realized on the initiative of UMS, of collect/building information on the instructions sensor of astronomical time and salient the control pressures according to program algorithm of control.

Coupler US-2A/2V-1 has input informational and output command busbars. Command busbars are indicated by index U, and informational - by an index B.

Quantity of busbars of coupling 2V following:

(1) Информационных ШИН-Б	9
(2) Признак „управление" УПР-Б	1
(3) Признак „информация" ИНФ-Б . . .	1
(4) Сигнал „сброс" СБР-Б	1
(5) Командные ШИН-У	9
(6) Признак „управление" УПР-У	1
(7) Признак „информация командная" (8) ИНФ-У	1
(9) Сигнал „работа" РАБ-У	1
(10) Сигнал „отказ" ОТК-У	1
(11) Номер „канала" КАН-У	2

Key: (1). Informational ShIN-B. (2). Sign/criterion "control" UPR-B. (3). Sign/criterion "information" INF-B. (4). Signal "reset" SBR-B. (5). Command ShIN-U. (6). Sign/criterion "control" UPR-U. (7). Sign/criterion "information command". (8). INF-U. (9). Signal "work" RAB-U. (10). Signal "failure" OTK-U. (11). Number of "channel" KAN-U.

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Input-output of the information through coupling 2V is realized by potential signals with gating on go side byte-by-byte with the addition of one check bit on parity. The byte of information with error UVV is not taken in and into the device of coupling US·2A/2B-1 is put out the byte of state "error".

The exchange of information on the initiative UMS begins with the send operation of byte to connection.

CONSTRUCTION/DESIGN.

The fundamental principle of the equipment construction of the informational part of ASUPP is the direct dependence of the capacity of equipment in system on a quantity of functions, capacity of the transmitted information, method of transmission (telemechanical or remote), of forms of processing and representation of information to dispatcher and the loading into TsVM.

For purpose of the realization of this principle, the equipment for the subsystems of the transmission of information is carried out in the form of the set of 32 standard mutually butting functional units. The designing of the modifications of informant for concrete/specific/actual ASUPP is reduced to the determination of the set of functional boxes and devices and the composition of the tables of their connections according to functional diagrams. The construction/designs of units and cabinets, from which are compose/collected informant's devices, and also standard module/moduli (subunits) in a quantity of 27 types are undertaken from the in series produced complex the "spectrum".

For the comparison of tactical-technical possibilities, are

given below the short technical characteristics of the devices of the transmission of information TIS -1, "chord" and the devices of the transmission of the informational part of ASUPP of the type "Information clerk".

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	ТИС-1	(1) «Аккорд»	(2) «Информатор»
(3) Количество контролируемых пунктов в системе передачи	12	25	21
(4) Протяженность линии связи одного направления, км	15	15	5—10
(5) Предельный объем информации, передаваемой с одного КП, при телемеханической передаче:			
(6) аналоговых параметров	20	58	60
(7) дискретных сигналов	19	60	60
(8) информации в цифровой форме, *бит*	208	120	1 052
(9) команд ТУ (ТР)	(11) 6	50	21
(10) команд ТРК, *команд бит*	Не ограничено	15 120	64/1 376
(12) При дистанционной передаче:			
(6) аналоговых параметров	—	—	60
(7) дискретных сигналов	—	—	330
(8) информации в цифровой форме, *бит*	—	—	9 600
(10) команд ТРК, *команд бит*	—	—	(11) Не ограничено
(13) Быстродействие:			
передача аналоговых параметров, *параметров/сек*	36	25	31
(14) передача дискретных сигналов, *бит/сек*:			
(15) телемеханическим способом	36	10	35
(16) дистанционным способом	—	—	528
(17) передача информации в цифровой форме, *бит/сек*:			
(15) телемеханическим способом	9	8	120
(16) дистанционным способом	—	—	120
(18) Основная погрешность, %	±1	±1,6	±1
(19) Дополнительная погрешность при отклонении напряжения питания на +10, —15% или при уменьшении или увеличении в 2 раза амплитуды сигнала в линии связи	(20) Не превышает основную	(20) Не превышает основную	(21) Отсутствует
(22) Дополнительная погрешность от изменения температуры окружающего воздуха в пределах рабочих температур	(23) Не превышает утроенную основную	(23) Не превышает утроенную основную	(21) Отсутствует
(24) Расчетная надежность функциональных цепей, входящих в них устройств и блоков, наработка на отказ (не менее), *ч*	2 400	1 000	6 000
(25) Условия эксплуатации для всех систем передачи:			
(26) колебания напряжения питания от номинального, %	—15 ÷	+10	
(27) частота напряжения питания, *гц*	50±2	50±2	50±2
(28) Изменение температуры окружающего воздуха при относительной влажности до 80% и температуре 35°С, С:			
(29) для аппаратуры ПУ	+5	÷	+50
(30) для аппаратуры КП	—30	÷	+50

Key: (1). "chord". (2). "informant". (3). Quantity of controlled/inspected point/items in transmission system. (4). Extent of line of communication of one directions, km. (5). Maximum volume of information, transmitted from one KP, with telemechanical transmission:. (6). analog parameters. (7). discrete signals. (8). information in digit form, bits. (9). instructions TU (TR). (10). instructions TRK, instruction/bit. (11). Not limited. (12). With remote transmission. (13). Quick-action:. (14). transmission of analog parameters, parameters/s. (14a). the transmission of discrete signals, bits/s:. (15). in a telemechanical manner. (16). remotely. (17). transmission of information in digital form, bits/s:. (18). Fundamental error, o/o. (19). Supplemental error during voltage error of feed on +10, -15o/o or during decrease or increase 2 times of signal amplitude in communication line. (20). It does not exceed fundamental. (21). It is absent. (22). Supplemental error from change in temperature of surrounding air within limits of operating temperatures. (23). It does not exceed triple fundamental. (24). Calculated reliability of functional circuits, entering in them devices and units, mean time between failures (it is not less), h. (25). Operating conditions for all systems of transmission:. (26). fluctuation of supply voltage from nominal, o/o. (27). voltage frequency of feed, Hz. (28). Change in temperature of surrounding air at relative humidity to 80o/o and temperature of 35°C, C:. (29). for equipment PU. (30). for equipment KP.

Chapter Five.

MEANS OF THE PROCESSING AND OF INFORMATION RETRIEVAL.

The entered to control post information is processed in accordance with the algorithms of ASUPP of different kind by devices and is put out then to dispatcher in convenient for recognition form. Depending on the complexity of algorithm, size/dimensions of the workable files of the information, necessary for the degree of authenticity and accuracy of information processing and of other factors are applied specialized or general-purpose means [L. 23-25].

11. Special-purpose equipment for processing.

The great circle of the functions, target/purpose of which is the centralized monitoring of the parameters of process and state of production, can be successfully realized by the special-purpose devices and means reproduction. Among these functions: scaling of the values of the measured parameters; the visual representation/transformation of the values of the parameters with the aid of analog instruments; recording the values of the analog

parameters by recording instruments; the visual representation/transformation of the digital equivalents of the values of the parameters with the aid of digital indicators. the automatic check of the divergences of the parameters from normal values; the signaling of the states of equipment on the cell/elements of the mnemonic device of panel or console dispatcher; recording in the digital form of the values of the measured values on form or paper tape or on intermediate carriers - punched tape, punch card.

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Each of the devices, which ensure execution by one of the enumerated functions, works according to the specific program which within some limits can be changed by the corresponding commutating assemblies, available in devices. This special feature/peculiarity, and also unitized execution of the devices of information processing provides the great flexibility of their application/use. Are examined below the characteristic methods of processing signals - the data carriers and is given description of the devices, necessary for the synthesizing of ASUPP.

SCALING DEVICES.

The application/use of sensors with the standardized output

signals for the transformation of different measured values, which are changed over wide limits, and also tendency toward shortening in the time, spent on the transmission of information, and to simplification in the equipment on KP lead to the fact that are telemetered the parameters they are transmitted on PU in the form of the analog or digital equivalent, expressed in relative unity. Thus, to control post is transmitted the information, which characterizes the law of a change in one or the other parameter. To dispatcher it is necessary to know not only character of a change in the parameters with time, but also their absolute values, expressed in unity, which correspond to their physical nature. Therefore on PU the parameter before the reproduction they scale, i.e. into its analog or digital equivalent is introduced scale factor; this process/operation is executed with the aid of the scaling devices, in which usually are utilized the methods of translation or multiplication [L. 26, 27].

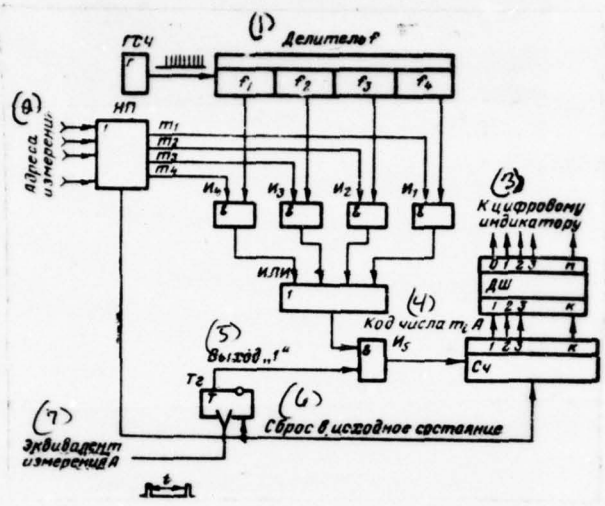

Fig. 20. Structural scheme of the device of scaling according to the method of frequency division.

Key: (1). Divider. (2). Addresses of measurement. (3). To digital indicator. (4). Code of number. (5). Output. (6). Resetting to initial state. (7). Equivalent of measurement A.

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The first of the devices in question, structural scheme of which is given in Fig. 20, carries out scaling of the parameters, represented in analog form with the pulse-position modulation of the signals which by flip-flop TG are converted into ShIM. Momentum/impulse/pulses with ShIM by length t, which are the function of the measured parameter, control the schematic I_5, connected at the

input of counter SCh. The second input of schematic I_5 enter the momentum/impulse/pulses of different frequencies from divider f to input of which is connected the generator of the stable frequency of GSCh. After input process of setting field NP of the address of the measurement accepted first of all is carried out the installation of the network elements into initial state, and then depending on given one on NP for each measured parameter of the scale factor m_1-m_4 is open/disclosed one of the schematics I_1-I_4, gating pulses of one of the step/stages f_1-f_4 of divider f on the input of the counter SCh, in which is form/shaped the code of a number, it is proportional to the measured parameter (interval t) and to the preset coefficient of scaling. In device, that works according to this principle, is provided for the series of the frequency scaling factors, which is approximately geometric progression with denominator 1.5. To coefficient m=1 corresponds the lowest frequency. In the remaining cases it is equal to $m_i f$. As can be seen from schematic, the function of scaling in this device is combined with the function of the analog-digital conversion as a result of which SCh form/shapes binary-decimal digital code of the value of the parameter, proportional $m_i A$.

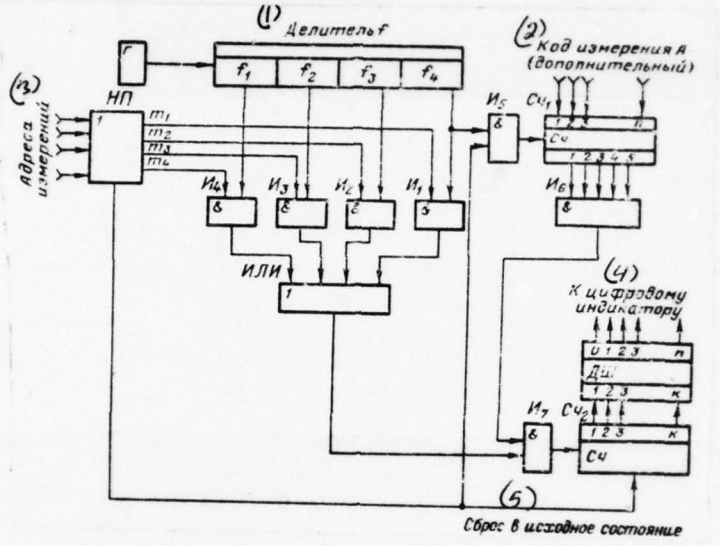

Fig. 21. Structural scheme of the device of scaling according to the method of the translation of the codes.

Key: (1). Divider. (2). Code of measurement A (additional). (3). Addresses of measurements. (4). To digital indicator. (5). Resetting to initial state.

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Chapter Six.

IMMEDIATE DISPATCHING EQUIPMENT.

The process of the creation of the automated control systems by productions with continuous technological processes unavoidably leads to the need organizing of central control rooms (TsDP), and equipment of them by the contemporary equipment, including operational-dispatcher equipment (ODO).

In connection with the fact that ODO is the basic link, which ensures the effective participation of man (dispatcher) in control loop and is inseparably connected with system, its composition and structure are determined on the basis of the functions, entrusted to dispatcher. Immediate dispatching equipment allows the possibility for dispatcher to conduct continuous control of the course of technological process, to coordinate the work of all sections of production, to consider his work with other productions, etc.

13. Composition and structure.

As has already been mentioned, the construction of the control systems, including in their composition of ODO, it is carried out taking into account the specific special feature/peculiarities of the continuous productions of the branches of the industry indicated:

by the presence of shop (production) structure;

by the presence of the series-parallel connections of shops on technological process;

by the presence relative to a small number large-capacity unity of fundamental technological equipment;

by the possible multistage nature of technological processes in single apparatuses;

by the insignificant park/fleet of stand-by;

by different inertness of a change in the fundamental technological parameters;

duration of the process of starting and stop of fundamental technological equipment;

by the presence of the strongly developed system of the pipeline connections between shops;

by the presence of a large number of technological parameters whose state must be monitored.

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All these special feature/peculiarities in the greatest measure affect the construction/design of ODO, the schedule reproducing panels, etc.

Immediate dispatching equipment unites in itself the information flows, intended for the reception by the dispatcher of solution by control. It reproduces in available form the processed and concentrated of functional groups information about the values of the fundamental technological parameters and the technical-economic indices, about the state of fundamental technological equipment. On ODO are put out the sign/criteria of emergency situations and

recommendation regarding optimum control of process.

In the case of breakdown of some devices of system, ODO provides the reproduction of the branched flows of primary information, processed with two independent from each other groups of devices. Industrial control is realized with the aid of reliable two-way dispatcher communication with all subdivisions of enterprise.

Immediate dispatching equipment organizes the work sites of dispatcher and his assistant, providing the execution of the current works and decrease in the fatigability of dispatcher personnel.

The fundamental orders of dispatcher and management/manual of enterprise, passing through the central control room, are record/fixed with special means recording.

The standardized construction/designs of the single devices ODO provide the interchangeability of cell/elements, growth, introduction of changes into equipment, and they also facilitate the production both of series and individual specimen/samples.

Immediate dispatching equipment can be completed by different methods. At present several plants specialize in the production of means dispatcher system. Most adequate/approaching for purposes of

ASUPP are the construction/designs, produced by plants "Elektropul't" (Leningrad) and "Shchitavtomatika" (Zhitomir) [L. 37, 38].

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By plant "Shchitavtomatika" are released modular mosaic panels of type ShchDSM-1, intended for the creation of the mimic diagrams of different productions, predominantly energy branches of industry. Panels are collect/built from the skeleton sections of four fundamental typical dimensions. The construction/design of panels makes it possible to compose the panels of different length and height/altitude (length of panel can be increased with space 400 mm, maximum altitude is 3,650 mm). Depending on specific conditions, the panel can be collect/built by rectilinear or concave.

The section of panel has on face the dismountable metallic grating into windows of which with assembly are inserted the standardized mosaic cell/elements. Fundamental mosaic cell/element accepted cell/element with frontal size/dimensions 40x40 mm. Furthermore, on separate sections can be establish/installed miniature/small and miniature showing and recording instruments. Produced by plant "Elektropul't" modular mosaic panels are intended for the construction of the mimic diagrams of energy objects - stations, substations, transmission lines, etc. Panels are released

two types - ShD-5 and ShD-6, which differ from each other only in terms of depth which for the first composes 410, and in second 830 mm. The size/dimensions of panels along the length are not virtually limited and are determined depending on specific conditions.

Panels are collect/built from the separate panels, which consist of the established/installed on each other sections. The lower sections of panels of the type ShD-6 are executed in the form of the inclined panels of light construction which are intended for the mounting on them of the individual sections of mnemonic device and plug-type commutators for manual control of the illumination of symbols.

By plant are released modular dispatcher consoles one-argument PDO-3 and two-argument ~~pdd~~ PDD-4, intended for the equipment of the work site of dispatcher personnel, which controls power system. Consoles are collect/built from the sections of two types each of which consists of instrument, attachment, table top, stone and foundation. On instrument attachments they are establish/installed in panels PDO-3 to 36 reading instruments ~~pmdo~~ PMDO-1, in panels ~~pdd~~ PDD-4 to 60. On the panels of the lateral sections, arrange/located to the left and to the right of dispatcher, are establish/installed the panels with command-acknowledging equipment and consoles telephone switch. Consoles have an identical height/altitude and a depth, being 850 and

2,000 mm, and they are characterized by only the length which for the console PDO-3 is equal to 2300 mm, and for the console PDD-4 to 3780 mm.

14. Immediate dispatching equipment of automated systems of type "cascade/stage".

For purposeful application/use in the automated control systems of continuous productions in the SCSRILSA developed immediate dispatching equipment, utilized in the interstitial into industry systems "cascade/stage" [L. 4].

The immediate dispatching equipment of systems of the type "cascade/stage" in the general case is included in its composition: panel with the mnemonic device of production; the panel of the instruments, which record the fundamental technological parameters; the panel of the instruments, which record the fundamental technical-economic indices of process; the console dispatcher and his assistant; the rack of printing; the rack of the settings of the signalled technological parameters and input/introduction into the computers of supplemental information.

On the devices of immediate dispatching equipment, it is arrange/located equipment, instruments, communications, signaling and

controls, intended for execution by the dispatcher personnel of its functions on control of process.

For the creation of the most favorable conditions of work and decreasing the fatigability of dispatcher personnel, the layout of the cell/elements of mnemonics and the coloration of the devices ODO must be carried out taking into account the requirements of human factors engineering.

The digital and alphabetical symbols which will be deposited to different cell/elements of ODO, will be made by type of Makvort, the size/dimension of type is selected in each specific case.

Panel with mnemonic device is intended for the arrangement/position of the detachable plane tables, which symbolize shops, the cell/elements of trouble signaling, signaling of divergence from the preset limits of the technological parameters and technical-economic indices, the signaling of the position of "bottleneck" (shop), and also of light signal panels with text recommendations regarding optimum control of process.

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On plotting boards are establish/installed locking gates, which

symbolize fundamental technological equipment and signalling its state. Furthermore, on plane tables are assembled the light signal panels of trouble signaling with the plotted designations of shops. Plane tables are connected between themselves by those fasten/strengthened to of front panel panel colored rods, which indicate interdepartmental production lines. Along rods on the front panel of panel, are placed the numbered light signal panels of the signaling of the livergence of the fundamental technological parameters. In the upper part of the panel, are establish/installed the light signal panels of the text recommendations, between which in the middle part of the panel are assembled those electrified watches. Lower than the signal panel of recommendations are arrange/located the cell/elements of the signaling of the divergence of the technical-economic indices and position of "bottleneck", establish/installed in two series above the plane tables of the corresponding panels. Switching on of the signal panel of recommendations, cell/elements of the signaling of the position of "bottleneck" and of the divergence of the technical-economic indices is accomplished by signals of TsVM, that works with respect to the appropriate programs. Signals of the switching on of the light signal panels of the divergence of the technological parameters and locking gates are produced by informational devices. The signal panel of trouble signaling is connected directly to the line of intershop trouble signaling.

In connection with the fact that fundamental technological symbol to scale of production, is the shop or the section, which it is expressed as plane table and needs sharp extraction on anelboard with mnemonic device, the layout of plane table is satisfied rectangular with the relationship/ratio of sides vertical to horizontal, equal to 0.75:1.

If as the component parts of plane table serve mosaic cell/elements (size/dimensions 40x40 mm), then its overall dimensions are selected from the calculation of arrangement/position on each plane table of the following quantity of different symbols and signs:

Symbols of fundamental technological equipment. - to 16 unity.

Symbols of the controlled/inspected technological parameters. - to 32 (16 mosaic cell/elements).

Alphabetical symbols (signals of the divergence of technical-economic indices, position of "bottleneck", emergency situation - designation of shop). - to 6 unity (4+1+3=8 mosaic cell/elements).

Symbols of technological connections. - to 16 (16 mosaic cell/elements).

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Thus, each of the plane tables is designed for arrangement/position to 88 mosaic cell/elements with the plotted on them symbols.

Usually a quantity of "dead/blind" (the not having symbols) mosaic cell/elements, necessary for the distribution of symbols and filling of the windows of rectangular plane table, is from 30 to 35o/o. In this case the total number of mosaic cell/elements of plane table composes 130 (13 on horizontal and 10 on the vertical lines), for arrangement/position of which the size/dimensions of plane table will be equal to 520x400 to mm.

The selection of the overall size of panel with mnemonic device is determined by two considerations. In view of the fact that continuous productions virtually consist of a series of the consecutive technological sections, natural is the horizontal location of the flow chart of production on the mnemonic device of panel. Moreover it is known that is most effective the motion of the eye of man with survey/coverage along horizontal (angle on the order

of 140-160° and 50-80° on vertical line). Therefore the overall size of panel with mnemonic device is accepted equal to 5000x1500 (1800), which makes it possible to place in one series 9, and in two series to 18 symbols of subdivisions (shops). For the location of the objects of control at the level of the eye of the sitting person (approximately 1200 mm from floor level) the plane tables, which symbolize shops during arrangement/position in one series, are establish/installed on height 1300 mm, and in two series on the height/altitudes of 1100 and 1700 mm, and panel itself with mnemonic device is raised on two racks with a height/altitude of 600 mm.

On the basis of the fact that the greatest depth of the devices of illumination and of signal armature does not exceed 120 mm, or for convenience in the mounting and debugging the depth of panel with mnemonic device it is accepted as the equal to 350 mm.

In mosaic cell/elements are provided the devices of illumination, which ensure direct/straight brightness contrast. Symbols on the screens of mosaic cell/elements on the plane tables of panel with mnemonic device are made with size/dimensions 18x10 mm during plotting of symbol in one series, and 15x9 mm during plotting of symbols in two series (thickness of lines 2 mm).

The panels of recorders are intended for the location of the instruments, which realize recording the fundamental technological parameters of process, the most important technical-economic indices, and also the digital indicators, which reproduce on their screens the left the preset zones technological parameters.

In certain cases is permissible the installation on these panels of the cathode-ray tubes of industrial television equipment or screen indicators.

Overall sizes of basic part of panel 2000x1500, the depth of 600 mm. Recording is realized by recording instruments (millivoltmeters, potentiometers). For recording the technical-economic indices, are utilized the instruments sometimes multipoint with a wide tape (of type ASP, KSP-4), that have comparatively high size/dimensions; on panel it is possible to arrange to 6 instruments.

For recording of the technological parameters, are utilized miniature/small automatic recorders - to 15 pieces. The remaining place (usually on top) is utilized for the location of digital indicators (to 5 pieces).

The scales of recorders are calibrated in natural unity of measured parameters. To digital indicators the parameters are derive/concluded, as a rule, in relative form.

The console dispatcher (Fig. 33) is the work site of dispatcher personnel and functionally is divided on three sections. Right section is the desk on which are establish/installed the microphones of the loud speaker connection. Middle section is intended for the arrangement/position of telephone switch, armature of the signaling of the state of all devices of system, telephone sets, devices, which check the soundness of signalings, devices, which ensure the input/introduction into computers and the conclusion/derivation from it of the results of calculations. The results of calculations are reproduced on digital optical indicators, which are establish/installed on vertical attachment. The left section is intended for the arrangement/position of micromnemonic device with the built-in into it plug-type commutator.

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The panel of left section is made by inclined and has in lower part a micrommemonic device which corresponds to the mnemonic device of production and has at the points, which correspond to the signalled parameters, telephone jacks. In upper part are assembled

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THE TECHNICAL EQUIPMENT OF COMPUTERIZED CONTROL SYSTEMS (SELECT--ETC(U)
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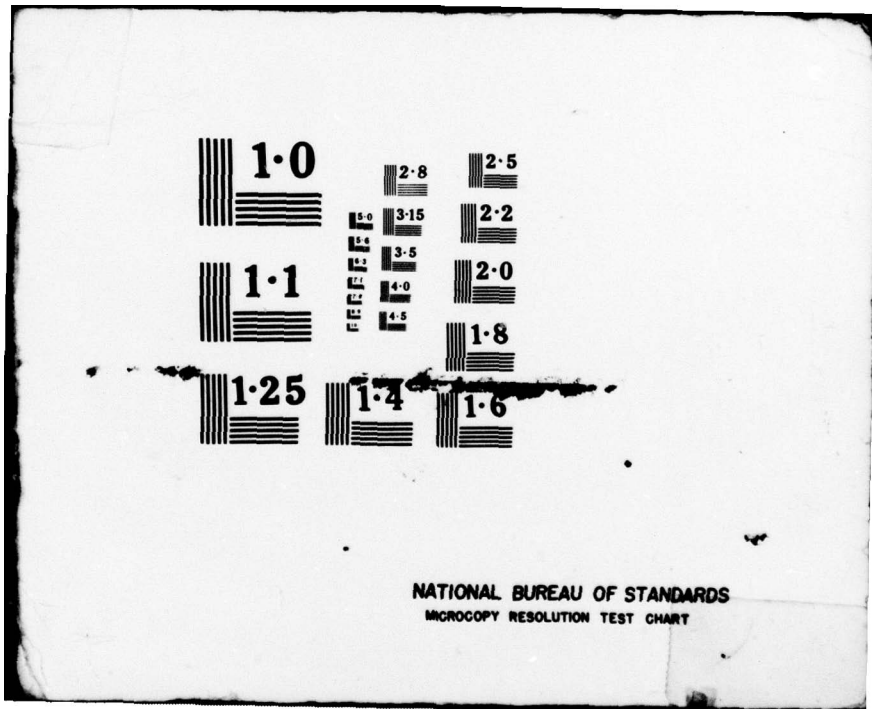
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MICROCOPY RESOLUTION TEST CHART

The scales of recorders are calibrated in natural unity of measured parameters. To digital indicators the parameters are derive/concluded, as a rule, in relative form.

The console dispatcher (Fig. 33) is the work site of dispatcher personnel and functionally is divided on three sections. Right section is the desk on which are establish/installed the microphones of the loud speaker connection. Middle section is intended for the arrangement/position of telephone switch, armature of the signaling of the state of all devices of system, telephone sets, devices, which check the soundness of signalings, devices, which ensure the input/introduction into computers and the conclusion/derivation from it of the results of calculations. The results of calculations are reproduced on digital optical indicators, which are establish/installed on vertical attachment. The left section is intended for the arrangement/position of micromnemonic device with the built-in into it plug-type commutator.

Page 135.

The panel of left section is made by inclined and has in lower part a micromnemonic device which corresponds to the mnemonic device of production and has at the points, which correspond to the signalled parameters, telephone jacks. In upper part are assembled

five plugs of the call of the parameters each of which corresponds to their digital indicator. Above the micromnemonic device are arrange/located the sockets of the clearings of signal "bottleneck", for which there is a plug, which identify/indexes after the clearing of signal "bottleneck". Indicator of the combined scales is intended for the conversion percentage values of the parameter into absolute ones.

The indicator of the combined scales is carried out in the form of the vertical panel, establish/installed on the left section of console.

For storing the documentation in the pedestals of left and right sections, are made drawers. Common/general/total overall sizes of console - length of 2,800 mm, the height/altitude of horizontal panel 750, inclined 800 mm, the height/altitude of attachment 300 mm, the width of the working zones of dispatcher and his assistant 1 of 100 mm, the depth of console 900 mm, overall height 1 of 100 mm.

The rack of printing is intended for the arrangement/position of the electrified typewriter, with the aid of which on program of TsVM or order of dispatcher are recorded the parameters, the situation, recommendations, is maintained station log.

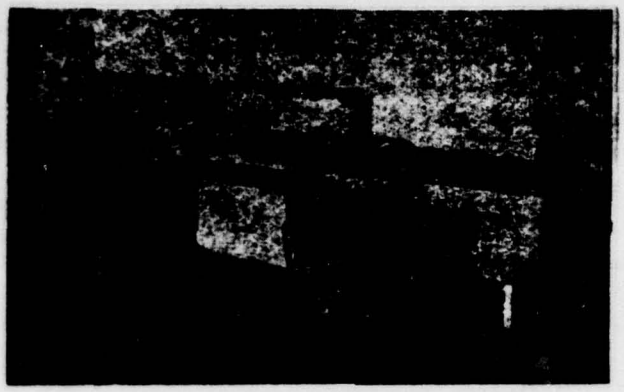

Fig. 33. Console for the dispatcher of system "Kaskad-22".

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The rack of the loading of information into TsVM and the assignments of the settings of the signalled technological parameters is intended for the arrangement/position of the controllers of hand data input and a plug-type commutator for fixation of the limits of the signalled parameters. The unit of the controllers of hand input/introduction is establish/installed on lateral inclined panel, plug-type commutator is arrange/located on upper horizontal panel and is closed by transparent cap/cover.

The layout of ODO in central control room.

Immediate dispatching equipment, as a rule, is

establish/installed in the isolated/insulated location by area from 80 to 120 mm², arrange/located not far from machine room, and location for the receivers of informant. As a rule, before the front of console on distance 4-5 m, is establish/installed the panel with mnemonic device (Fig. 34). To the left and to the right of panel with mnemonic device and nearer to console are establish/installed the panels of recorders. They are establish/installed in such a way that their front panels are inclined at an angle from 45 to 60° to the front of console.

Fig. 34. Layout of ODO of system "Kaskad-22" in central control room.

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If panel with mnemonic device has small linear dimensions, panels of recorders can be establish/installed close to it, forming common/general/total concave panel. The racks of printing and input/introduction are establish/installed to the right and to the left of console at the level of the seats of dispatcher personnel or they are establish/installed close with the extreme sections of console. The mutual location (right or left) of the panels of recorders relative to panel with mnemonic device is determined depending on the location of machine room and locations for the receivers of informational system.

The universalization of ODO.

Together with the advantages of ODO systems of the "Kaskad" type its joining to the object of control requires one or the other changes in the construction/design. It is not general-purpose and in certain cases requires the execution of the works, connected with the considerable expenditures of time. During a change in the flow chart of the object of control (installation in the shops of the auxiliary equipment, change of the quantity of controlled/inspected technological parameters, etc.) single devices of ODO and first of all panel with mnemonic device require serious alterations. The alterations in process of which are carried out bench and electrical assembly works, unavoidably lead to the need for the disconnection/cutoff of part of ODO, which impedes the work of dispatcher personnel.

Mosaic panels provide the possibility of rapid introduction into the mnemonic device of any changes, connected with a change in the flow chart of the object of control, but also they are not deprived of the number of deficiency/lacks (high cost/value, the considerable weight, hinder/hampered admission to electric armature, etc.).

In connection with grown demand on the automated control systems of productions, there arose the need for production of ODO by

industrial method. For this purpose, was developed most ideal ODO, combining in itself the advantage both of the mosaic and cabinet panels of systems of the type "cascade/stage" (production of which planned at the plant "Shchitavtomatika" Zhitomir).

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As the basis of newly developed ODO is placed the building block concept, which ensures possibility of the unification of a series of assemblies, speed of growth and recomposition of the single devices ODO, reduction in the cost/value of equipment and labor expenses.

Panel with mnemonic device is the combination of the cabinet and mosaic types of panels. As the basis of panel serves cabinet type section, on which are establish/installed the mosaic plane tables, which symbolize the shops of the object of control. This combination is accepted in connection with the fact that, as a rule, change in the common structure of production (construction or complete reconstruction of the operating shops) they are carried out not more frequent than one time in 3-4 years, but the intrashop structure and interdepartmental connections change much more frequently.

On the frontal part of the section, which has overall size 2000x1500x350 mm, is establish/installed six movable vertical rods

which are intendei for the attachment of plane tables. Panel is collect/built from several sections and is establish/installed on two rectangular racks or common/general/total duct.

Plane table consists of rectangular framework/body in which is establish/installed dismountable grating (analogous to the setting grating of plant "Shchitavtomatika"). Mosaic cell/elements are made with the transparent screens on which that or by another method will be deposited alphanumerical, silhouette and other symbols. On each plane table is establish/installed 130 mosaic cell/elements with screens 40x40 mm or the corresponding number of cell/elements with screens 40x80 and 40x120 mm. On the screens of mosaic elements are applied the symbols of fundamental technological equipment (silhouette), of divergence of the technical-economic indices (alphabetical), of the position of "narrow bridge" (alphabetical), "emergency situations" (alphabetical) and divergences of the technological parameters (digital). As a rule, to each mosaic cell/element will be deposited one symbol or part of the symbol, but sometimes when is required the savings of effective area of plane table, is allow/assumed plotting on the screen of two alphabetical or digital symbols. Each mosaic cell/element with the plotted to its screen symbol is supplied with the group or individual device of illumination. The devices of illumination are applied two forms - with one and four incandescent lamps. For purpose of the signaling of

different states of fundamental technological equipment of the device of illumination, they provide the successive illumination of symbol by four different colors.

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The total quantity of silhouette symbols (fundamental technological equipment), does not exceed 50 and it makes it possible to collect virtually any flow chart of the production of the chemical and petrochemical branches of industry. For conducting of inspection, repair or replacement of mosaic cell/elements and devices of illumination the plane table can be turned on the flapping hinges and be record/fixed in horizontal position. For preventing the pollution, the faces of plane tables can be closed by transparent sheets with the dulled surface, and sometimes by mosaic sheets with dulled surface. Sometimes mosaic cell/elements are establish/installed with transparent screens, and on the surface of transparent sheet, is made the duct/contour of the flow chart of shop and all remaining symbols.

For the unification of plane tables and provision for their uniformity, necessary for facilitation for the dispatcher personnel of control of signals, the symbols, common/general/total for all plane tables, are arrange/located in the strictly defined order. Common/general/total symbols are establish/installed in an upper

series of plane table in the following sequence from left to right - the divergence of the technical-economic indices, "emergency situation", position "bottleneck".

The panels of recorders differ from the analogous panels, which form part of ODO of system "Kaskad", only by size/dimensions which correspond to the size/dimensions of the panel of section with mnemonic device, and are 2,000x1,500x700 mm. On the front panels of panels, it can be establish/installed to 18 miniature/smallen ones and to 6 full-scale recorders. For the attachment of instruments in panels, are establish/installed several movable horizontal rods.

The console dispatcher is made by composite from the sections of three typical dimensions 1,000, 800 and 600 mm. All sections have constant depth 900 and height/altitude of 750 mm. Sections are made with the removable covers on which can be establish/installed the attachments, intended for the arrangement/position of the units of text recommendations, the indicators of the combined scales, miniature and miniature/small recorders, armatures of signaling and control.

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The modular construction of console makes it possible to give to it

any layout, most adequate/approaching these specific conditions.

Technical capabilities of ODO of systems of the type "Kaskad".

Характеристики (1)	(2) „Каскад-22"	(3) „Каскад"	(4) Примечание
(5) Аналоговая регистрация основных технологических параметров на приборах	(6) До 15	(6) До 18	
(7) Аналоговая регистрация технико-экономических показателей на приборах	(6) До 18	(6) До 18	
(8) Сигнализация основных технологических параметров	(6) До 200	(6) До 576*	(9) *Из расчета до 32 на каждом планшете
(10) Воспроизведение значений контролируемых технологических параметров	(6) До 200	До 576*	(12) То же
(11) Выдача текстовых рекомендаций	До 66	До 99*	*На одну приставку
(13) Одноцветных сигналов состояния оборудования	(6) До 140	(6) До 288/576*	(14) *16/32 на планшет
(15) Четырехцветных сигналов состояния оборудования	(16) Нет	(6) До 288/576	(17) То же
(18) Световых сигналов отклонения технико-экономических показателей	(6) До 4	(6) До 4	(19) На планшет
(20) Аварийных сигналов	1	1	На планшет (19)
(21) Индикация или регистрация на приборах пульта	(16) Нет	(6) До 3*	(22) *На приставку секции
(23) Телефонная связь абонентов	40	(6) До 100	(25) Типа „Орбита"
(24) Устройства магнитофонной записи	(6) До 2	До 4	
(26) Аппаратура ввода в ЭВМ и вывода результатов в разрядах	(6) До 10	(6) До 3×11*	(27) *На приставку

Key: (1). Characteristics. (2). "Kaskad-22". (3). "Kaskad". (4). Note. (5). Analog recording of fundamental technological parameters at instruments. (6). To. (7). Analog recording of technical-economic indices at instruments. (8). Signaling of fundamental technological parameters. (9). *From calculation to 32 on each plane table. (10). Reproduction of values of controlled/inspected technological

parameters. (11). Delivery of text recommendations. (12). The same. (12a). *For one attachment. (13). Monochromatic signals of state of equipment. (14) * 16/32 to plane table. (15). Four-colored signals of state of equipment. (16). No. (17). The same. (18). Indicating lights of divergence of technical-economic indices. (19). To plane table. (20). Emergency signals. (21). Indication or recording on instruments of console. (22). *For the attachment of section. (23). Telephone communication of subscribers. (24). Devices of tape recording recording. (25). Type "orbit". (26). Equipment for input/introduction into computers and for conclusion/derivation of results into digits. (27). *For attachment.

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