FABRIKANT, V.L.

AID P - 1027

Subject : USSR/Electricity

Card 1/2 Pub. 27 - 4/23

Authors : Fabrikant, V. L., Kand. of Tech. Sci., Dotsent, Smorodinskiy, Ya. M. and Popov, I. N., Kands. of Tech. Sci.

Title : Directional high-frequency relay protection of transmission lines

Periodical : Elektrichestvo, 11, 23-31, N 1954

Abstract : The author discusses the application of directional versus phase-angle differential high frequency relay protection, both systems using power-line carrier as a pilot channel. The aim of such protective devices is to provide restraining impulse voltage to block tripping of circuit breakers in certain faults, and causing back-feed tripping on a time-delay selective basis in specific instances. The author reports directional protection preferable to the phase-angle differential scheme. He gives a detailed description of the directional scheme in various areas of application. Five diagrams, 6 Russian references (1935-1953).

FABRIKANT, V.

AID P - 4125

Subject : USSR/Electricity

Card 1/2 Pub. 27 - 12/33

Author : Fabrikant, V. L., Kand. Tech. Sci.

Title : Protection relay without nonlinear elements.

Periodical : Elektrichestvo, 12, 53-59, D 1955

Abstract : The author investigates the problem of obtaining desired characteristics from multipole relays without nonlinear elements. He presents methods of making relay windings so as to obtain given characteristics which will correspond to an established problem. Multipole relays without nonlinear elements are compared with a relay associated with rectifiers and another associated with circuits with saturated steel. Two tables, 2 diagrams, 5 Soviet references (1944-1954).

Elektrichestvo, 12, 53-59, D 1955 AID P - 4125

Card 2/2 Pub. 27 - 12/33

Institution : Trust for the Planning and Investigation of Thermal and Electric Power Plants, Networks, and Substations.

Submitted : Ap 21, 1955

Fabrikant, V.L.

621.316.5

4464. OPTIMUM CIRCUIT FOR A DETECTOR-TYPE DIRECTIONAL IMPEDANCE RELAY. V.L. Fabrikant. Elektrichestvo, 1956, No. 7, 36-41. In Russian.

Detector-type relays having the same characteristics may yield different expressions for the torque in the complex impedance plane, differing in this ... non-linear elements. Judicious ... general expression for the torque ...

of the rise of the torque at the end ... or the average value of the torque ... value. Combination of these ... characteristics ... at impedance relays ...

FABRIKANT, V.L., Doc Tech Sci--(diss) " Problems of the theory of windings of ~~fast-acting~~ rapid-action AC relays. ~~of an alternating current.~~" Mos, 1958. 39 pp with drawings; 1 sheet of ~~charts~~ tables (Min of Higher Education. Mos Order of Lenin Power Engineering Inst), 100 copies. List of author's works: pp 38-39 (10 titles) (KL,30-58, 126)



APPROVED FOR RELEASE: Thursday, July 27, 2000 CIA-RDP86-00513R00041232(

FAPRIKANT, Veniamin L'vovich; KOZIS, V.L., red.; FRIDKIN, A.M., tekhn.red.

[Theory of alternating current relay winding] Teoriia obmotok rele peremennogo toka. Moskva, Gos. energ. izd-vo, 1958. 263 p.
(Electric relays) (MIRA 11:4)

KASABOV, G.; FABRIKANT, V.

Effect of the magnitude of an electric current on the lifetime of metastable atoms in a fluorescent lamp. Fiz.sbor. no.4:51-54 '58. (MIRA 12:5)

1. Moskovskiy ordena Lenina energeticheskiy institut.
(Electric currents) (Fluorescent lamps)

SOV/105-58-7-9/32

AUTHOR: Fabrikant, V. L., Candidate of Technical Sciences

TITLE: Utilization of Transistors in Relay Protection (Ispol'zovaniye poluprovodnikov v releynoy zashchite)

PERIODICAL: Elektrichestvo, 1958, Nr 7, pp. 41-45 (USSR)

ABSTRACT: The individual protection elements are separately investigated. Two principles are applied in the design of the collective protection devices: 1) Comparison of the absolute values of the vectors A and B of two electric quantities and 2) Their comparison according to their phase difference. The devices for obtaining A and B are simple and consist of voltage autotransformers, arc-suppression coils and intermediate current transformers. The main part of the device is the comparison circuit which can be executed in the same way for all or almost all collective protection devices. A definitive solution of the problem which of the relays given is the most suitable one, can be found only after a comparison of the best specimens of these relays. Using transistor triodes as d.c. amplifiers, two fundamentally different ways may be applied with

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respect to the lay-out of the comparison-circuit. The second proves to be the more adequate one. With this method, the transistor triode is used for the amplification of the difference, i.e. as zero indicator. It is shown that a comparison of the vectors A and B with respect to the angle, as well as with respect to the absolute value, makes it possible to obtain a resistance-relay with a characteristic in a complex plane in form of a cycle or of a straight line. - A comparison of the phase difference can be carried out by the determination of the part of the period, during which the signs of the quantities to be determined, agree. Circuits by means of which the absolute values and phases are compared make it possible to obtain any characteristic whatsoever in form of a straight line or of a circle in a complex plane, and make it possible to obtain a universal comparison device. Up till now, however, this device appears in a more simple manner in a circuit for the comparison of absolute values than for a phase comparison circuit. Not much evidence is available at present and the investigations should be continued in both directions. The possibility of obtaining simple relays on the basis of the comparison of outputs of the linear and non--linear element (both of them supplied by a common source)

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Utilization of Transistors in Relay Protection

has been examined with resepct to the lay-out of the simple devices. Tests have shown that the consumption of such a device is greater than that of the corresponding electromechanical relays. Their use would only be justified in places where this protection would simplify the total design of the circuit.

In the investigation of the logical part of the circuit, the view is taken that it is not expedient in the design of protective circuits, at any rate, to exclude all electromechanic relays and to replace them by transistors. Either intermediate relays or logical transistor circuits should be used (according to which of them gives the better solution for the circuits as a whole). There are 8 figures and 7 references, 2 of which are Soviet.

ASSOCIATION: Teploelektroproyekt

SUBMITTED: October 8, 1957

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Utilization of Transistors in Relay Protection SOV/105-58-7-9/32

1. Electric relays--Design 2. Transistors--Circuits

Card 4/4

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FABRIKANT, V.L.

E(2)

AUTHOR: Osadchenko, N. I., Engineer SOV/105-59-10-21/25

TITLE: Conference on the Results and Prospects of the Development of Soviet Relay Construction

PERIODICAL: Elektrichestvo, 1959, Nr 10, pp 86-87 (USSR)

ABSTRACT: An All-Union Scientific-technical Conference was held at Cheboksary from July 7 to 11, 1959. It dealt with the results obtained in relay construction during the last nine years. Furthermore, the prospects of the further development of relay construction, and the protection and automation of electric installations were outlined. The Conference was attended by representatives of scientific research institutes, planning institutes and colleges, special laboratories, planning organizations, of the Soyuzglavenergo (All-Union Main Power Administration) and a number of power systems. The representatives of the Cheboksarskiy elektroapparatnyy zavod (Cheboksary Plant for Electric Apparatus) M. M. Kulygin and M. B. Tsfasman reported on the achievements of the Plant in the modernization and the development of new highly sensitive and high-speed relays and protective circuits. V. L. Fabrikant, Candidate of Technical Sciences, spoke

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Conference on the Results and Prospects of the Development of Soviet Relay Construction SOV/105-59-10-21/25

"Developments in Foreign Relay Construction". Professor I. A. Syromyatnikov, Doctor of Technical Sciences, spoke about his impressions from a tour to the United States and delivered a report on "The Ways of Further Development of Soviet Power Engineering". Engineer V. M. Yermolenko spoke about "The Principles Underlying the Design of Complicated Alternating Control Circuit Protective Devices". M. I. Tsarev, Candidate of Technical Sciences, spoke about the work of the VNIIE for the development of power-supply units. Ye. D. Sapir, Candidate of Technical Sciences, delivered a speech "On the Usefulness of Developing Protective Devices With a Sensitive Electromechanical Element". Engineer Yu. A. Gayevenko: "Prospects of the Development of Relay Protection With Semiconductors". Engineer V. I. Grinshteyn reported on the development of the resistor- and power relays with semiconductors. Professor A. D. Drozdov, Doctor of Technical Sciences, spoke about the prospects of further employment of saturated steels in relay construction. The manufacture of large oil- and air circuit breakers by the plants "Elektroapparat" and "Uralelektroapparat" was sharply criticized. The Conference pointed out that automatic frequency- and power controllers,

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Conference on the Results and Prospects of the Development of Soviet Relay Construction SOV/105-59-10-21/25

grouped installations for excitation and power control, modern automatic synchronizers, and automatic regulators for the batteries of static condensers which are indispensable in the full automation of electric installations have not yet been provided for in the Soviet manufacturing program.

Card 3/3

[illegible], Valentin L., FEDOSOYEV, A. M., IVANOV, V. I., MIKUTSKIY, G. V., SAPIR, Ye. D.

"Relay protection with semi-conductor devices"

report to be submitted for Intl. Conference on Large Electric Systems (CIGRE), 18th Biennial Session, Paris, France, 15-25 Jun 60.

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S/104/60/000/007/002/002
E194/E455

AUTHORS: Ivanov, V.I., Doctor of Technical Sciences,
Mikutskiy, G.V., Candidate of Technical Sciences,
Sapir, Ye.D., Candidate of Technical Sciences,
Fabrikant, V.L., Doctor of Technical Sciences and
Fedoseyev, A.M., Doctor of Technical Sciences

TITLE: Relay Protective Equipment Based on Transistor Instruments

PERIODICAL: Elektricheskiye Stantsii, 1960, No.7, pp.59-64

TEXT: By the use of semiconductor diodes and triodes and also magnetic components, measuring devices and logical parts of protective circuits may be constructed without contacts. Devices responding to the ratio of two electrical magnitudes are often required. They can be made of semiconductor rectifiers or may be based on the principle of comparing the absolute or the phase values of electrical magnitudes. Absolute values may be compared by rectifying and smoothing them and then, using a relay of high sensitivity, to detect the difference between them. With transistors, it has been possible to develop circuit elements with d.c. rectifiers that react to differences between the magnitudes



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compared, and operate other parts of the circuit. The Hall and magneto-restrictive effects may also be used to compare the phase of two electrical magnitudes. High-speed relays may, however, react to the alternating double-frequency component of the Hall emf. It is accordingly necessary to eliminate this component, by the use of filters or special compensating circuits. Two circuits were constructed around two identical Hall emitters, the alternating components of Hall emf being cancelled and the constant components summated. In the second method, the crystal rectifier of one pick-up passes current induced in an additional winding by the flux of the second pick-up. The flux is set up by one of the electrical magnitudes to be compared. Conversely, the current of the second pick-up induces a flux in the first set up by the second electrical magnitude. An expression is given for the resultant emf. In this way, the relay may be made to operate reliably under various circuit conditions. Relays may also make use of the dependence of the resistance of semiconductor elements on the intensity of the magnetic field in which they are located. This



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effect is particularly marked if the semiconductor elements are in the shape of discs. The principles underlying a relay of this type are briefly explained and a schematic circuit diagram of a voltage relay is shown in Fig.4. Multi-phase resistance relays have been proposed for remote control. Such a relay reacts to all kinds of multi-phase short-circuits, or at any rate to most of with without opening or closing contacts. Contactless relay systems have been built up in this way. The time-delay elements are usually of the capacitor charging type. Phase differential high-frequency protective relays are then described. Two methods of protection have been devised that differ in the method of making the phase comparison of currents at the ends of the protected line. One of these methods, due to Candidate of Technical Sciences O.V.Mamontov (see Elektricheskiye Stantsii, 1958, No.5), uses the impulse method of comparing the current phases and was installed in 1958 in experimental service on a 220 kV line. In the other system, the current phases at the ends of the protective lines are compared by means of an integrating circuit, shown as a block

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with a band-width of 1900 c/s, a high-frequency amplifier and detector and a d.c. amplifier. From the output of this amplifier the d.c. impulse is applied to the phase comparator circuit. The overload protection of the triodes of the output cascades of the transmitter is described. In 1958, a prototype of the transmitter-receiver based on transistors was put into service with a differential phase protection scheme type ДФЗ 2 (DFZ-2) on a 110 kV line of 60 km. The operating frequency of the protective channel was 210 kc/s and in 11 months service the performance was fully satisfactory. A method of differential protection with delay has been developed which differs from other systems in that the currents are rectified by a method that ensures selectivity and speed of operation. The reacting element of the protective system is a d.c. relay connected to the output of the comparator circuit, either directly or through a d.c. amplifier based on semiconductors. A common reacting element can be used for all three phases. Fig.10 gives a block circuit diagram of a protective circuit; the method of operation is briefly described. There are 11 figures and 3 Soviet references.

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Relay Protective Equipment Based on Transistor Instruments

much less than 50 milliseconds. In this case the second part of the circuit is used. It contains a grid control element which also responds to instantaneous measurement of the sign of the power acting on the output relay of the protective circuit. In the event of asymmetrical damage to the protected line, the power-directional elements on both ends of the line operate the output protective relay. A receiving-transmitting high-frequency protective system is then described. It is intended for operating with a phase differential protective system. A block circuit diagram is given in Fig.8. The emitter generator is based on a triode and has a quartz frequency-stabiliser. The operating principles are explained, briefly, if there is no manipulation voltage applied to the control cascade it is open and the transmitter operates. If power-frequency voltage appears on the output of the manipulation elements this becomes blocked and the transmitter is stopped. The power of the high-frequency signal beyond the line filter is 6.5 W in the frequency range of 30 to 250 kc/s. The receiver contains an input high-frequency filter

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diagram in Fig.6. The operation of this circuit is explained. A directional high-frequency protective circuit is described with a block circuit diagram in Fig.7. It was developed by Candidate of Technical Sciences Ya.M.Smorodinskiy and Engineers O.D.Velichkin, Ye.V.Lysenko and V.P.Kletskiy and uses semiconductor diodes and triodes. If the line is not provided with lightning arresters, so that use can be made of protective systems with an operating time of less than 25 milliseconds, then only the main high-speed part of the circuit is used. The operating principle of the circuit depends on rapid sensing of the direction of negative phase-sequence power at the ends of the protected line and comparison of these directions by means of a high-frequency channel. For this purpose, the protective system uses high-speed double-acting power-directional elements based on semiconductors. Because of the characteristics of lightning arresters, when they are used the line protection must be delayed by 50 milliseconds. Therefore, it cannot be entirely based on instantaneous response to the sign of the negative phase-sequence power as the asymmetry time may be

FABRIKANT, V.L., prof., doktor tekhn.nauk (Moskva)

Analysis of longitudinal differential protection of electric lines using a method involving diagrams in a complex plane. Elektrichestvo no. 12:40-47 D '60. (MIRA 14:1)
(Electric lines ) (Electric protection)

FABRIKANT, Veniamin L'vovich; OVCHARENKO, N.I., red.; BUL'DYAYEV, N.A., tekhn. red.

[Filters with symmetrical components]Fil'try simmetrichnykh sostavliaiushchikh. 2. izd., perer. Moskva, Gosenergoizdat, 1962. 423 p. (MIRA 15:10)
(Electric filters) (Radio filters)

FABRIKANT, V.L. [Fabrikants, V.] (Riga); PUTNYN'SH, V.Ya. [Putnins, V.] (Riga)

A new phase comparison method for building relays with two electrical quantities. Elektrichestvo no.10:75-79 O '62. (MIRA 15:12)

(Electric relays)

FABRIKANT, V.L., doktor tekhn. nauk, prof. (Riga); GRESHNEV, L.A. inzh. (Riga).

Principles of the design of longitudinal differential protection systems for tapped lines. Elektrichestvo no.6:37-43 Je '64 (MIRA 17:7)

FABRIKANT, V.L., doktor tekhn.nauk, prof. (Riga)

Use of the reliability theory in the evaluation of relay protection systems. Elektrichestvo no.9:36-40 S '65. (MIRA 18:10)

ATABEKOV, G.I.; BELOUSOV, M.M.; BULGAKOV, K.V.; VASIL'YEV, D.V.; YEGIZAROV, I.V.; ZAKHAROV, S.N.; ZEYLIDZON, Ye.D.; KOSTENKO, M.P.; MANOYLOV, V.Ye.; MARNEVSKIY, B.I.; RYZHOV, P.I.; SOLOV'YEV, I.I.; SYROMYATNIKOV, I.A.; FABRIKANT, V.L.; CHERNIN, A.B.; CHERNOBROVOV, N.V.; FEDOSEYEV, A.M.; SHABADASH, B.I.; SHCHEDRIN, N.N.; FATEYEV, A.V.

Viktor Ivanovich Ivanov, 1900-1964; an obituary. Elektrichestvo no.11:89 N '64. (MIRA 18:2)

FABRIKANT, Ye.A.

BESEKERS'KIY, V.A.; FABRIKANT, Ye.A. (Leningrad).

Evaluating the errors in passive differentiating and integrating electric circuits depending on the supposed character of the process to be investigated [with summary in English]. Avtomatyka no.4:52-66 '57. (MIRA 11:1)

(Electronic circuits)

FABRIKANT, Ye.A., kand. tekhn. nauk.

General rules for selecting derived circuit contours in writing down equations by the application of Kirchhoff's second law. Trudy LVMI no.6:306-307 '57. (MIRA 11:5)
(Electric circuits)

L 21976-66 EWP(k)/EWT(d)/EWP(h)/EWP(v)/EWP(1)

ACC NR: AP6007868 SOURCE CODE: UR/0103/66/000/002/0117/0122

AUTHOR: Ovanes'yants, G. A. (Leningrad); Fabrikant, Ye. A. (Leningrad); Yanushevskiy, O. I. (Leningrad)

ORG: none

48
B
14

TITLE: Automatic system damping using inertia damper motors

SOURCE: Avtomatika i telemekhanika, no. 2, 1966, 117-122

TOPIC TAGS: automatic control equipment, automatic control system, damping moment

ABSTRACT: This article proposes a procedure for the selection of the parameters of an inertia magnet damper motor from the viewpoint of its most efficient employment in automatic systems. The inertia damper motor can assure efficient damping of an automatic system with different values of its transmission coefficient even when the moment of inertia and the coefficient of the high-speed magnetic disk damping are constant. If, however, a motor of the same type is used as an all-purpose damper at a very high drop in the system transmission coefficient, this may be achieved by adjusting the magnetic damping coefficient within a small range. These recommendations are valid for cases when the moment of inertia of the controlled plant is smaller or close to the moment of inertia of the motor

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rotor. It is shown in the analysis that inertia damper motors are promising for high-efficiency, low-power automatic systems, in which a-c amplifiers are used without the conversion of the modulating signal into alternating current. Orig. art. has: 5 figures and 28 formulas.

SUB CODE: 13 / SUBM DATE: 05May65 / ORIG REF: 004 / OTH REF: 003

Card 2/2 nst

BESEKERSKII, Viktor Antonovich; PAL'TOV, Ivan Petrovich; FABRIKANT, Yevgeniy Anatol'yevich; FEDOROV, Stepan Mikhaylovich; CHINAYEV, Petr Ivanovich; SOBOLEV, O.K., red.; MURASHOVA, N.Ya., tekhn. red.

[Collection of problems on the theory of automatic control] Sbornik zadach po teorii avtomaticheskogo regulirovaniia. [By] V.A.Besekerskii i dr. Moskva, Fizmatgiz, 1963. 408 p. (MIRA 16:12)

(Automatic control)

BLAZHKIN, A.T., doktor tekhn. nauk. prof.; BESEKERSKIY, V.A., doktor tekhn. nauk, prof.; AZIMOVA, K.F., kand. tekhn. nauk, dots.; LANSKOV, V.D., kand. tekhn. nauk, dots.; FABRIKANT, Ya.A., kand. tekhn. nauk, dots.; GUL'DIN, Yu.V., inzh. MEYERSON, I.G., dots.. kand. tekhn. nauk, dots., retsenzent. FROLOV, B.K., red.

[General electrical engineering] Obshchaia elektrotekhnika. Moskva, Energiia, 1964. 655 p. (MIRA 17:12)

1. Prepodavatel' Leningradskogo mekhanicheskogo instituta (for Blazhkin, Besekerskiy, Azimova, Lanskov, Fabrikant, Gul'din).

FABRIKANT YE. M.

AUTHORS: Smelyanskaya, B. Ya., Engineer, Fabrikant, Ye. M, Engineer 105-58-4-24/37

TITLE: Conference for the Checking of the Proposed Directives for Relay Protection (Soveshchaniye po rassmotreniyu proyekta rukovodyashchikh ukazaniy po releynoy zashchite)

PERIODICAL: Elektrichestvo, 1958, Nr 4, pp. 83-84 (USSR)

ABSTRACT: In December 1957 in Moscow a conference took place for the evaluation of the proposed directions for relay protection of station and substation elements. The project had been worked out by the "Teploelektroproyekt" Institute. The conference was called by the Department for Relay Protection at the Commission for Long Distance Transmission of the ENIN imeni Krzhizhanovskiy of the AS USSR and by the MONTOEP (Moscow Branch of the All-Union Scientific Technical Society of Power Engineering Industry). Representatives of the power engineering systems, of scientific research and training institutes, of projecting organizations and many others took part in it. Professor A. M. Fedoseyev, Doctor of Technical Sciences, said in his in-

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troductory words that in the course of the last ten years no directions had been published. Lectures were held by: the representatives of the "Teploelektroproyekt" Institute, A. B. Chernin, Candidate of Technical Sciences, B. Ya. Smelyanskaya, Engineer, and S. Ya. Petrov, Engineer. Supplementary lectures were held and discussions were joined by: Ye. D. Zeylidzon (Technical Department at the Ministry for Electric Power Stations of the USSR), V. N. Blinova (ODU Ural), V. D. Kuz'minykh (Sverdlovenergo), O. L. Rivkin (Lenenergo), N. V. Vinogradov (Mosenergo), V. I. Dorofeyev (Dneptroenergo), F. F. Deryugin (Chelyabenergo), B. B. Slobodnik (Permenergo), V. S. Makagon (Donbassenergo), L. N. Voronov (Gorenergo), P. A. Fomin (Lengidep), I. M. Sirota (Institute for Electrical Engineering of the AS Ukrainian SSR), I. N. Popov (ENIN AN USSR), V. A. Smirnov (MKS Mosenergo), A. B. Barzam (ODU Tsentra), V. M. Yermolenko (TEP), M. I. Tsarev (TsNIEL), V. A. Satarov (Mosenergoproyekt), A. M. Averbukh (Lenenergoproyekt), V. M. Shurin (Odessenergo) and others. P. I.

Conference for the Checking of the Proposed Directives 105-58-4-24/37
for Relay Protection

Ustinov discussed a number of problems in connection with the organization of the publication of these directions and showed problems in the field of relay protection. I. A. Syromyatnikov evaluated the general state of relay protection in the USSR.

AVAILABLE: Library of Congress

1. Relay protection-Directives-Conference

Card 3/3

ZHELTVAI, V. V., KATASONOV, N. S. and FABRIKANT, Yu. V. (The Trans-Carpathian Oblast' Veterinary Bacteriological Laboratory, Ukrainian SSR). (Abstracted by V. A. ALIKAYEV)

"Improving the technique of determining carotene in blood sera.".. Veterinariya, vol. 39, no. 2, February 1962 pp. 78

FABRIKANTOV, G.A.; SHIRONIN, L.I.

Use of gamma globulin in preventing epidemic hepatitis. Med. zhur. Uzb. no. 2:22-23 F '61. (MIRA 14:2)
(HEPATITIS, INFECTIOUS) (GAMMA GLOBULIN)

FABRIKANTOV, G.A.

Latent forms of Q fever. Med. zhur. Uzb. no.3:25-28 Mr '61. (MIRA 14:5)

(Q FEVER)

SHIFRIN, I.A.; FABRIKANTOV, G.A.; LAVRINENKO, S.P.

Spreading of leptospirosis infection (Pomona type) through reservoir water. Med. zhur. Uzb. no.2:43-45 F '62. (MIRA 15:4)
(LEPTOSPIROSIS) (WATER—POLLUTION)

FABRIKANTOV, G.A. (Tashkent)

Early detection of epidemic hepatitis (Botkin's disease). Zdrav. Turk. 6 no.4:21-24 Jl-Ag '62. (MIRA 15:8)

(HEPATITIS, INFECTIOUS)

FABRIKANTOV, G.N., inzh.

Mechanization of the treatment of freshly laid concrete pavement.
Avt.dor. 26 no.12:19-20 D '63. (MIRA 17:4)

FABRIKANTOV, G.N.; PLOTNIKOVA, I.A.

Most important characteristics of bitumen emulsions.
Avt.dor. 28 no.10:26-28 O '65.

(MIRA 18:11)

FABRIKOV, A.I., inzh.

Use of narrow trenches in drainage. Gidr. i mel. 12 no.8:27-30 Ag '60. (MIRA 13:8)

1. Yuzhnyy nauchno-issledovatel'skiy institut gidrotekhniki i melioratsii.
(Excavating machinery) (Drainage)

FABRIKOV, A. I.

Cand Tech Sci - (diss) "Mechanisms for excavation of narrow trenches and prospects for their use in hydro-reclamation." Novocherkassk, 1960. 15 pp; 1 separate page of diagrams; (Ministry of Agriculture RSFSR, Novocherkassk Land Reclamation Engineering Inst "NIMI"); 150 copies; price not given; (KL, 5-61 sup, 194)

PODDUBNYY, I.; YANIKOV, I.; FABRIKOV, G., zhivotnovod; TARASYUK, A.; TSAPLIN, V.; BAKLITSKAYA, Ye., zven'yevaya; GRIDINA, A., doyarka; KRAVTSOVA, Z., telyatnitsa; KOMYAGINA, R., svinarka; SAVEL'YEV, I., chaban; SLADKOMEDOVA, N., ptichnitsa; RUD, M., mekhanizator; GOGIN, S., mekhanizator.

Our collective farm in seven years. Nauka i pered.op.v sel'khoz. 9 no.1:5-9 Ja '59. (MIRA 13:3)

1. Kolkhoz "Ukraina," Kirovskogo rayona Krymskoy oblasti. 2. Predsedatel' kolkhoza "Ukraina" Kirovskogo rayona Krymskoy oblasti (for Poddubnyy). 3. Glavnyy agronom kolkhoza "Ukraina" Kirovskogo rayona Krymskoy oblasti (for Yanikov). 4. Glavnyy mekhanik kolkhoza "Ukraina" Kirovskogo rayona Krymskoy oblasti (for Tarasyuk). 5. Sekretar' partorganizatsii kolkhoza "Ukraina" Kirovskogo rayona Krymskoy oblasti (for TSaplin).
(Kirovskoye District--Agriculture)

FABRIKOV, V.I.

Asymmetric phase voltage overload protection in the performance of electric power engines. Tekst.prom. 15 no.12:47-48 D '55. (MLRA 9:3)

1. Student IV kursa Ivanovskogo tekstil'nogo instituta.
(Electric machinery)

Fabrikov, V.A.

2

538.221 : 621.318.134 : 538.6 493

**Peculiarities of the Faraday Effect in Paraffin-Ferrite Mixtures.**—V. A. Fabrikov. (*C. R. Acad. Sci. U.R.S.S.*, 11th Aug. 1955, Vol. 103, No. 5, pp. 807–809. In Russian.) The Faraday effect was investigated at frequencies between 2·2 and 3 kMc/s at magnetic field strengths up to 1 500 oersted, using disks of paraffin-ferrite mixture with a typical composition 70% paraffin, 16% Ni-Zn ferrite and 14% rutile, added to increase the dielectric constant. The rotation of the plane of polarization was in a sense opposite to that observed in ferrite disks. The rotation was found to depend on the dimensions of the disks, the field strength, the frequency and the concentration of the ferrites in the mixture. The results are discussed on the basis of theories of the permeability tensor of ferromagnetics.

Moscow Power Eng. Inst. im. Molotov

FABRIKOV, V. A., MICHKAYLOVSKIY, L. K., KOLLEY, Y. N., and POLIVANOV, K. M., (Moscow)

"Magnetodielectrics in Waveguides," a paper submitted at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, 23-31 May 156.

session on Paramagnetic and Ferromagnetic Resonance

FABRIKOV, V. A.

AUTHOR: Fabrikov, V.A.

TITLE: Some Problems in the Theory of Gyrotropic Media (Nekotoryye voprosy teorii girotrophykh sred)

PERIODICAL: Izvestiya Akademii Nauk, Vol. XX, #11, pp 1318-1328 1956, USSR, Seriya fizicheskaya

ABSTRACT: A general case of gyrotropic linear electrodynamic medium is phenomenologically considered and generalized Maxwell equations for a gyrotropic medium are composed and solved in the article.

The Faraday effect was investigated in paraffin -ferrite mixtures at a wavelength of 10 to 14 cm. It showed that internal anistropic fields have considerable effects on gyromagnetic properties of magnetized ferrites, and the intensity of these fields depends on the mechanical state of the materials.

Samples made of mixtures of paraffin with powdered Ni-Zn ferrite, natural ferrite (magnetite) and metal ferromagnetic "Alsifer", show the anomalous

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TITLE: Some Problems in the Theory of Gyrotropic Media (Nekotoryye voprosy teorii girotrophykh sred)

rotation of a polarization plane in the opposite sense to that of massive ferrite rings.

This change of the Faraday rotation sign can apparently be explained in the following way: the intensity of the effective anisotropic field of a magnetic material increases with the decrease of dimensions of individual particles and their connection between each other. The bibliography contains 14 references, of which 5 are Slavic (Russian). Two appendices are added at the end of the article.

INSTITUTION: Power Engineering Institute imeni V.M. Molotov in Moskva

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SUBMITTED: No date

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Card 2/2

FABRIKOV, V.A.

AUTHORS: Fabrikov, V.A. and Kolli, Ya.N

TITLE: Approximate Computation Methods of Gyromagnetic Media (Priblizhennyye metody rascheta giromagnitnykh sred)

PERIODCIAL: Izvestiya Akademii Nauk, Vol. XX, #11, pp 1329-1335 1956, USSR, Seriya fizicheskaya

ABSTRACT: The possibility of engineering computations in some cases of gyromagnetic media application is shown. The problem is considered about a gyromagnetic ring of finite thickness, which fills the cross section of a round wave guide with an arbitrary load at the end.

Solution of the problem is possible in one of the two approximations: the approximation of plane waves and the approximation in which the medium is assumed to be weakly gyromagnetic.

Formulae are derived for the coefficient of reflection and the coefficient of polarization, and these coefficients are connected with electromagnetic para-

TITLE: Approximate Computation Methods of Gyromagnetic Media (Priblizhennyye metody rascheta giromagnitnykh sred)

meters of the substance.

Computation formulae obtained for the weakly gyromagnetic media in a round wave guide were used, and confirmed in an investigation of the Faraday effect in paraffin-ferrite mixtures. The bibliography lists 11 references, of which 6 are Slavic (Russian). The article is supplemented with 2 appendixes.

INSTITUTION: Power Engineering Institute imeni V.M. Molotov in Moskva

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Card 2/2

Fabrikov, V.A.

109-10-12/19

AUTHORS: Fabrikov, V.A., Kudryavtsev, V.D., and Gushchina, Z.M.

TITLE: Nickel-Copper Ferrites having a Narrow Absorption Line at Ultra-high Frequencies (Nikel'-Mednye ferrity s uzkoy rezonansnoy krivoy pogloshcheniya na sverkhvysokikh chastotakh)

PERIODICAL: Radiotekhnika i Elektronika, 1957, Vol.II, No.10, pp. 1299 - 1300 (USSR)

ABSTRACT: Some nickel-copper ferrites were produced which, when operated at frequencies of the order of $10^{10}$ c.p.s., gave an attenuation ratio of 125 for the two opposite directions of the magnetising field. Thus, it was found that over a band-width of ± 3%, the direct losses in a rectangular waveguide were 0.5 db, while the reverse losses were more than 20 db. The authors thank Corresponding Member of the Ac.Sc.USSR A.A. Pistol'kors for his constant attention.
There are 1 photograph and 2 **references**.

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(axis z). If the transverse components of the alternating field in Eq.(1) are as expressed by Eq.(2), and $m_z = M_z - M_o$; Eq.(1) can be split into Eqs.(7a) and (7b), in which various parameters are defined by Eqs.(3), (5), (6) and (8) and $\omega_o = \mu_o|\gamma|H_o$. Eqs.(7) are transformed into:

$$\frac{d^3 m_z}{dt^3} + A\frac{d^2 m_z}{dt^2} + B\frac{dm_z}{dt} + Cm_z = F \qquad (10)$$

where the parameters A, B, C and F are defined by Eqs.(11). Eqs.(7) and (10) describe the oscillations of the gyro-magnetic medium which are produced by a modulating field $h_2$ in the presence of a transverse field having a circular polarisation. If it is assumed that the variable quantities $h_z$ and $m_z - m_o$ are comparatively small, it is possible to neglect their products in Eq.(10). Consequently, the equation can be expressed by Eq.(12), in which the necessary parameters are defined by Eq.(13). The solution of Eq.(12) is given by Eq.(14), where

$h_{20}$ is the amplitude of the modulating field, $\Omega$ is the modulating frequency and $\chi$ is expressed by Eq.(15). Under the resonant conditions, $\Omega = \alpha$. The imaginary part of $\chi$ is expressed by Eq.(19), which is positive when it fulfils the condition given by Eq.(19a). This phenomenon indicates the possibility of amplifying the small modulating signals by the gyro-magnetic medium; the highest amplification is obtained when $\Omega = \alpha$; the maximum value of the imaginary component of $\chi$ is expressed by Eq.(20), which is obtained when $\Omega = \alpha$ and when the conditions given by Eq.(21) are fulfilled. If Eq.(14) is substituted into Eq.(7a), an expression for the complex amplitude of the transverse oscillations is obtained. This is in the form of:

$$n = \chi_1 h_1 = (\chi_{11} + \chi_{12}\omega_{20} e^{i\Omega t}) h_1 \qquad (22),$$

where the parameters $\chi_{11}$ and $\chi_{12}$ are defined by Eq.(23).

The author thanks Professor A.L. Mikaelyan for his constant attention and valuable advice.

109-3-2-5/26

The Possibility of Amplifying the Power of a Small Modulating Signal by Means of a Gyromagnetic Medium

There are 1 figure, and 8 references, 5 of which are English, 2 Russian and 1 French. There is also an appendix in which it is shown that the results obtained by the author are similar to those obtained by the method devised by Pierre Mari (Ref.5).

SUBMITTED: February 12, 1957

AVAILABLE: Library of Congress

Card 4/4 1. Ultra high frequency amplifiers-Mathematical analysis

SOV/109- - -4-3-28/38

AUTHORS: Fabrikov, V.A., Gushchina, Z.M., and Vasil'yev, V.N.

TITLE: Magnesium Ferrite-Chromites for the Application at the Lower Region of the Ultrahigh-Frequency Band (Magniyevyye Ferrito-khromity dlya primeneniya v nizhnem diapazone sverkhvysokikh chastot)

PERIODICAL: Radiotekhnika i Elektronika, Vol 4, Nr 3, 1959, pp 536-537 (USSR)

ABSTRACT: Ferrite-chromites of the type $MgCr_{0,64}Fe_{1,36}O_4$, baked at a temperature of 1350°C or 1300°C are of considerable interest for microwave applications. These ferrite-chromites are characterised by magnetic saturation of 600G and a Curie temperature of 160°C, while their resistivity at dc is $10^8$ ohm.cm. The parameters of the second type of the material (baked at 1300°C) are illustrated in Figs 1, 2 and 3. Fig 1 shows the dependence of the non-reciprocal phase shift and the losses on the magnitude of the magnetising field at a wavelength of 10 cm; the material was employed as a valve device and a waveguide. The dependence of the tensorial parameters of the material on the magnetising field at a wavelength

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SOV/109- - -4-3-28/38

Magnesium Ferrite-Chromites for the Application at the Lower Region of the Ultrahigh-Frequency Band

of 14 cm are illustrated in Fig 3. The authors make acknowledgement to Yu.N. Afanas'yev and A.A. Manuylova for collaboration in carrying out the measurements. There are 3 figures and 4 references, one of which is English and 3 Soviet.

SUBMITTED: January 4, 1958

Card 2/2

AUTHOR: Fabrikov, V.A. SOV/109-4-7-18/25

TITLE: A Ferrite Amplifier for the High-frequency Electromagnetic Signals

PERIODICAL: Radiotekhnika i elektronika, 1959, Vol 4, Nr 7, pp 1203 - 1204 (USSR)

ABSTRACT: In an earlier work (Ref 1), the author investigated the possibility of amplifying small modulated signals by means of a gyromagnetic medium. It was shown that the complex susceptibility $\chi$ of the medium with respect to the modulating field is given by:

$$\chi = \frac{\omega_1^2 \omega_M \left(1 - \frac{2\Delta\omega}{\alpha^2}\right) + i\Omega T \left(1 - \frac{\Delta\omega}{\alpha^2}\right)}{\omega_o \left(i\Omega + \frac{1}{T}\right) \left[(\alpha^2 - \Omega^2)T + 2i\Omega\right]} \qquad (2)$$

where $\Delta = \omega - \omega_o$, $\omega_1 = \gamma h_1$, $\alpha^2 = \Delta^2 + \omega_1^2 + 1/T^2$,



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SOV/109-4-7-18/25

A Ferrite Amplifier for the High-frequency Electromagnetic Signals

$\omega_M = \gamma M_o$ , $\gamma$ is the absolute magnitude of the gyromagnetic ratio (equal to $1.8 \times 10^7$ sec/Oe), T is the relaxation time determined by the width $\Delta H$ of the resonance line ($1/T = \gamma \Delta H/2$) and $M_o$ is the saturation magnetisation of the material. When the conditions defined by Eqs (3) are fulfilled, the imaginary part of $\chi$ is positive, which means that the medium is characterised by negative losses with regard to the modulating signal. Eq (2) can be written as Eq (4), provided the conditions defined by Eq (5) are fulfilled. If the modulating field $h_z = h_2 \cos \Omega t$ is produced by a circuit having a qualitative factor Q whose coil is wound on a ferrite sample subjected to the interaction of a constant field $H_o$ and a transverse high-frequency field $h_1$ (see the figure on p 1203), the amplification of the signal applied

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SOV/109-4-7-18/25

A Ferrite Amplifier for the High-frequency Electromagnetic Signals

to the input of the circuit is proportional to N, which is given by Eq (7), where $\chi''$ is defined by Eq (6). On the basis of the above formula, it was found that by means of a monocrystalline ferrite sample it was possible to obtain amplification of about 10 db when the power of the high-frequency supply signal was of the order of 20 W. When using special yttrium ferrites, whose relaxation time was of the order of $1.10^{-7}$ sec, the same amplification could be obtained with a smaller supply power.
There are 1 figure and 2 Soviet references.

SUBMITTED: January 23, 1959

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24(3)

AUTHORS: Fabrikov, V. A., Kudryavtsev, V. D., Gushchina, Z. M.

SOV/48-23-3-17/34

TITLE: Ferrites With Intense Saturation Magnetization and a Narrow Resonance Absorption Curve at Superhigh Frequencies (Ferrity s bol'shoy namagnichennost'yu nasyshcheniya i uzkoy rezonansnoy krivoy pogloshcheniya na sverkhvysokikh chastotakh)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 3, pp 372-376 (USSR)

ABSTRACT: In the present paper the authors investigated Ni-Cu-ferrites with admixtures of cobalt and small quantities of manganese, which had been added in order to attain a higher electric resistance of the material in direct current (Ref 12). Saturation magnetization, density, electric resistance in direct current, width of the resonance absorption curve on the frequency of 9,350 megacycles, working characteristics of ferrites in a valve device of the resonance type in the same range of frequency, as well as the microstructure of the material were measured. The results obtained in connection with the investigation of the ferromagnetic resonance of spherical samples in the rectangular resonator

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Ferrites With Intense Saturation Magnetization and a Narrow Resonance Absorption Curve at Superhigh Frequencies SOV/48-23-3-17/34

are given in figure 1. The width of the resonance curve depends to a considerable extent on the copper content. Figure 2 shows by means of an experimentally found curve the effect of Co admixtures exercised upon the width of the resonance curve of Ni-Cu-ferrites. The dependence on the temperature of sintering is given in figure 3. Compositions with an especially narrow line of resonance are characterized in a waveguide valve by relations of the wave extinction device (in decibels) which correspond to two opposite directions of propagation (Ref 7). All Ni-Cu-ferrites can be divided into two groups with respect to microstructure. In the case of a substitution of less than 14 % nickel by copper the ferrites usually have fine-grained structure with an average size of grains amounting to 10 μ. If the substitution amounts to more than 14 %, the average size of grains varies between 45 and 55 μ. Figures 4 and 5 show photographs of typical structures of both types as well as experimentally found curves. The authors thank A. A. Pistol'kors for the interest he displayed. There are 5 figures and 16 references, 2 of which are Soviet.

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24(3)

AUTHORS: Fabrikov, V. A., Ritter, Ye. G. SOV/48-23-3-19/34

TITLE: Non-linear Gyromagnetic Properties of Ferrites on Low Levels of Superhigh Frequency Capacity (Nelineynyye giromagnitnyye svoystva ferritov na nizkikh urovnyakh sverkhvysokochastotnoy moshchnosti)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1959, Vol 23, Nr 3, pp 380-387 (USSR)

ABSTRACT: The present paper investigates the problem of the shift of oscillations with different frequency in the gyromagnetic medium and gives some experimental data of the non-linear properties of ferrites on low levels of superhigh frequency capacity. The equation of motion of the gyromagnetic moment in the constant magnetic field $H_0\overline{k}$ and in the alternating field of spontaneous polarization $\overline{h} = \overline{h}_{10}e^{i\omega_1 t} + \overline{h}_{20}e^{i\omega_2 t}$ was solved in this case in second approximation according to small variables (see enclosure). The possibility of isolating two adjacent frequencies by the envelope of combined signal was experimentally investigated by means of a device, the schematic drawing of which shows figure 1. Measurements were made

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Non-linear Gyromagnetic Properties of Ferrites on Low Levels of Superhigh Frequency Capacity SOV/48-23-3-19/34

at a wave length of 3 cm on polycrystalline Ni-Zn-ferrite with a saturation magnetization of $M_o = 256,000$ A $m^{-1}$. The half-width of the resonance curve of the material amounted to 24,000 A $m^{-1}$, which corresponds to a duration of transverse relaxation of $T = 1.9 \cdot 10^{-10}$ sec. In the magnetization of the ferrite nucleus during the detuning of the frequencies of two klystrons for 30 megacycles an envelope of modulated oscillations appeared on the screen of the oscilloscope. The optimum values of the magnetizing field, which were similar to the resonance values ($H_o \sim 24,000$ A $m^{-1}$), were experimentally chosen. The signal was visible on the screen of the oscilloscope at various functions of the capacities $P_1$ and $P_2$ possible under experimental conditions. They corresponded to the inequality $(P_1P_2)_{exp} \geq 5 \cdot 10^{-8} W^2$, the amount of the signal being proportional to the capacity of two sources $P_1$ and $P_2$

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Non-linear Gyromagnetic Properties of Ferrites on Low Levels of Superhigh Frequency Capacity SOV/48-23-3-19/34

(Fig 2). The authors thank A. L. Mikaelyan for his assistance. There are 2 figures and 10 references, 2 of which are Soviet.

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FABRIKOV, V.A.

PHASE I BOOK EXPLOITATION SOV/4893

Vsesoyuznoye soveshchaniye po fizike, fiziko-khimicheskim svoystvam ferritov i fizicheskim osnovam ikh primeneniya. 3d, Minsk, 1959

Ferrity; fizicheskiye i fiziko-khimicheskiye svoystva. Doklady (Ferrites; Physical and Physicochemical Properties. Reports) Minsk, Izd-vo AN BSSR, 1960. 655 p. Errata slip inserted. 4,000 copies printed.

Sponsoring Agencies: Nauchnyy sovet po magnetizmu AN SSSR. Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR.

Editorial Board: Resp. Ed.: N. N. Sirota, Academician of the Academy of Sciences BSSR; K. P. Belov, Professor; Ye. I. Kondorskiy, Professor; K. M. Polivanov, Professor; R. V. Telesnin, Professor; G. A. Smolenskiy, Professor; N. N. Shol'ts, Candidate of Physical and Mathematical Sciences; E. M. Smolyarenko; and L. A. Bashkirov; Ed. of Publishing House: S. Kholyavskiy; Tech. Ed.: I. Volokhanovich.

PURPOSE: This book is intended for physicists, physical chemists, radio electronics engineers, and technical personnel engaged in the production and use of ferromagnetic materials. It may also be used by students in advanced courses in radio electronics, physics, and physical chemistry.

COVERAGE: The book contains reports presented at the Third All-Union Conference on Ferrites held in Minsk, Belorussian SSR. The reports deal with magnetic transformations, electrical and galvanomagnetic properties of ferrites, studies of the growth of ferrite single crystals, problems in the chemical and physicochemical analysis of ferrites, studies of ferrites having rectangular hysteresis loops and multicomponent ferrite systems exhibiting spontaneous rectangularity, problems in magnetic attraction, highly coercive ferrites, magnetic spectroscopy, ferromagnetic resonance, magneto-optics, physical principles of using ferrite components in electrical circuits, anisotropy of electrical and magnetic properties, etc. The Committee on Magnetism, AS USSR (S. V. Vonsovskiy, Chairman) organized the conference. References accompany individual articles.

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FABRIKOV, V. A.

PHASE I BOOK EXPLOITATION SOV/4893

Vsesoyuznoye soveshchaniye po fizike, fiziko-khimicheskim svoystvam ferritov i fizicheskim osnovam ikh primeneniya. 3d, Minsk, 1959

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PHASE I BOOK EXPLOITATION SOV/4893

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FABRIKOV, V. A.

PHASE I BOOK EXPLOITATION SOV/4893

Vsesoyuznoye soveshchaniye po fizike, fiziko-khimicheskim svoystvam ferritov i fizicheskim osnovam ikh primeneniya. 3d, Minsk, 1959

Ferrity; fizicheskiye i fiziko-khimicheskiye svoystva. Doklady (Ferrites; Physical and Physicochemical Properties. Reports) Minsk, Izd-vo AN BSSR, 1960. 655 p. Errata slip inserted. 4,000 copies printed.

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AUTHORS: Gushchina, Z.M., Fabrikov, V.A. and Kudryavtsev, V.D.

TITLE: Temperature characteristics of ferrite elements in SHF devices

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 7, 1961, 49, abstract 7 I298 (V sb. Ferrity. Fiz. i fiz. khim. svoystva, Minsk, AN SSSR, 1960, 522-529)

TEXT: A study has been made of the temperature characteristics of ferrite elements in switching devices with the rotation of the polarization plane. It was shown that by choosing the optimum operating conditions, it is possible to obtain a good temperature stability (TS) of the rotation angle of the polarization plane of the wave: 45 ± 2.5° in the temperature range -60 to +100°C. The admixture of Cu to the Mg-Mn ferrites improves the TS of the ferrite

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D201/D305

elements, operating in medium and strong magnetizing fields. An important method in obtaining the TS of ferrite elements is the use of compensating circuits. The procedure is given of measuring the temperature characteristics of ferrite elements. 2 references. [Abstracter's note: Complete translation]

X

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30137
S/194/61/000/007/066/079
D201/D305

9.2590

AUTHOR: Fabrikov, V.A.

TITLE: Theory of ferrite-dielectric delay lines with distributed constants

PERIODICAL: Referativnyy zhurnal. Avtomatika i radioelektronika, no. 7, 1961, 49, abstract 7 I297 (V sb. Ferrity. Fiz i fiz. khim. svoystva, Minsk, AN BSSR, 1960, 596-606)

TEXT: The problem is considered of propagation of electromagnetic waves in a coaxial helical line with a combined ferrite-dielectric filling. The fundamental design formulae are derived relating the line characteristics with its geometrical dimensions, the parameters of the filling material and frequency. It is thought that the application of existing ferrite and dielectric materials in composite lines may produce pulse delays of 0.5 - 1.0 micro sec. without considerable distortion of shapes, the line having a length 1 - 5 cm

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and an input resistance $\leqslant$ 1000 ohms. 5 references. [Abstracter's note: Complete translation]

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77197
SOV/109-5-1-10/20

AUTHOR: Fabrikov, V. A.

TITLE: On Conditions for Appearance of Natural Oscillations of Magnetization of a Gyromagnetic Medium

PERIODICAL: Radiotekhnika i elektronika, 1960, Vol 5, Nr 1, pp 117-125 (USSR)

ABSTRACT: The paper considers longitudinal oscillations of the magnetization of a gyromagnetic medium in a constant magnetic field $\vec{H}_0 = \vec{i}_z H_0$. These oscillations, appearing under joint action of a transverse SHF field of circular polarization $\vec{h}_1$ and of a modulating field $\vec{h}_2 = \vec{i}_z h_2$, are described by the differential equation:

$$\frac{d^3 m_z}{dt^3} + A\frac{d^2 m_z}{dt^2} + B\frac{dm_z}{dt} + Cm_z = S_0 + S_1 h_2 + S_2\frac{dh_2}{dt}. \qquad (1)$$

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where $m_z$ designates the change in the longitudinal

component of the magnetization $M_z = M_0 + m_z$. It is shown that the coefficients in Eq. (1) may be considered as constant and be defined as

$$A = \frac{3}{T},\ B = \alpha^2 + \frac{2}{T^2},\ C = \frac{\alpha^2}{T},\ S_0 = -\frac{M_0 \omega_1^2 \omega}{\omega_0 T},\ S_2 = \frac{T}{2} S_1 = -S, \qquad (2)$$

where T is the magnetic relaxation time; $\omega$ is the frequency of the SFH field $h_1$; and $1/T = \gamma \Delta H$, where $\Delta H$ is the half-width of the resonance line of the material and $\gamma$ is the absolute magnitude of the gyromagnetic ratio of the electron spin and equals $1.78 \times 10^7$ oersted$^{-1}$ sec$^{-1}$. When the modulating field $h_2$ is the reaction field and is expressed by the linear relationship

$$h_z = v m_z + w \frac{dm_z}{dt}, \qquad (4)$$



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then Eq. (1) may be transformed into a homogeneous differential equation of the third order:

$$\frac{d^3 m_z}{dt^3} + a\frac{d^2 m_z}{dt^2} + b\frac{dm_z}{dt} + c(m_z - m_0) = 0 \qquad (5)$$

with constant coefficients given by Eq. (6):

$$\left.\begin{aligned} a = A + wS,\ b = B + \left(w\frac{2}{T} + v\right)S, \quad c = C + v\frac{2}{T}S, \\ m_0 = -\frac{\omega_1^2\omega}{\omega_0\alpha^2}M_0. \end{aligned}\right\} \qquad (6)$$

The stability of the system described by Eq. (5) is analyzed using the Vishnegradskiy stability criterion. According to this criterion the system is stable if all three coefficients a,b,c and their combination (ab - c) are positive or equal zero. When any of these conditions is not fulfilled the system becomes unstable. The minimum value of the magnitude $w_1^2$ at

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which this may occur, i.e., when $\omega_1^2 = \omega_{cr}^2$, depends not only on the parameters of material T and $M_o$ but also on magnitudes of v and w. It is determined for two cases. In the first case, a transversely magnetized thin ferrite plate is considered. The reaction field of this ferrite sample is a demagnetizing field $h_2 = -m_z$. Applying the above criterion for stability it is shown that the smallest value $S_{cr}$ of coefficient S at which the system is still stable equals $\alpha^2/2$ and corresponds to the condition c = 0. From $S_{cr} = \alpha^2/2$ an expression for the critical frequency $w_{cr}^2$ is obtained; it has a minimum

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$$\omega^2_{\text{кр}} = \frac{1,54}{\omega_M T^2} \quad (8)$$

at

$$\omega - \omega_0 = \frac{0,575}{T}, \quad \alpha^2 = \frac{1,33}{T^2}. \quad (9)$$

In the second case, a ferrite sphere is considered. Here the reaction field is produced by the induction coil of a resonance circuit tuned to the oscillation frequency of the magnetization $m_z$ of the sample. Thereby the sample inside the coil. As in the first case, the smallest value $S'_{cr}$ is determined from the stability condition, and an expression is found for $\omega^2_{cr}$ which has a minimum

$$\omega^2_{кр} = \frac{2,73}{\omega_M T^2 L/R} \qquad (13)$$

*at*

$$\omega - \omega_0 = \frac{0,775}{T}, \quad \alpha^2 = \frac{1,6}{T^2}, \quad \sqrt{\alpha^4 \frac{T^2}{16} + \frac{1}{T^2}} = \frac{1,08}{T}. \qquad (14)$$

Equations (8) and (13) define critical values of the magnitude $h_1^2 = \omega_1^2/\gamma^2$, which when exceeded causes natural oscillation of the magnetization to appear in the ferrite sample. These oscillations are of the relaxation type in the case of a ferrite plate. They are sinusoidal in the case of a ferrite sphere. It is stated that measuring the frequency of the above oscillations constitutes a simple method for determining the relaxation time T of the material. The author draws the conclusion that in mixers using nonlinear gyromagnetic properties of ferrite a high magnitude of the transformation coefficient may be obtained through regeneration. This is obtained when the heterodyne power is near the critical power value



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On Conditions for Appearance of Natural Oscillations of Magnetization of a Gyromagnetic Medium

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$P_{cr}$, the latter corresponding to the critical value of $h_1^2$. The paper has two appendices. In the first appendix an expression is derived for the reaction field $h_2$ of the resonance circuit; in the second, expressions are derived for the steady-state longitudinal oscillations of magnetization of a gyromagnetic medium under the effect of a transverse SHF field of circular polarization. There are 9 references, 3 Soviet, 6 U.S. The 5 most recent U.S. references are: P. W. Anderson, The Reaction Field and Its Use in Some Solid-State Amplifiers, J. Appl. Phys. 1957, 28, 9, 1049; M. T. Weiss, Microwave and Low-Frequency Oscillation Due to Resonance Instabilities in Ferrites, Phys. Rev., Letters, 1958, 1, 7, 239; A. D. Berk, L. Kleinman, C. E. Nelson, Modified Semistatic Ferrite-Amplifier, IRE Wescon., Los Angeles, 1958; W. L. Whirry, F. B. Wang, Experimental Study of Modified Semistatic Ferrite Amplifier, J.

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Appl. Phys., 1959, suppl. to 30, 4; L. B. Valdes, Circuit Conditions for Parametric Amplification, J. Electronics and control, 1958, 5, 2, 129.

SUBMITTED: September 1, 1959

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24976

9.4300 (1482,1158,1160)

S/109/61/006/007/016/020
D262/D306

AUTHORS: Mikhaylovskiy, L.K., Makarishchev, V.P., Pollak, B.P., and Fabrikov, V.A.

TITLE: Non-linear gyromagnetic effects of a nutational character in ferrites

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 7, 1961, 1178 - 1183

TEXT: This paper presented at a meeting of All-Union Scientific and Technical Society of Radio Engineering and Electrical Communications im. A.S. Popov on May 15, 1960 deals with the non-linear gyromagnetic properties of ferrites which are responsible for the amplification of IF and permit the increase of the mixing efficiency of ferrite mixers, result from the nutational oscillations of magnetization. The nutational oscillations mentioned above have been predicted from theoretical considerations by V.A. Fabrikov (Ref. 5: Radiotekhnika i elektronika, 1960, 5, 1, 117) and (Ref. 6:

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Tr. 5-y Vsyesoyuznoy konferentsii po ferritam , Minsk, 1959). The present article gives the results of experimental work by the authors, performed with the aim of a) determining the non-linearity of the dependence of intermediate frequency power $P_{IF}$ on the power of local oscillator $P_H$ in a SHF mixer; b) determining the presence in the ferrite sample. placed in the resonant circuit of the IF of sinusoidal oscillations of magnetization under the influence of the SHF power of the local oscillator. The source of SHF was a continuous or pulse modulated klystron generator (Klystron type 43-И (43-I)). The ferrite sample with the coil was placed in a section of a standard waveguide at a distance of 6 mm from the narrow wall of the waveguide. Frequency range was 3 cm, IF was 3 cm, IF was 30 Mc/s. The effective Q of the resonant cct was 20 at 30 Mc/s. The constant magnetic field was applied parallel to the narrow wall of the waveguide. Its magnitude was corresponding to that of the ferromagnetic resonance. The ferrite sample was a mono crystal of yttrium ferrite having the ferromagnetic resonance band 5-10 oersted. The shape of the sample was nearly spherical with unlapped

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surface. The overall IF amplification was about $10^5$, the noise level of the amplifier, as reduced to that of the pre amplifier input was about 5 microvolt (measured with a (SG-1) [Abstractor's note: Measuring of SG-1 not mentioned]). The main difficulties to overcome were as follows: Transients in the ferrite set due to rapid changes of the d.c. component of magnetizing force in the direction of d.c. field under the influence of the leading and trailing edges of the local oscillator pulses (Ref. 6: N. Bloembergen, S. Wang. Relaxation effects in para and ferromagnetic resonances, Phys. Rev., 1954, 93, 1. 72). The over-heating of ferrite sample was due to power dissipation from the SHF field by the sample. Direct transmission of pulse from the local oscillator led to the IF amplifier chain. The heating was avoided by the use of pulses of short duration (1-6 microseconds). The transients were reduced by applying pulses to the ferrite not directly from the magnetron oscillator but from the resonator 50-И (50-I) with a Q ≈ 100,000 executed by the magnetron generator. The block diagram of the experimental installation is shown. Rotation oscillations of magnetiza-

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tion in the magnetized ferrite placed in the resonator of the IF were observed under the influence of a SHF transverse field when the power of the field exceeded a certain critical value of the order of 1-5 watt. It is thought that the observed oscillations are sinusoidal and cannot, therefore, be of a relaxation character as observed by M.T. Weiss in a ferrite placed in a high Q cavity resonator (Ref. 9: Microwave and low frequency oscillation due to resonance instabilities in ferrites Phys. Rev. Letters, 1958, 1, 7, 239). The existence was also observed of a non-linear region on the characteristics of IF signal power against the local oscillator power $P_H$ in mixing arrangements in which $P_H$ was near the critical power $P_{c2}$. These results are in agreement with the theory of non-linear gyromagnetic effects related to the nutation of ferrite magnetization (Refs. 5 and 6: Op.cit.). The final identification of these experimentally observed effects will be possible after their careful quantitative analysis. The above results may be of practical interest in problems of increasing the efficiency of SHF ferrite mixers. The experiment was carried out at the Moskovskiy ener-

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geticheskiy institut, Kafedra teoreticheskikh osnov radiotekhniki (Moscow Power Engineering Institute, Department of Theoretical Principles of Radio-Engineering). The results of the experiment were discussed at the seminar of K.M. Polivanov [Abstractor's note: No further data given]. There are 5 figures and 9 references: 6 Soviet-bloc and 3 non-Soviet-bloc. The references to the English-language publications read as follows: L. Lewin. The efficiency of a ferrite as a microwave mixer, Proc. I.R.E., 1959, 106 part C, 10, 153, N. Bloembergen. S. Wang, Relaxation effects in para and ferromagnetic resonance, Phys. Rev. 1954, 93, 1, 72, M.T. Weiss, Microwave and low-frequency oscillation due to resonance instabilities in ferrites, Phys. Rev. Letters, 1958, 1, 7, 239.

SUBMITTED: July 4, 1960

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29318
S/109/61/006/010/016/027
D201/D302

9.2570 (1144)

AUTHOR: Fabrikov, V.A.

TITLE: A new principle of amplifying SHF oscillations using ferrites

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 10, 1961, 1707 - 1717

TEXT: It has been pointed out by the author (Ref. 3: Ob effektivnosti raboty ferritovykh elementov v kachestve smesiteley CVCh v skhemakh detektirovaniya, Trudy 3-y Vsesoyuznoy konferentsii po ferritam, Minsk, Iyun' 1959, 'Ferrity', Sb. statey, IN BSSR, Minsk, 1960, p. 534) that it is possible to obtain the effect of power amplification of one of the SHF signals being mixed at the cost of the other more powerful signal, by utilizing the nutation gyromagnetic effect in ferrites. This effect, which may be taken as a new principle of SHF amplification on ferrites, is analyzed by the author in the present article. The analysis is carried out by solving

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the equations of motion of gyromagnetic moments of magnetized ferrite under the influence of two transversely polarized SHF signals and of a longitudinal alternating reaction field. The solution of the problem is sought in a system of coordinates revolving in synchronism with the constant in the magnitude revolving magnetic moment of the ferrite sample. If the ferrite sample is magnetized to saturation by a constant magnetic field $\vec{H}o = \vec{i}_2 Ho$ and with the acting small alternating field h, so that $\vec{H} = \vec{H} + \vec{h}$ the magnetic moment M has its equation of motion as

$$\dot{\vec{M}} = \gamma[\vec{H}\,\vec{M}] - \vec{R}. \qquad (1)$$

In it the term with $\vec{R}$ representing losses, has components $R_x = M_x/T_2$, $R_y = M_y/T_2$, $R_z = (M_z - M_o)/T_1$, where $\gamma = 1.76 \times 10^7$ 1/oersted sec, $T_1$ and $T_2$ - times of longitudinal and transverse relaxation; $M_o$ - equivalent magnitude of moment within the constant field $H_o$. Using the notation of Fig. 1 and restricting the analysis to the fields of circular polarization the system of two linear differen-

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tial equations is obtained with respect to the independent variables $\varphi$ and $\theta$ ($\theta$ being the angle between $\vec{M}$ and $\vec{i}_\zeta$, $\vec{i}_z = \vec{i}_z$)

$$\dot{\varphi} = (\gamma H_0 - \omega) + \gamma h_z + \gamma h_1 \operatorname{ctg} \theta \cos \varphi,$$

$$\dot{\theta} = \gamma h_1 \sin \varphi - \frac{\operatorname{tg} \theta}{T_2}. \qquad (5)$$

Introducing

$$x = (\omega - \gamma H_0)T_2 = \frac{H_{res} - H_0}{\Delta H} \qquad (7)$$

where $H_{res} = \omega/\gamma$ and $\Delta H = 1/\gamma T_2$ - the half width of the ferromagnetic resonance line, Eq. (5) is easily solved if $h_z = 0$ and consequently $\dot{\varphi} = \dot{\theta} = 0$. The solution becomes then

$$\operatorname{tg} \varphi_0 = \frac{1}{x}, \qquad \operatorname{tg} \theta = \frac{1}{\sqrt{1 + \alpha^2}} \frac{h_1}{\Delta H}, \qquad (8)$$



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when $h_z \neq 0$, the exact solution of Eq. (5) is complicated, but its approximate solution is comparatively easy if $h_z$ is considered to be a small variation of the system and

$$T_2\dot{\varphi}_1 + \varphi_1 = \frac{h_z}{\Delta H} - x\sqrt{1 + x^2}\,\frac{\Delta H}{h_1}\,\theta_1,$$

$$T_2\dot{\theta}_1 + \theta_1 = \frac{1}{\sqrt{1 + x^2}}\,\frac{h_1}{\Delta H}\;1 \qquad (9)$$

are then obtained, whose solution permits the reaction of the gyromagnetic medium to a small modulating signal to be evaluated. If two transverse magnetic fields with circular polarization

$$h_x + ih_y = h_1 e^{i\omega t} + h_2 e^{i(\omega+\Omega)t} \qquad (11)$$

act upon the ferrite, then the expression for the field $\vec{H}$ in the revolving system of coördinates has the general shape of



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$$\vec{H} = \vec{i}_\xi \{h_1 \sin\varphi - h_2 \sin(\Omega t - \varphi)\} + \vec{i}_\eta \{h_1 \cos\varphi + h_2 \cos(\Omega t - \varphi)\} + \vec{i}_\zeta (H_0 + h_z). \tag{12}$$

Considering only cases when $h_2 \ll h_1$, Eqs. (8) remain unchanged and Eqs. (9) must be replaced by

$$T_2\dot{\varphi}_1 + \varphi_1 = \frac{h_z}{\Delta H} - x\sqrt{1 + x^2}\,\frac{\Delta H}{h_1}\,\theta_1 + \frac{h_2}{h_1}\sqrt{1 + x^2}\cos(\Omega t - \varphi_0),$$

$$T_2\dot{\theta}_1 + \theta_1 = \frac{1}{\sqrt{1 + x^2}}\,\frac{h_1}{\Delta H}\,\varphi_1 - \frac{h_2}{\Delta H}\sin(\Omega t - \varphi_0), \tag{13}$$

from which the parameters of the alternating components of magnetic moment $m_x$, $m_y$ and $m_z$ may be determined. For further analysis only the modulation of field $H_z$ is considered which is due to the action

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A new principle of amplifying ...

of external signal, whose magnetic field is polarized in the Z-axis direction. The author acknowledges the help of A.A. Pistol'-kors. In the appendix the solution is given of problem of interaction between electromagnetic signals with a modulated gyrotropic medium for large amplitudes of the modulating field. There are 4 figures and 10 Soviet-bloc references.

SUBMITTED: December 6, 1960

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30067
S/048/61/025/011/012/031
B104/B102

9,2571
24,7900 (1055,1144,1163)

AUTHORS: Fabrikov, V. A., Kozlov, V. I., Kadeyev, V. T. and Kudryavtsev, V. D.

TITLE: Experimental study of effects on yttrium ferrite single crystals, which are related to nutational oscillations of magnetization of the material on ferromagnetic resonance

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 11, 1961, 1367 - 1371

TEXT: Nonlinear gyromagnetic effects in ferrites may, in first approximation, be divided into two groups. The first group consists of those gyromagnetic effects which are related to the frequency modulation, the other gyromagnetic effects related to the angle modulation of the precessional motion. The effects examined on yttrium garnet single crystals belong to the second group. The authors studied the interaction of two electromagnetic signals in the specimen: a h-f signal (10,000 Mc) polarized at right angles to the direction of magnetization and a l-f signal (0.5 - 8 Mc) polarized in the direction of magnetization. The magnetic field

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directions in the experiments are shown in Fig ' The theoretical aspect of the problem under consideration had been previously studied by V. A. F...kov (Radiotekhnika i elektronika, 3 no 2 190 (1958); 4 no. 7, 1203 (1959); 6, no 10, 1707 (1961)) Fig 3 bases on these papers to show the complex susceptibility $\chi$ of a magnetized ferrite as a function of the constant magnetizing field. This function was calculated with the following formula derived in the previous papers:

$$\chi_{\Omega} = \frac{Mh_1^2}{(\Delta H)^3} \frac{x}{1+x^2} \frac{1+x^2-y^2-2iy}{(1+x^2-y^2)^2+4y^2} \qquad (2)$$

Here, the magnetic moment M = const; $h_1$ is the amplitude of the circularly polarized h-f field; $\Delta H = 1/\gamma T_2$ is the half width of the ferromagnetic resonance line; $\gamma$ = 2 8 Mc/oe is the gyromagnetic ratio of the electron spin; $x = (H_{res} - H_c)/\Delta H$ and $y = \Omega T_2$; and $\chi = \chi' - \chi''$. The investigation was conducted with an yttrium ferrite single crystal where the width of the ferromagnetic resonance line was 1 - 2 oersteds The spherical specimens (0 5 - 1mm in diameter) were placed in the center of a coil with several turns. The coil was connected to a resonant circuit (0 5 10 Mc). To

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B104/B102

Experimental study of effects...

gether with the specimen it was placed in a square waveguide connected to a tron generator. The parameters of the circuit with the specimen were riodically changed by a h-f signal (3 cm). The curve describing the ferrite losses under the action of the h-f signal was observable on an oscilloscope screen. perimental data are compared in Fig. 5. with a theoretical curve. The modulati field causes the ferromagnetic resonance lines to be broadened. The effect investigated may be used for studying resonance effects in ferrites with narrow resonance lines. K. M. Polivanov is thanked for his interest. There are 5 figures and 7 Soviet references.

Fig. 2. Phase relations between changes of the magnetizing field $H_z$ and the precession angle of magnetic moments in the material.
Fig. 3. Complex susceptibility of a magnetized ferrite relative to a 1-f modulation field $h_z$ as a function of the constant magnetizing field.
Fig. 5. " as a function of amplitude $h_o$ and of frequency f of the 1-f field. Legend: (1)$\chi''(h_o)$; (2)$\chi''(f)$. The circles are experimental values; the curves were calculated.

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30084
S/048/61/025/011/030/031
B117/B102

24.2200 (1137,1144,1164,1147)
15.2450

AUTHORS: Fabrikov, V. A., Gushchina, Z. M., and Kudryavtsev, V. D.

TITLE: Ferrites with high saturation magnetization and narrow shf resonance absorption line

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 25, no. 11, 1961, 1429-1430

TEXT: The authors developed a series of ferrite types with high saturation magnetization and narrow shf resonance absorption line. Some of these ferrites may be of practical importance when used in shf valve devices, for example, ferrites of the types П-28 (P-28), M-55 (M-55), and M-258 (M-258). P-28, is an improved modification of the formerly developed Mg-Mn-Zn ferrite П-1 (P-1) (Ref. 1: Authors, Radiotekhnika i elektronika, 4, no. 11, 1940 (1959)). Its composition in % by weight is: 53.55% of $Fe_2O_3$, 6.76% of MgO, 30.35% of $MnCO_3$, 9.34% of ZnO. It has the following characteristics: saturation magnetization $M_s$ = 3200-3400 gauss; for a wavelength of 3 cm, the width of the resonance line

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B117/B102

Ferrites with high saturation ...

$\Delta H$ = 50-70 oersteds (in some carefully polished samples, $\Delta H$ may be below 40 oersteds). Curie temperature $T_c$ = 170-180°C; the d-c resistivity $\varrho_V$ = $10^7$ ohm·cm. The ferrite was produced by sintering in air at 1370°C for 5 hr and subsequent vacuum cooling, in the furnace. The briquettes were annealed for 6 hr at 900°C. M-55 is an improved modification of the formerly developed ferrite type M-50. Its composition in % by weight is as follows: 63.79% of $Fe_2O_3$, 20.95% of NiO, 4.89% of $MnCO_3$, 10.37% of ZnO. The characteristics of M-55 are as follows: $M_s$ = 4300-4500 gauss; $\Delta H$ = 230-250 oersteds; $T_c$ = 330-350°C; $\varrho_V$ = $10^7$ ohm·cm. Annealing took place in air for 4 hr at 1300°C. Preliminary annealing of briquettes was conducted for 2 hr at 1100°C. M-258 was developed on the basis of the U. S. 4-component (Ni-Zn-Mg-Mn) ferrite "Ferramic C" (Ref. 2: see below) by introduction of 20 mole% of CuO. It has the following characteristics: $M_s$ = 4600-4800 gauss; $\Delta H$ = 120-140 oersteds; $T_c$ = 300°C; $\varrho_V$ - $10^5$ ohm·cm. It was produced by sintering the following mixture at 1150°C in air for 20 hr: 66.38% of $Fe_2O_3$, 8.11% of ZnO, [illegible]% of NiO,

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