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SCIENTIFIC AFFAIRS

No. 572

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34

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GDR'S ROBOTRON COMPUTER PRODUCTION SUPPORTED BY SOVIETS

East Berlin NEUE ZEIT in German 10 Jan 78 p 5

[Article by K.W.: "Dresden's 'Electronic Hearts' Beat Precisely: Robotron Computers Proving Themselves in Many Countries--Experiences of Minsk Partners Applied"]

[Text] The punch tape is running, control and push buttoms light up and go out again. The men in orange overalls attentively watch the progress of the test. They will tolerate not even the slightest error, so that their "ward" will not fail in later life. "This time it will be a roughly 40-hour test," explains engineer Gerhard Sebald at his test bench of VEB Robotron Electronics, Dresden. The item being tested is the Robotron EC 2640 central unit, the key part of the EC 1040 EDP system produced by the GDR within the scope of the CEMA uniform EDP system. Such a unit can perform 380,000 computations per second. "And at the same time such an 'electronic heart' must work without any discrepancy at temperatures between -5 and 40 degrees Celsius," says Gerhard Sebald.

"For about 4 years we have been producing the EC 2640 central unit in modern shops," I am further told. "Around 180 units have already gone through our testing facility and have been proving themselves ever since, for example, in the dispatching service of the North-West energy supply system of Riga; in the Main Administration for Oil and Gas Industry, Tyumen; in the Danube Iron Works, Dunajvaros; in the Petrochemical Combine, Pardubice; and at the Institute for Rationalization of the Building Industry, Prague."

For about 3 years the USSR State Committee for Material-Technical Supplies has been working with an EC 1040 from Robotron. A. Solyanik, head of this committee's main computer center, reports: "Upon installation of the unit, intensive utilization of the large computer began with the assistance of GDR specialists, and the operation to date has demonstrated that it is guaranteed to be reliable. All problems to be solved have been managed with excellent results. The computer's enormous storage capacity, the high processing speed, the possibility of running through several programs simultaneously and, last but not least, the reliability of the total system should contribute decisively toward solving our management and planning problems more effectively."

Many precise manipulations and mechanized operations are needed before a large computer can become the indispensable helper of industry and science. Toward this end the Dresden Robotron electronics specialists have created a well thought-out production rhythm. There has been an influx also of many ideas and experiences from Ordzhonikidze, the Soviet partner enterprise of Minsk. For the aim has been to produce the large computers in series: From the initial laying of the cable and other preparatory work, through installation and final assembly right up to the testing facility. Many innovations have helped lay the foundation for the EC 2640 central unit's "Q" [quality indicator].

The EDP systems are the result of cooperation among several enterprises of the Robotron Combine. Thus, for example, the collectives from Riesa supply the plug-in units, while Radeberg prepares various components. "Everything doesn't always run smoothly, and only a comprehensive competition among all partners--spreading even beyond the combine, since many other partners are also producing parts for the computer--has thrown the switch clearly in the direction of quality and reliability of delivery," Gerhard Wartig, chief of the technical control organization, points out. Only recently the Dresdeners have been honored as the "enterprise of excellent quality work."

Fifty-nine of the EC 1040 EDP systems are installed in Soviet enterprises and facilities; the 60th unit has just passed its "test" and is being installed in the USSR's oil industry ministry.

CSO: 2302

BULGARIA

SCIENTIFIC-TECHNICAL DEVELOPMENTS BY YOUNG PEOPLE OUTLINED

Sofia RADIO, TELEVIZIYA, ELEKTRONIKA in Bulgarian No 10, 1977 p 3

[Article by E. Ashkanova: "Ninth National Exhibition of the Technical and Scientific Creative Work of Young People"]

[Text] The Ninth National Show of the Technical and Scientific Creative Work of Young People took place from 15 to 25 October 1977 in Plovdiv. It was held in commemoration of the 60th anniversary of the Great October Socialist Revolution.

The show covered a period of two years during which the TNTM [Technical and Scientific Creative Work of Young People] clubs in the country grew from 4260 to 5463. They instill in young people a love for science and technology, labor and production. At the Ninth Show the number of young rationalizers reached 17,300, which was 15 percent more than in 1975.

In an exhibition area of 16,000 square meters 2300 displays were arranged, making an excellent impression with their design layout. Traditionally the most impressive was the display of working young people (1200 exhibits), followed by the Palace of Secondary School Pupils (600), Pioneers (240), while the students and young scientific workers at higher educational institutions and academies were represented with 230 exhibits.

A commission chaired by Professor Ivan Mladenov, deputy chairman of the Committee for Scientific and Technical Progress and Higher Education, on behalf of the government awarded Komsomol honors for great successes achieved in the technical and scientific creative work of young people during the Ninth Show. Here are some of them.

Medal for Contribution to Technical Progress:

"Optimization of Principal Transmission Networks for Television and USW Radio Broadcasting," leader -- Senior Science Associate and Candidate of Technical Sciences Engineer Georgi Peychev, Scientific Research Institute for Construction, Sofia.

"Numerically Controlled Machine Tool," leader -- Zakhari Bukov, Kalinin OTMT [expansion unknown], Plovdiv.

"System for High-Speed Printout of Computer Solutions," leader -- Engineer Major Bogdan Tsakov, Bulgarian People's Army.

"Automatic Telegraph Station," leader -- K. Kiryakov, Ministry of Internal Affairs.

"Automatic Traffic-Flow Recording System," leader -- Engineer Nikolay Yordanov, GUSV [Main Administration of Construction Troops].

Gold Medal for Young People's Scientific and Technical Creative Work:

"Electronic Cigarette Counter," leader -- Engineer Neno Penev, PRChNOPM [expansion unknown], Plovdiv.

"Interphone System with One Main and Five Subordinate Stations with Capability of Expansion and Connection with PBX and City Telephone Exchange," leader -- Petko Stoilov, Fine Mechanics PU [Vocational School], Sofia.

"Complex Device for Checking Principal Instrumentation Systems of TU-154 Aircraft," leader -- Engineer Angel Borisov, Aviation Engineering Directorate, Balkan Bulgarian Civil Aviation Economic Trust, Sofia.

"Electronic System for SEATs-1 Automatic Beet Cutter," leader -- Kalin Karov, IRE [expansion unknown; possibly Radio Electronics Institute], Sofia.

"AN Automatic Dial," leader -- Boris Apostolov, TsPEKhP [expansion unknown], Sofia.

"Digital Multimeter," leader -- Slaveyko Neychev, IME [expansion unknown; possibly Institute for Mechanization and Electrification], Sofia.

"Electronic Test Table for Radio-Relay Line," leader -- Kiril Konov, Scientific Research Institute for Construction, Sofia.

"Eight-Line Distribution Board for High-Power Broadcasting Rediffusion System," leader -- Zdravko Marinov of Okrug Administration of Communications, Yambol

Military Youth

"Numerically Controlled Video Switching Distributor," leader -- Engineer Blagoy Angelov, Georgi Benkovski VNVVU [expansion unknown; possibly a military school].

"Medium-Power, Medium-Wave Radio Transmitter V," leader -- Khristo Buchvarov, Ministry of Internal Affairs.

"Radio-Controlled Ship Model ZE," leader -- Plamen Kamenov, Okrug Modelers' Club, Vratsa.

"Automatic Switch with 512-Bit Memory," leader -- Junior Sergeant Dimitur Galmadiev, Okrug Radio Club, Tolbukhin.

"Undulator Apparatus for Graphic Recording of Telegraph Signs and Other Electric Signals," leader -- Georgi Apostolov, Central Radio Club, Sofia.

Students and Young Scientific Workers at Higher Educational Institutions and the Academy of Sciences:

"Television Display for General-Purpose Device for Machine Designing of Electronic Circuits," leader -- Professor Engineer Yordan Boyanov, Lenin Higher Institute of Electric Machinery, Sofia.

"Electronic Handwriting Analyzer," leader -- Docent and Doctor of Technical Sciences Engineer Yuliyan Marinov, Lenin Higher Institute of Electric Machinery, Sofia.

"Electronic Taximetric Apparatus," leader -- Gancho Slavchev and Vladimir Tsvetanov, Higher Institute of Electric Machinery, Varna.

All the creative results show that wherever it is most arduous and difficult, wherever creativity, innovation and dedication are necessary, the younger generation is always there. The best measure of the young people's creative labor is its practical exploitation. About 40 percent of the developments on display have already been put into production and close to 15 percent are in the process of being put into production.

6474
CSO: 2202

INSTABILITY OF CERTAIN AVIATION GYROCOMPASSES DESCRIBED

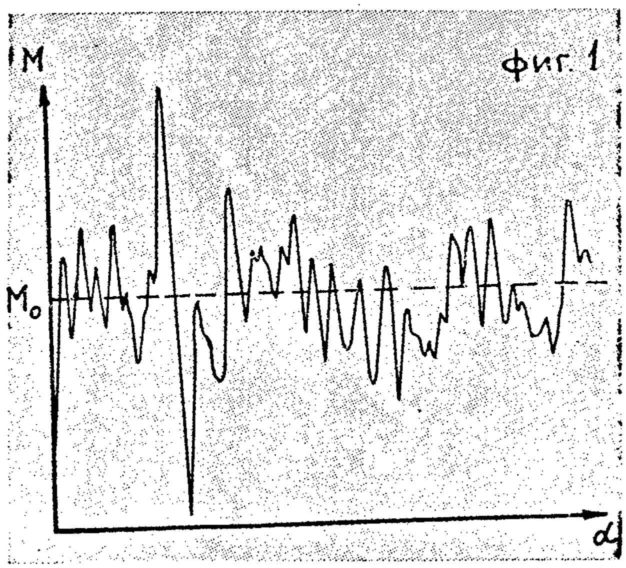
Sofia VOENNA TEKHNIKA in Bulgarian Vol 11, No 10, Oct 77 pp 14-15

[Article by Engineer Major Viktor Putov, candidate of technical sciences: "The Instability of Aviation Directional Gyro Parameters and the Minimization Thereof"]

[Text] One of the principal aircraft gyroscopic instruments is the directional gyro, which is used as an independent instrument or as the gyro unit in compasses and course systems.

The principal parameter used to estimate the state of a directional gyro and its fitness for further operation is the azimuth deviation of its gyro compass (error in course measurement). The magnitude of this deviation is strongly influenced by the moments of the forces which prevent the rotation around the axes of the inner gimbal of the gyroscope. Studies show that these moments do not remain constant, but change according to a random law with a change in the relative position of the elements of the bearings. This is confirmed by experimental charts, one of which is shown in Figure 1. The causes of the change in these moments are the design peculiarities of the bearings, the deviation of their geometric form from the ideal form, and the presence of uneven spots and microroughness from machining. It has been proved that the mean value of the moment M_0 (Figure 1) changes its signs with a change in the rotational direction but the random oscillations about it do not (Figure 2, a). This is so because M_0 is caused by the frictional forces while the random oscillations are due to the above-enumerated peculiarities of the bearings.

The operation of gyroscopic instruments is always accompanied by oscillations about the axes of the gimbals caused by the vibrations of the rotor, by the nutational oscillations of the gyroscope and by the operation of different auxiliary systems (adjustments, slaving systems etc.). The amplitude αm of these oscillations is insignificant (several seconds of arc) and their period T is less than one second, for which reason they are still called microoscillations.

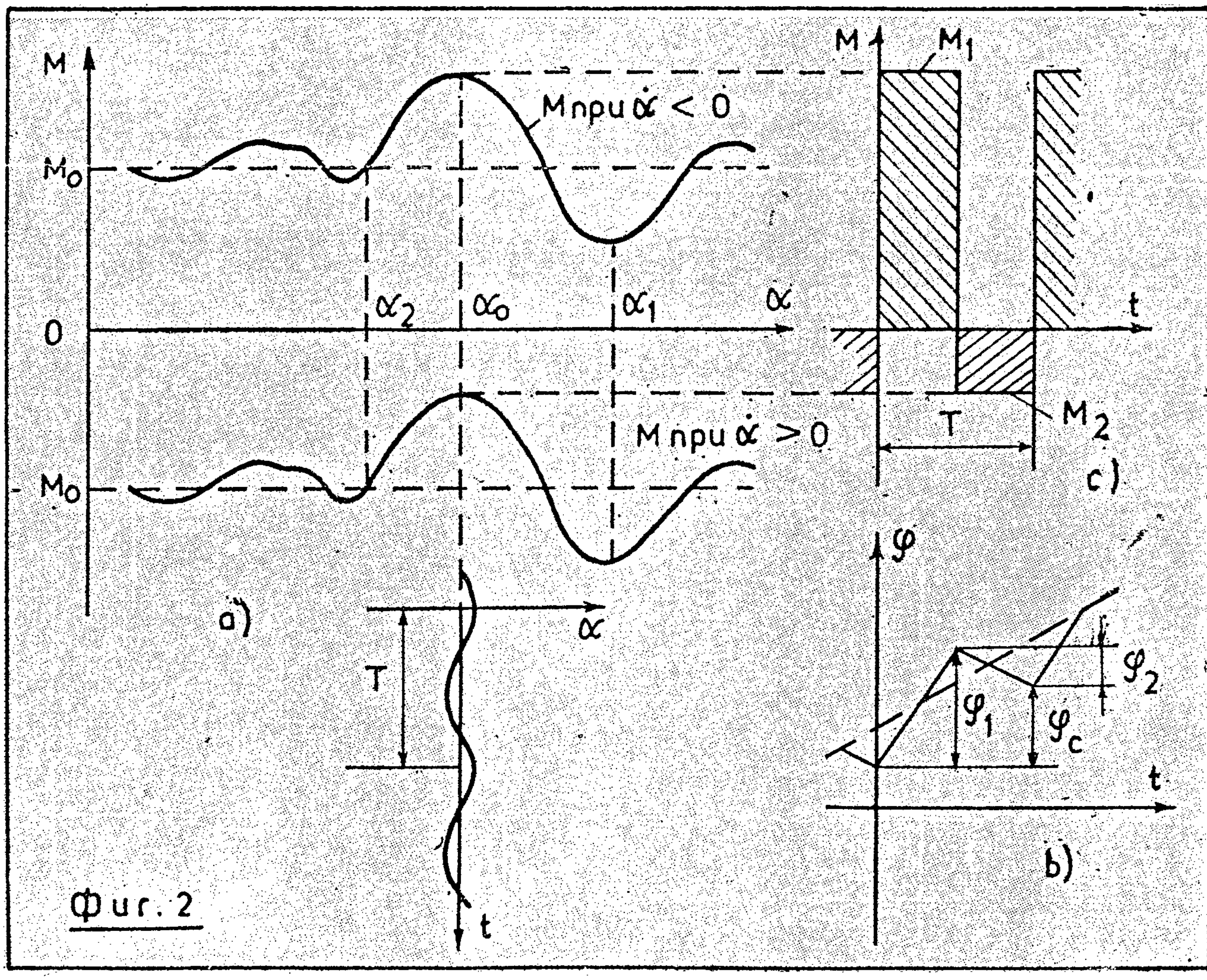


It has been established, besides, that during the normal operation of a gyroscopic instrument the relative initial position of the bearing parts does not remain constant, but changes under the action of the microoscillations, albeit slowly and at small angles. A significant change in their relative position is possible during start-up, adjustments and transport when significant loads are present, accompanied by large swings about the gimbal axes.

On the basis of what has been said thus far, let us consider what processes take place in the operating directional gyro. Suppose, after the instrument begins to operate, that the relative position of the bearing parts of the inner gimbal axis are determined by the angle α_0. Unless we allow for the slow changes in this angle, under the action of the microoscillations it will change according to the law (Figure 2, a):

$$\alpha=\alpha_0+\alpha_m \sin\frac{2\pi}{T}t.$$

This change is opposed by the moments of the forces that impede the rotation. According to what was said above, they are negative with a positive angular velocity, and vice versa (Figure 2, a). Thus for half the oscillation period the gyroscope is acted on by the positive moment M_1 and after that by negative moment M_2 (Figure 2, b). Since the amplitude is very small, the moments M_1 and M_2 remain practically constant for their respective semiperiods.



Key: 1. given

For the one microoscillation semiperiod the precession (deviation) of the gyroscope will be (Figure 2, c):

$$\varphi_1 = \frac{M_1}{H} \cdot \frac{T}{2}$$

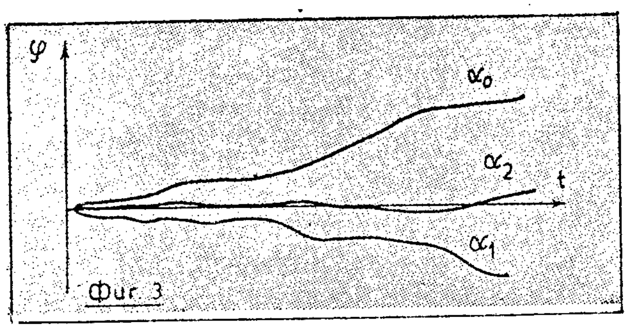
and for the other:

$$\varphi_2 = \frac{M_2}{H} \cdot \frac{T}{2}.$$

Or for the period T as a whole the following total deviation is obtained:

$$\varphi_c = \varphi_1 - \varphi_2 = \frac{1}{2} \cdot \frac{M_1 - M_2}{H}, T,$$

which leads to error accumulation during the entire operating time t of the instrument.



Фur. 3

After each stop and subsequent switching on of the directional gyro, the original angle (for example α_1, α_2) changes (Figure 2, a). But in this case the moments M_1 and M_2, caused by the microoscillations, will have a different relationship and consequently the total deviation of the gyroscope will be different.

And since the original angle α_o (α_1, α_2) does not remain constant, it turns out that the errors in φ of the directional gyro change in time according to a random law, as is shown, for example, in Figure 3.

During the operation of directional gyros a check is periodically made as to whether their error does not exceed the maximum permissible value. But because of the above-described phenomenon, during consecutive measurements various error values are obtained which differ significantly from one another. This creates a certain uncertainty during the normal operation of these instruments and is especially undesirable during adjustments, when adjustments have to be made according to several measurements (ordinarily four) so as to determine the mean error value.

From Figures 1 and 2 it can be seen that if the amplitude of oscillations around the gimbal axes of the gyroscope is made great enough, approximately the same mean values of the moments M_1 and M_2 will be obtained for both a negative and a positive angular oscillation velocity. In such a case the resultant deviation for one period will be equal to zero and no error will accumulate.

But how can oscillations with sufficiently great amplitude around the gimbal axes be provided without disturbing the normal operation of the directional gyro.

A way out of this difficulty has been found by using bearings with a special design for the gimbal axes. They consist of three rings and two rows of balls. The middle ring is rotated at a velocity of 70-100 rpm by means of an electric motor. In this way the moment which is operative as the bearing rotates is averaged, remains constant and equal to M_0. The error of the directional gyro is constant here and can be compensated for.

The use of such bearings also has another advantage. If the middle rings of the bearings at the two ends of the gimbal axis rotate in opposite directions, given the same mean values of the moment M_0 the total moment equals zero and no error is obtained. But since usually the mean values of the moment M_0 for the two bearings differ by 10-20 percent, an instrument error results. This error can be compensated for if periodically (every 30-60 seconds) the rotational direction of the bearings is changed. If after reversal the difference in the mean moments remains the same, the error accumulated during the rotation in the previous direction will be eliminated. But in practice this difference does not remain the same on reversal, for which reason a certain part of the error cannot be compensated for. However, it is considerably smaller (15- to 20-fold) than the error that would result if the bearings did not rotate and -- what is especially important -- it remains constant for a long period of time during the operation of the directional gyro.

Thus the azimuth deviation of the directional gyro can be reduced to a very small magnitude. This makes it possible to guarantee the permissible error by using much smaller gyroscopes which are more reliable in operation, thereby compensating for the reduction in total reliability resulting from the use of additional elements for rotation of the bearings.

There are gyroscopic devices in which a complete turn does not take place, but only an oscillation of the middle ring of the bearings at a fairly large angle.

It is a must for some time now, in the design of new directional gyros and the modernization of existing ones, to use bearings with rotating middle rings. They are already being employed in some types of vertical gyroscopes.

6474
CSO: 2202

FREQUENCY METER FOR AIR FORCE USE DEVELOPED

Sofia VOENNA TEKHNIKA in Bulgarian Vol 11, No 10, Oct 77 p 16

[Article by Engineer Nedko Kirkov: "ICh-76 Transistorized Frequency Meter"]

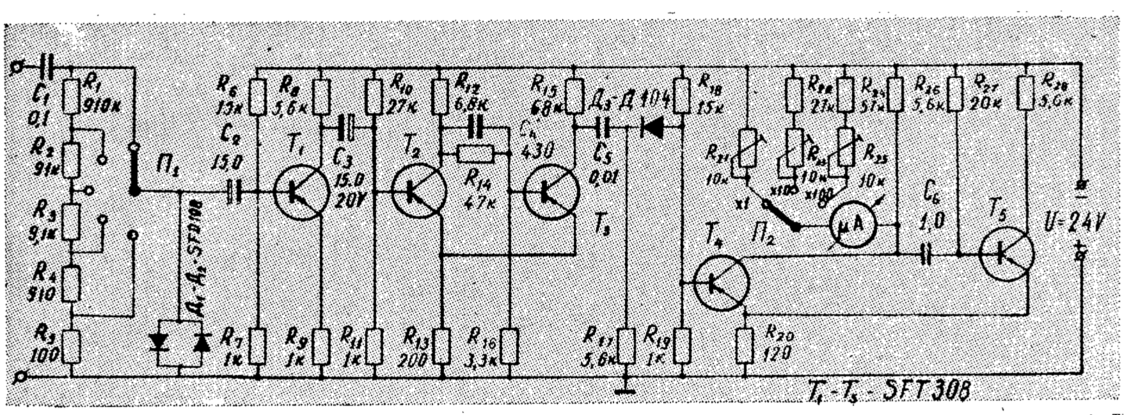
[Text] A transistorized frequency meter ICh-76 has been developed at the G. Benkovski VNVVU [expansion unknown; possibly a military school] for the needs of educational, scientific-research, and planning-and-design work. It is used to measure the frequency of sinusoidal and non-sinusoidal voltages with an amplitude of 0.15-700 V in the 20 to 10,000-Hz range.

The operating principle of the frequency meter consists in the conversion of the input voltage by means of an amplifying-clipping circuit into single-polarity short-duration pulses, which after their calibration for duration and amplitude by a biased multivibrator act on a magneto electric microammeter.

Through the capacitor C_1 the measured voltage is fed to the divider R_1-R_5 and from it to the base of transistor T_1, which operates as an amplifier. With switch Π_1 the desired (effective-) voltage range is selected: 10, 50, 150, 250 and 500 V. Thanks to the diode protection employed, the device permits a 20-fold input-voltage overload.

The voltage amplified by transistor T_1 is fed to a Schmitt trigger made with transistors T_2 and T_3, which shapes square pulses. The repetition rate of these pulses is equal to the frequency of the input voltage, while their duration depends on its amplitude and shape. After this, the square pulses are differentiated by the circuit C_5, R_{17}. Through diode $Д_3$ the negative pulses are fed to a biased multivibrator made with transistors T_4 and T_5, which generates short-duration duration- and amplitude-calibrated pulses with a frequency equal to the frequency of the input voltage. Microammeter µA is connected to the collector circuit of transistor T_4. Since the mean value of the current through the microammeter depends linearly on the frequency of the calibrated pulses, the microammeter scale is graduated for a frequency of 0-100 Hz.

To expand the measured frequency range, resistors R_{21}÷R_{25} are connected in series to the microammeter by means of switch Π_2. With Π_2 is chosen the multiplier (x1, x10, x100) by which the result read from the microammeter scale is to be multiplied.



The maximum reduced measurement error does not exceed 4 percent, while the input resistance of the device depends on the frequency and position of switch Π_1 and is from 1 kΩ to 1 MΩ. The power supply is 24 V with maximum current consumption 22 mA.

The ICh-76 frequency meter can also be used to measure nonelectric quantities which are converted to frequency (angular velocity, vibration frequency etc.).

6474
CSO: 2202

BRIEFS

EC 1025 COMPUTERS--Our first third-and-a-half generation computer, the EC 1025, is being given birth to at the Research Institute for Computer Equipment in Prague in collaboration with specialists from the Industrial Automation Business Enterprise in Cakovice. The first series is to be produced in 1979. The test series of a new third-and-a-half generation minicomputer called the SM 1 will be finished at that time, also. [Text] [Prague ZEMEDELSKE NOVINY in Czech 29 Dec 77 p 3]

CSO: 2402

BRIEFS

LASER DRILLER--A laser device, built by the physics department of Friedrich Schiller University in Jena, is supposed to be able to drill holes with a minimum diameter of one-fiftieth of a millimeter. The first models of this device are now being tested. In contrast to the usual commercial models, this device is operated without helium. It is said to be suited to drilling and marking both superhard metals and glass and ceramic materials with high melting points. Moreover, this carbon dioxide high pressure impulse laser is supposed to be able to handle materials, such as gold, silver, copper and aluminum, whose optical reflectivity makes special demands on laser technology. [Text] [Bonn IWE-WIRTSCHAFTSDIENST in German No 46, 23 Dec 77 p 4]

CSO: 2302

AREAS FOR APPLICATION OF MICROCOMPUTERS CONSIDERED

Bucharest STIINTA SI TEHNICA in Romanian No 11 Nov 77 pp 6-7

/Article by Dr Engr Adrian Petrescu, senior professor of computer technology at the Bucharest Polytechnical Institute/

/Text/ Computer technology is one of the modern fields of science and technique which are considerably expanding. In order to assess the development of this area suffice it to say that in the last 30 years the speed of computers increased by 6 orders of magnitude, the cost of computer data processing decreased by 4 orders of magnitude, the reliability of computer systems went up by 3 to 4 orders of magnitude, and the consumed power decreased by 4 orders of magnitude. Moreover, the productivity of programmers went up by 1 to 2 orders of magnitude because of the major achievements obtained in the area of programming technique and programming languages.

In the last 5 years the evolution of computer technology has been significantly influenced by the appearance of large-scale integrating network, with the microcomputers playing a major role.

Because this review previously carried articles on the technology, structure, and characteristic features of microcomputers, in this article we plan to highlight a number of applications of microcomputer equipment in various economic and technical areas. Regardless of the type of application, the microcomputer must include elements of connection with the human operator, elements of connection with the environment (technological processes, other controlled items), and an external memory of an adequate capacity.

The areas of application of microcomputers, as data processing programming factors are very diversified. They include the control of technological processes, communications, data processing, scientific instrumentation, space research, medicine, transportation, education, consumer goods, business computer equipment, and so on.

Lack of space prevents us from providing examples in all the areas mentioned above. Hence, we shall only tackle some of them in which the team headed by the author has been involved.

A major area in the application of microcomputers involves this type of computers which control technological processes. In the first stage of the microcomputer-controlled process the functions of the microcomputer only involve collection and primary processing of data, control of the values of major parameters, and formulation of messages to the operator.

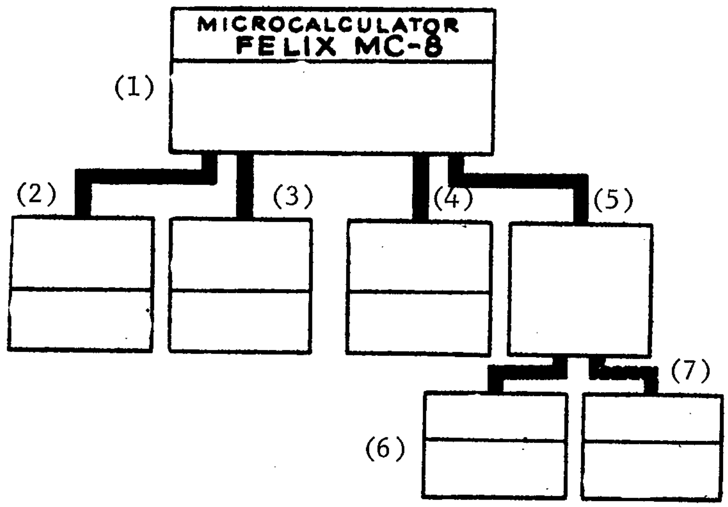
An example of application for the collection and primary data processing involves the use of the MC-1 microcomputer turned out in 1974 by the Computer Section of the Bucharest Polytechnical Institute. In order to perform calculations on the forecasts of electric power consumption by the population it is necessary to collect a considerable amount of data from the points of distribution of electric power. Sometimes these data are being continuously collected for several weeks, from tens of distribution centers, with readings at intervals of minutes. In order to objectively assess the electric power consumption the data read must be processed. Furthermore, these results are recorded and processed and are also compared with data on industrial power consumption.

The MC-1 microcomputer was designed and produced for the purpose of automatically performing a program in accordance with the specifications pointed out above. The program was stored in a permanent memory. The data collecting and processing cycle was controlled by means of a real time clock controlled by a quartz oscillator. The results obtained were taped in a recording which contained the processed values, the maximum values read, and the period of time to which these values were related. The tape ensured the prospect for subsequently processing these data on a FELIX C-256 computer.

A more advanced stage in controlling industrial processes by means of microcomputers involves replacing conventional controllers, that is using microcomputers in the control loop. This stage occurs at the point when the characteristics of the process have been properly estimated and the control rules have been worked out.

For the purpose of clarifying the problems which arise in the utilization of microcomputers for controlling continuous technological processes, a comprehensive team made up of teachers (from computer and automation II sections) and students conducted pilot plant tests on controlling yield and pressure by means of the MC-3 microcomputer. This computer, turned out by the Computer Section in 1975, is provided with analog/numerical and numerical/analog conversion elements and with elements of multiplexing, demultiplexing and analog storage.

Chart 1



Key:

1. FELIX MC-8 Microcomputer
   Microcomputer. 51 Instructions (8, 16, 24 bits), semiconductor memory, 16 k octaves (Ram, Prom, Reprom). Time for completing instructions: 20-44 microseconds

2. Tape reader, 200 characters/sec

3. Input-output console, 10 characters/sec

4. Dual unit of magnetic cases, capacity: 2x2.8 M bits

5. Double serial interface

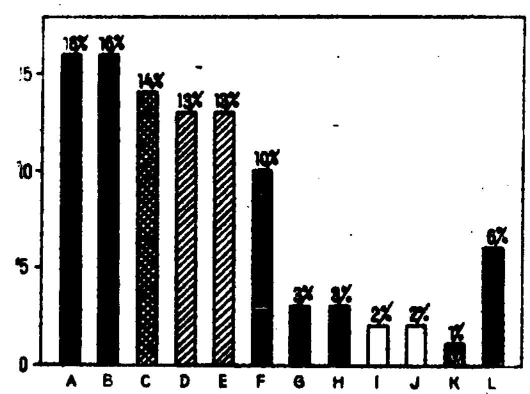
6. Input-output serial console, 10...30 characters/sec

7. Display, posting type: alphanumerical graphical

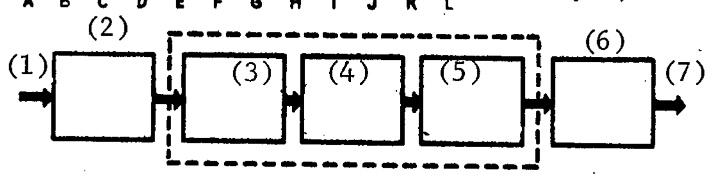
The coupling of the microcomputer provided with converters to the process was done by means of standardized elements turned out by the Factory for Automation Elements. Through program the PID (proportional-integral-differential) control laws for each loop were produced in light of the specific adjusting parameters. The maximum sampling time for the input magnitudes does not exceed 209 µs. This permits the control of relatively rapid processes. The whole program took less than 512 octaves of memory. The calculations of economic efficiency showed that the microcomputer approach is justified in the case when it takes over at least three control loops.

Graph 1. Principle of Direct Process Control by Microcomputer

Distribution of Various Microcomputers in Various Areas (1975):
A. Scientific Instrumentation. B. Communications. C. Data Processing. D. Control of Processes. E. Use in Space Industry. F. Application in the Military Area. G. Medicine. H. Consumer Goods. I. Business Equipment. J. Education. K. Transportation. L. Other Applications.



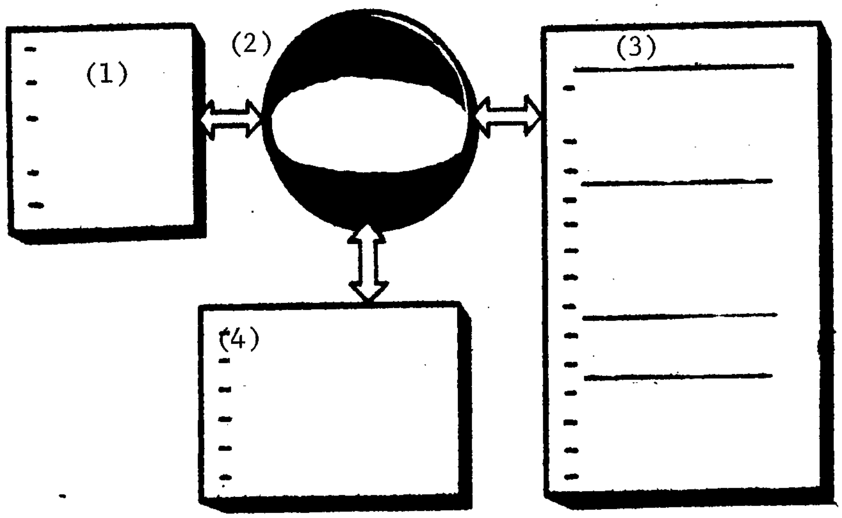
Distribuţia utilizării microcalculatoarelor în diverse domenii (1975): A — Instrumentaţie ştiinţifică. B — Comunicaţii. C — Prelucrări date. D — Conducerea proceselor. E — Aplicaţii aerospaţiale. F — Aplicaţii militare. G — Medicină. H — Bunuri de larg consum. I — Echipament de birou. J — Învăţământ. K — Transporturi. L — Alte aplicaţii.



Key:

1. Process
2. Adjusting equipment
3. Analog/numerical conversion. Multiplexing
4. Microcomputer processing equipment. Control algorithm
5. Analog numerical conversion. Demultiplexing
6. Adjusting equipment
7. Process

Chart 2. Offline Setup for a Microcomputer



Key:

1. Connection with operator
   Keyboards
   Printing
   Posting devices
   Readers
   Etc.

2. Microcomputer

3. Connection with the environment
   Analog input
      Translators of physical magnitudes
      Currents, voltages
   Numerical input
      Switches
      Relays
      Counters
      Encoders
   Analog output
      Currents, voltages
   Numerical output
      Relays
      Step-by-step motors
      Valves
      Etc.

Moreover, the Computer Section also conducted tests on a graphical system for viewing the condition of electrical power equipment in an electrical station. Similarly to the manner in which the symbol of electrical power installations are represented on the panel at the control center, the symbols were program-produced on the screen of a viewing tube. The microcomputer receives from the installation information on the condition of the equipment. The equipment may be in operation connected, disconnected, or out of order. The equipment in operation connected or disconnected is represented by corresponding symbols. A defective machine has a symbol whose degree of brightness varies in time and this may warn the operator. If a defect appears the operator must perform a series of moves in a specific logical order. Nonobservance of this order may result in the damaging of other machines. Through a slide the operator may indicate the elements in the diagram which he wishes to connect or disconnect. The type of the operation is specified by means of alphanumerical keyboards. The microcomputer examines the accuracy of the chain of operations and issues corresponding messages which support or do not support the operation involved.

The use of microcomputers in control centers cuts down the expenses involved in posting panels, confirmation of handling operations, recording of all events and operations for subsequent processing, and coupling with a superior calculator within the framework of an integrated control system.

Control of road traffic is another area in which microcomputers display their advantages. The replacement of conventional logic with microcomputers achieves the control of stops at intersections in light of the vehicles in the waiting lanes and the waiting time and can ensure priorities on specific traffic directions on the basis of data provided by translators. Experience has shown that to control the stops of an intersection on a primary and on a secondary thoroughfare, under the above-mentioned conditions, 88 instructions for the FELIX MC-8 type microcomputer are necessary. Because the internal memory of this microcomputer can store about 16,000 instructions and the programs written for specific types of intersections can be extended to more, practically there are very great prospects for using MC-8 for these applications.

The staff of the Computer Section of the Bucharest Polytechnical Institute, in conjunction with other institutions, has tackled problems pertaining to the use of microcomputers for controlling processes in the metallurgical industry, for automating the processing of the data provided by measurement equipment, for controlling facilities in real time, and so on. The outcome of this research has resulted in lower electric energy consumption, greater productivity of measurement installations, and smaller efforts in terms of foreign currency involved.

The area of application of microcomputers is very broad and promising. Workers in the field of computer technology must display a firm approach to the extensive use of microcomputers.

ROMANIA

DEVELOPMENTS IN METROLOGY EXAMINED

Bucharest STIINTA SI TEHNICA in Romanian No 11 Nov 77 pp 25-26

/Article by Engr I. Ivanof, head of the microproduction department/

/Text/ The move to improve the technical standard of industrial output through using modern procedures and automation has involved the need for providing the production lines with more accurate measurement devices, in accordance with the tolerance allowed by the specific parameters of the product, and for providing the central and plant metrological laboratories with measurement devices corresponding to the high level of production.

In his speech at the Conference on Romania's Trade Activity and subsequently on various occasions party secretary general Nicolae Ceausescu pointed out: "It is necessary for us to turn out greater amounts of control and measurement and control apparatus and machines in small-lot production or unique products. Let us firmly put an end to costly imports of products which can be turned out properly at home."

In the context of the measures taken in the overall economy to reduce imports through the efficient use of material resources and know-how -- a basic task outlined in the Directives of the 11th Congress of the Romanian Communist Party, the National Institute of Metrology assumed the task of developing a program of small-scale production. Its major goals involved: arrangement for priority production of precision measurement devices which are import items; advancement of technical progress through the use in the economy of Romanian-designed modern precision measurement devices; on the basis of the increase in labor productivity and as the economic needs are met, the creation of a surplus for export; production and provision of the own laboratories with equipment designed by the research workers of the institute, on a par with its counterparts in other countries.

The production of standard and high-precision measurement apparatus in the areas of electric power, electronics, geometric magnitudes, mass, output, pressure and volume, force, physical-chemical magnitudes, temperatures, spectrophotometry, and other areas involves a number of characteristics. These characteristics include the great amount of higly skilled labor, the need for turning out small series of products, the great flexibility of the production process, the rapid switch to new types and variants, and so forth.

The National Institute of Metrology correctly assessed the importance for the economy of advancing the small-scale production of precision measurement standards and apparatus. In 1970, eight types of measurement devices were turned out under the microproduction program. The institute is now turning out more than 80 types of measurement devices and more than 300 variants of these types in the following areas: electric and magnetic magnitudes, mechanical magnitudes, thermal magnitudes, photometric magnitudes, and analytic magnitudes.

Small-scale production at the institute at first involved apparatus in the area of electric magnitudes. An arrangement was made for the production of several families of apparatus based on a primary technology including: the technology of apparatus based on precision resistors and the technology of apparatus based on ratio transformers.

The National Institute of Metrology has developed the production technology of wound precision resistors, the essential element of an important class of electric measurement apparatus with nominal values ranging between $10^{-4}\,\Omega$ and $10^{6}\,\Omega$, whose precision class has reached 0.02 percent and even 0.01 percent and an annual stability of 0.01 percent for those of the 0.02 percent class and 0.06 percent for those of the 0.01 percent class. On the basis of these resistors, considered as end standards in the diagram of unit transmission, arrangements were made for small-scale production and current delivery to the economy of standard resistors, decade resistance boxes, various types of Wheatstone bridges, Thomson bridges, combined Wheatstone-Thomson bridges, continuous current compensators, resistive voltage dividers, bridges for determining the wire defect point by means of the Varley and Murroy diagrams and for measuring the ohmic asymmetry of conductors, and so on. For these apparatuses the precision class reached was up to 0.01 percent and other performances were similar to those of counterparts produced by world reputed firms.

The ratio transformers turned out by the institute underlie a wide range of end standards, secondary standards and apparatus. Many of these are the object of invention patents of research workers of the National Institute of Metrology in Bucharest. Worthy of note are the decade inductive voltage dividers, current and voltage standard transformers for precision measurement of alternating currents up to 2000 A and voltages up to 660 V; apparatus for the standardization of current transformers for determining the errors of standard current transformers of 0.1 precision class; apparatus for the standardization of voltage transformers whose precision class has reached 0.001 percent.

Special attention was paid to the electric voltage standards of the small-scale production of the institute, normal elements (Weston), and Zener diode reference voltage sources. The elements turned out by the institute fully meet the needs of the domestic market in terms of performance and structural variants, saturated type, unsaturated type, normal type, miniature, invertible, and so forth.

In the area of analytical magnitudes, the small-scale production of the institute meets the needs for some substance and translator standard samples such as: pH standard buffer solutions, standard electric conductivity solutions, and standard gas mixtures. Under the 1976-1980 Five-Year Plan the institute will turn out substance and material standard samples.

Moreover, in the area of spectrometry and photometry, various standard spectral lamps were produced. A Romanian first involves the Kr^{86} lamp for the production of the length standard. Other products included standard gas spectral lamps and various standard neutral lamps.

The standards and precision measurement apparatus produced by the institute have been provided to many Romanian state and plant metrologic laboratories and research, education, and other laboratories of various units in this country. They are majors factors in high precision and reliability measurements, for the purpose of ensuring the quality of products, obtaining new results in research, and so on. For instance, the standard resistors, the normal elements, the standard current transformers, the apparatus for the standardization of current and voltage transformers, manovacuummeters, and other devices are used as primary standards and secondary standards in most metrological laboratories in this country.

The standards and precision measurement apparatus turned out on the basis of small-scale production at the institute have helped to enhance the prestige of Romanian metrology internationally. An example in this context is the fact that a relatively large amount of the institute's products have been requested for the 1976-1980 period through the "Interetalonaparat" Scientific-Productive Union.

Provisions under the 1976-1980 Five-Year Plan involve, in addition to the greater volume of the small-scale production of the institute, also the great diversification of the range of standards and high-precision devices. Special attention will be paid to electronic apparatus for measuring electrical and nonelectrical magnitudes, including digital apparatus. The microproduction of mechanical and optical apparatus will be expanded.

The categories of standard apparatus taken into consideration for the 1976-1980 period include: resistors, condensers, decade inductors, semiautomatic and automatic bridges, standard electronic meters of electric energy, standard apparatus in the field of geometric magnitudes, various standard manometers, standard temperature and photometric lamps, standard apparatus in the area of spectrometry, and special standard electronic voltmeters (sensitive to phase, differential, selective, and high-frequency voltmeters).

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ROMANIA

LAND DAMAGED BY MINING OPERATIONS RECOVERED FOR AGRICULTURE

Bucharest MINE, PETROL SI GAZE in Romanian No 8, 1977 pp 361-364

[Article by Eng I. Colita, ICPML, Craiova]

[Text] The rapidly progressing technical and scientific revolution, and the growth of the population, demand the adoption of technical and economic measures of fundamental importance: the need to increase industrial and agricultural production, and to enlarge the resources of mineral raw materials, fuels, and energy. These increases which imply development, must occur with the greatest protection of the environment, in order to avoid degradation and maintain a constant balance between meeting the continually growing needs of society and protecting all environmental factors, in a word, while respecting ecologic laws.

The existence of environmental damage associated with technologic progress as a whole, is an objective reality.

Taking these facts in consideration, the RCP has adopted a constructive national policy which judiciously approaches all aspects of environmental protection: legal, economic, technical, political, socio-human, institutional, instructional-educational, and cultural. The main goal of this policy is to supervise, prevent, and combat environmental downgrading.

The extraction of energy-producing coal is developing rapidly both through modernized techniques in order to maintain and increase the capabilities of existing mines, as well as through the opening of new mines and quarries. The rapid achievement of these important goals in accordance to present demand, imply an undesirable increase in the amount of land which is removed from agricultural and forestry service.

By the year 2000, the area covered by wastes and quarries will amount to about 50,000 hectares of agricultural land. As a result, one of the foremost problems of the extractive industry, together with the complete exploitation and utilization of useful ores, is the return of degraded land to agricultural and economic applications. The wastes created by underground, and especially open pit mining increase every year, together with the progress achieved in building excavation machines, which are now veritable mobile plants with a capacity of 100,000 cubic meters per day.

The concept guiding the judicious utilization of land resources also implies the obligation of investment or production beneficiaries to recover before hand an area equivalent to the one which will be ultimately removed from use by the location of industrial installations; this recovery can be achieved through the transformation of unproductive ground into arable land, the return of land temporarily removed from agricultural production to the same production potential and the same end purpose as before, as well as the preparation of land left from exploitations for agricultural, forestry, fishing, recreation, and other purposes. The return of degraded land to agricultural uses requires steps to be taken during the planning stages of the exploitation, during the time the coal is mined, and afterwards, during the transformation of sterile wastes into productive agricultural zones which will become integrated into the national economy and will assure long lasting and reliable crops.

In waste heaps, the proportion of fertile soil to sterile rocks is low, raising difficulties for planting, especially when one considers the lack of structural uniformity and the very different agrochemical and cultivating properties of the waste.

At the present, beginning stage of recovery of damaged land, the steps taken to promote agricultural use (grain, vegetables, vineyards, orchards, technical crops, pastures, potatoes, and so on) are followed in distinct phases according to a domestic technology.

The first phase is the cultivation and agrochemical classification of the area under exploitation and of the surface geologic strata, in order to learn about their fertility and to be able to formulate recommendations for the dumping of rocks and strata, and of topsoil in particular.

The subsequent phases concern mining preparations and recultivation.

The mining preparations include the dumping of cover materials, leveling, sloping, agrochemical improvements, the construction of exploitation roads, drainage and removal of rain water, and the supply of water reserves.

Of great importance for the success of agricultural recovery and for high production results, is the nature of the upper strata (coarse soil, earth, top soil, scree, raw soil, base rock), a material whose properties can be changed, which is permeable to air, able to absorb and retain water, and therefore more or less suitable for crops.

For agriculture in particular, useful land must be 50-100 cm deep, with a clay or sandy clay structure, and contain about 15 percent clay; it must be capable of retaining humidity and be readily permeable to air and water; and it must have good adsorption properties while being well supplied with P, K, Ca, S, and Mg macroelements as well as microelements, and free of toxic substances. The pH value must be proper for plant development, since a direct relationship exists between this value and crop size.

The surfaces of waste heaps must be leveled in order to enable planting, mechanization, and irrigation. The leveling is performed to 3-8 percent slopes with suitable machinery.

After leveling, an agrochemical classification is performed to establish a mapping of structures and a horizontal distribution of nutritional substances. A very suitable and efficient physiologic-vegetal classification can be obtained with corn, which is allowed to develop to 6-8 leaves. Corn is preferrable to other plants because it consumes small amounts of seed per hectare and is sensitive to the major contents of macro and microelements. By observing the growth of the corn, it is possible to define the areas which contain fertilizing elements. This type of classification complements the agrochemical classification as a result of the plant's hypersensitivity. Depending on the seeding period of corn, the plants can be allowed to develop fully, so that they can be plowed under the soil to complete the necessary organic substances in the soil.

Slopes are constructed to prevent or reduce rain and wind erosion, and to consolidate the deposited material. Terraces are built to reduce the grade of the slopes. Drainage ditches are dug on the embankments and at their base (on the terraces); the water is collected in basins which are used for fish or for recreation. The same basins receive the water from underground draining channels.

Agrochemical improvement is necessary to a lesser extent, and is strictly needed only when the surface materials are derived from acid soils. The soil conditioners are abundantly available at thermal plants in the same zone.

In road building, particular attention must be devoted to those roads which cross embankments in order to discourage erosion or slippage of deposits.

Recultivation follows the mining preparations, its purpose being to transform the uncultivated land into land suitable for crops. It consists of improving the waste material into material suitable for producing reliable and long lasting agricultural crops.

Recultivation includes the application of fertilizers, the creation and stimulation of microbial activity, the formation and development of structures, the improvement of humus content, and the establishment of a proper carbon/nitrogen ratio. Fertilizers are applied according to the data of the agrochemical classification. Fertilizer must be applied to waste materials in such a way that the addition of nutritional substances will have a positive influence on the supply available in the soil, and so that it will have a maximum effect and positive economic consequences on production.

The use of small amounts of fertilizer does not take advantage of the productivity of the waste material. The amount of fertilizer which is used must be a function of the nature of the crops, the adsorption properties of the soil, and the content of nutritional substances.

The quantities of fertilizing elements for each application are established by the Homes method, leading to a balanced fertilization.

The activity of bacterial life is closely associated with the presence of organic substances. Waste material is as a rule poor in organic substances, as a result of which secondary agricultural products (straw, cobs, stalks, and so on) are chopped and plowed under the soil.

The introduction of large amounts of manure also introduces and activates bacterial life in the soil. After the harvesting of straw grains and the plowing under of secondary products, lupine is sowed and also plowed under when 50 percent of the plants have flowered. The lupine seeds are treated with specialized nitragin.

The introduction of fields of perennial grasses, grammineous plants, and leguminous plants, has a positive effect on the formation of a good soil structure.

In areas which contain large coal residues, nitrogen fertilizers are used to reduce the carbon/nitrogen ratio.

Applied in the mining regions of Romania, and especially in those of Oltenia, this technique has led to agricultural recultivations with the following uses:

Vineyards with table and wine grapes, already in production;

Thriving and producing orchards of walnuts, apples, pears, currants, hazelnuts, cherries;

Fields of straw and harrowing grain, whose productions exceed the average for the county of the mining region;

Technical crops and potatoes of high quality and high production;

Fodder crops consisting of mixtures of grammineous and leguminous plants.

Work is currently in progress to recultivate and improve about 1500 hectares of unproductive, barren land, to be used as arable soil, field crops, pastures, and high quality forest plantations (pinus nigra, pinus silvestris, robinia pseudacacia, amorpha fruticoza, or sophora japonica).

In the future some of the steep embankments will receive high quality forest plantations, decorative trees, and pre-plantings of white box thorns and lilacs.

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