URUSHADZE, G.I. [Urushadze, H.I.]

Thermal conductivity of antiferromagnetics at low temperatures.
Ukr. fiz. zhur. 6 no.1:34-39 Ja-F '61. (MIRA 14:6)

1. Fiziko-tekhnicheskiy institut AN USSR, g. Khar'kov.
(Magnetic materials—Thermal properties)

9.4300 (1035, 1138, 1143)

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83735

S/056/60/038/004/028/048
B006/B056

AUTHORS: Bar'yakhtar, V.G., Urushadze, G. I.

TITLE: The Theory of Relaxation Processes in Ferrodielectrics With Weak Magnetic Anisotropy at Low Temperatures

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 4, pp. 1253 - 1262

TEXT: A. A. Akhiyezer, V. Bar'yakhtar, and S. Peletminskiy (R . 1) developed a general theory of the relaxation of the magnetic moment in ferrodielectrics, which is based upon the fact that two kinds of interaction occur between the spin waves: A strong exchange interaction and a weak relativistic interaction (magnetic dipole interaction and interaction due to magnetic anisotropy). Details concerning these reactions are discussed by way of introduction. Many ferrites which may be considered to be dielectrics at low temperatures, have a complex magnetic structure, i.e. they have several magnetic sublattices. The consequence is that, besides the low-frequency (activation-less) branch in the magnetic energy spectrum also high-frequency branches (with high

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activation energies) occur. The contributions of these branches to the thermodynamic and kinetic properties are at low temperatures exponentially small. An analysis shows that the interaction between the low-frequency spin waves due to energy exchange between the sublattices of the same order is similar to the relativistic interaction describing the reciprocal scattering of spin waves. Thus, the magnetic structure may be neglected when investigating the relaxation processes in ferrodielectrics with low anisotropy. The ferrodielectrics, for which the relaxation of the magnetic moment and the leveling of spin and lattice temperature is investigated here, are in a weak magnetic field. Establishment of the equilibrium of the magnetic moment with respect to value and direction is due to magnetic dipole interaction, with the absolute value of the magnetic moment coinciding as to order of magnitude with the time of rotation of the magnetic moment toward equilibrium direction. Also the leveling time of spins and of the lattice are calculated. In an appendix a ferrodielectric having two magnetic sublattices is studied. Finally, the authors thank A. I. Akhiyezer for his advice, and M. I. Kaganov and V. M. Tsukernik for discussions. There are 9 references: 6 Soviet and

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The Theory of Relaxation Processes in Ferro-dielectrics With Weak Magnetic Anisotropy at Low Temperatures

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B006/B056

2 US.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Institute of Physics and Technology of the Academy of Sciences, Ukrainskaya SSR)

SUBMITTED: November 4, 1959

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BAR'YAKHTAR, V.G.; URUSHADZE, G.I.

Scattering of spinor waves and phonons on impurities in ferrodi-electrics. Zhur. eksp. i teor. fiz. 39 no.2:355-361 Ag '60.
(MIRA 13:9)

1. Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR.
(Ferroelectric substances) (Scattering (Physics))

83767

S/056/60/039/003/020/045
B006/B063

9.4300 (1035, 1138, 1143)

AUTHOR: Urushadze, G. I.

TITLE: Relaxation of the Magnetic Moment in an Antiferromagnetic Dielectric

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 3(9), pp. 680-683

TEXT: The present paper deals with the relaxation of the magnetic moment in a dielectric in the special case where the external magnetic field and the magnetic moment of the body are perpendicular to the crystal axis (z-axis). When a magnetic field is applied, the magnetic moments of the sublattices start turning into the direction of the crystal axis, and the magnetic moment existing at the instant of application disappears. The author now wanted to determine the relaxation time of this process. As the non-equilibrium value of this magnetic moment depends on the number of spin waves with a momentum $\vec{k} = 0$, the relaxation time of the magnetic moment, found by the author, determines the order of magnitude of the line width of the homogeneous antiferromagnetic resonance. As the exchange

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interaction Hamiltonian commutes with the total magnetic moment of the body, it is not able to change the occurring non-equilibrium magnetic moment. The magnetic moment of the body is changed as a result of the weak relativistic interaction. If the dispersion law of spin waves in antiferromagnetic dielectrics $\varepsilon_{1,2}(\vec{k}) = \mu M \sqrt{2\gamma[\beta + (\alpha - \alpha_{12})k^2]}\left[1 \pm (\pi/\gamma)\sin^2\Theta_k\right]$ (where $\Theta_k$ is the angle between the z-axis and the wave vector $\vec{k}$; the upper and the lower signs correspond to the two energy branches whose distance is $\Delta\varepsilon \sim \mu M$; $\alpha$, $\alpha_{12}$, and $\gamma$ are exchange interaction constants; $\beta$ is the magnetic anisotropy constant; M is the magnetic moment for saturation in the sub-lattice; $\mu$ is the Bohr magneton) is valid, one obtains the following relation: $\frac{1}{\tau_0} = \frac{\beta^2 U_0^2 \mu^4}{4\pi^5\gamma^3\sigma^6(\alpha-\alpha_{12})^3 T\hbar}(e^{\xi} - 1)J(T)$. Here, $\xi = \varepsilon_0/T$, $\sigma = \mu M/T$, and J(T) is a complex expression which is defined by (16). For $T \gg (\beta\mu M\Theta_c)^{1/2}$ (which corresponds to $\xi \ll 1$) the expression for J(T)

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is largely simplified. Then, one obtains an expression for $1/\tau_0$, which is accurate up to one numerical factor of the order of one: $\frac{1}{\tau_0} \sim \beta^2 \frac{\mu M}{\hbar} \frac{\mu M}{\Theta_c} \frac{T}{\Theta_c}$.

The author thanks A. I. Akhiyezer and V. G. Bar'yakhtar for suggesting the topic and for discussions. There are 3 references: 2 Soviet and 1 US.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk Ukrainskoy SSR (Institute of Physics and Technology of the Academy of Sciences Ukrainskaya SSR)

SUBMITTED: April 2, 1960

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URUSHADZE, G. I. Cand Phys-Math Sci -- "Kinetic theory of heat conductivity and relaxation of the magnetic moment in ferrodielectrics and antiferrodielectrics under low temperatures." Khar'kov, 1961 (Min of Higher and Secondary Specialized Education UkSSR. Khar'kov Order of Labor Red Banner State Univ im A. M. Gor'kiy). (KL, 4-61, 185)

25585

S/185/61/006/001/002/011
D210/D305

24.7600

AUTHOR: Urushadze, H.I.

TITLE: Thermal conductivity of antiferromagnetics at low temperatures

PERIODICAL: Ukrayins'kyy fizichnyy zhurnal, v. 6, no. 1, 1961, 34-39

TEXT: The author calculates the temperature dependence of the thermal conductivity of an antiferromagnetic dielectric in two cases: $\theta_C \gg \theta_D$ and $\theta_C \ll \theta_D$ ($\theta_C$ is the Curie temperature and $\theta_D$ is the Debye temperature). The Hamiltonian of an antiferromagnetic dielectric is the sum of three terms: $H = H^{(ss)} + H^{(pp)} + H^{(sp)}$ where the operators $H^{(ss)}$, $H^{(sp)}$ and $H^{(pp)}$ have the following form:

$$H^{(ss)} = \int\left[\frac{1}{2}\alpha_{pq}\frac{\partial M_p}{\partial x_i}\frac{\partial M_q}{\partial x_i} + \gamma M_1 M_2 + \frac{\beta}{2}(M_{1x}^2 + M_{1y}^2 + M_{2x}^2 + M_{2y}^2)\right] dV \quad (1)$$

$$H^{(sp)} = \int \delta_{pq}\left(\frac{\partial M_p}{\partial x_i}\frac{\partial M_q}{\partial x_k} u_{ik} + \frac{\partial M_p}{\partial x_i}\frac{\partial M_q}{\partial x_i} u_{ll}\right) dV \quad (2)$$

$$H^{(pp)} = \int\left(\frac{1}{2}\rho u^2 + \lambda_{iklm}u_{ik}u_{lm} + \varkappa_{iklmpq}u_{ik}u_{lm}u_{pq}\right) dV. \quad (3)$$

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Here $M_p$ is the magnetic moment density of the p-th sublattice (it is assumed that there are two magnetic sublattices in the antiferromagnetic, so that p = 1 or 2); $\alpha_{pq}$, $\gamma$, $\delta_{pq}$ are constants of exchange origin; $\beta$ is the magnetic anisotropy constant; $u_{ik}$ is the deformation tensor; u is the displacement vector; $\rho$ is the density of matter; $\lambda_{iklm}$ is the tensor which gives the elastic interaction between atoms; $\varkappa_{iklmsp}$ is the tensor which represents anharmonic vibrations of atoms. Four operators are introduced: $c_k^+$ and $c_k$, which represent creation and annihilation of a spin wave with a momentum k, and $b_{k_s}^+$ and $b_{k_s}$, which represent creation and annihilation of a phonon with a momentum k and a polarization s. These operators are used to rewrite the initial Hamiltonian. Further operators introduced represent a) the scattering of spin waves by spin waves and coalescence of three spin waves into one, as well as splitting of one spin wave into three; b) the processes of absorption of two spin waves and emission of one phonon, emission of a spin wave and a phonon accompanied by absorption of a spin wave, and the reverse processes; c) the processes of coalescence of two phonons into one and of splitting one phonon into two. The author eventually obtains

$$\delta n_K = n_k^o \left(n_k^o + 1\right) \frac{\varphi K}{T^2}$$
$$\delta N_{K_s} = N_{K_s}^o \left(N_{K_s}^o + 1\right) \frac{\varphi K}{T^2} \qquad (12)$$

$$g = -\frac{2^4 \cdot 15}{\pi^7} \rho a^5 c^2 \left(\frac{T}{\theta_D}\right)^3 e^{\pi \frac{\theta_D}{T}} \nabla T \qquad \theta_C \gg \theta_D \qquad (21)$$

$$g = \begin{cases} -\frac{2^{18}}{3^3 \pi^9} \theta_C a^2 \left(\frac{T}{\theta_C}\right)^2 e^{\pi \frac{\theta_D}{T}} \nabla T & T \gg (\beta \cdot \mu M \cdot \theta_C)^{\frac{1}{2}} \\ -\frac{2^{17}}{3^3 \pi^9} \theta_D a^2 \left(\frac{\theta_C}{\theta_D}\right)^2 \left(\frac{T}{\theta_D}\right)^2 e^{\pi \frac{\theta_C}{T}} \nabla T & T \ll (\beta \cdot \mu M \cdot \theta_C)^{\frac{1}{2}} \end{cases} \qquad (22)$$

with which he can find the heat flow in an antiferromagnetic dielectric:

$$S = \sum_k \varepsilon_k v_k \delta n_k + \sum_{K_s} \hbar \omega_{k_s} c_{K_s} \delta N_{K_s}$$

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Comparing this result with

$$S = -\varkappa V \nabla T$$

he finds the following expression for the thermal conductivity of an antiferromagnetic with $\theta_C \gg \theta_D$ ($\alpha Fe_2O_3$, GaSb, NiO):

$$\varkappa = 0.5 \frac{c}{a^2} \frac{\rho a^3 c^2}{\theta_D} \left(\frac{T}{\theta_D}\right)^6 e^{\frac{\theta_D}{T}} \quad (23)$$

For antiferromagnetics with $\theta_D \gg \theta_C$ ($CoCl_2$, $FeCl_2$, $VCl_3$) he obtains

$$\varkappa = \begin{cases} \frac{\theta_C}{\hbar a} \left(\frac{T}{\theta_C}\right)^5 e^{\frac{\theta_C}{T}} & T \gg (\beta \cdot \mu M_0 \theta_C)^{\frac{1}{2}} \\ \frac{c}{a^2} \left(\frac{\theta_C}{\theta_D}\right)^2 \left(\frac{T}{\theta_D}\right)^5 e^{\frac{\theta_C}{T}} & T \ll (\beta \cdot \mu M_0 \theta_C)^{\frac{1}{2}} \end{cases} \quad (24)$$

The above expressions show that for materials with $\theta_C \gg \theta_D$ the heat flow is due to phonons and Eq. (23) is identical with the conductivity obtained by O.I. Akhiyezer (Ref. 5: ZhETF, 10, 1934, 1940).

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Thermal conductivity... S/185/61/006/001/002/011
D210/D305

In conclusion, the author thanks O.I. Akhiyezer and V.H. Bar'yakht-ar for their advice and discussions. There are 5 references: 3 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATION: Fizyko-tekhnichnyy instytut AN URSR, Kharkiv (Physico-Technical Institute, AS UkrSSR, Khar'kov)

SUBMITTED: May 26, 1960

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34223
S/181/62/004/002/006/051
B102/B138

24.2130 (1035, 1164, 1325)

AUTHOR: Urushadze, G. I.

TITLE: Theory of the thermal conductivity of antiferromagnetics at low temperatures

PERIODICAL: Fizika tverdogo tela, v. 4, no. 2, 1962, 350-356

TEXT: In a previous paper (UFZh, 6, 1, 32, 1961) the author studied the heat conduction mechanism in pure antiferromagnetic dielectrics (spinwave-spinwave scattering, decay of one spinwave into three, decay of phonon into two). Now the effect of impurities (spinwave and phonon scattering from impurity centers) on this mechanism is studied for a cubic antiferromagnetic lattice containing dia- and paramagnetic impurity atoms. The Hamiltonian of this system can be composed of $\mathcal{H}_0$, for energy exchange in the ideal antiferromagnetic and $\mathcal{H}_{int}$ for the interaction of spinwaves and phonons with impurities:

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$$\mathcal{H}_0 = -\frac{1}{2}\sum_{l,n} J_1(R_{ln})\mathbf{S}_l\mathbf{S}_n + \frac{1}{2}\sum_n \dot{\mathbf{U}}_n^2 + \frac{1}{2}\sum_{l,n}{}' A_{ik}^{(1)}(\mathbf{R}_{ln})\, U_l^i U_n^k,$$

$$\mathcal{H}_{int} = \sum_{n\subset B}\sum_{l=1}^{N} J_1(R_{ln})\mathbf{S}_l\mathbf{S}_n - \sum_{n\subset B}\sum_{l=1}^{N} J_{12}(R_{ln})\mathbf{S}_l\sigma_n +$$

$$+\sum_{n\subset B}\sum_{l=1}^{N}[A_{ik}^{(12)}(\mathbf{R}_{ln}) - A_{ik}^{(1)}(\mathbf{R}_{ln})]\, U_l^i U_n^k + \frac{1}{2}\sum_n \Delta m_n \dot{U}_n^2,$$

The $A_{ik}^{(1)}$, $A_{ik}^{(12)}$ characterize elastic interaction between the atoms, $\vec{U}$ is the vector of displacement of atoms from equilibrium position, $\Delta m_n$ is the mass difference between original and impurity atoms at the n-th site, $J_1 < 0$ and $J_{12}$ are exchange integrals, $\vec{R}_{ln} = \vec{R}_l - \vec{R}_n$, $\vec{S}_l$ and $\vec{\sigma}_n$ are the spins of the original and the impurity atoms at the l-th and n-th sites. Spinwaves and phonons are introduced and $\mathcal{H} = \mathcal{H}_0 + \mathcal{H}_{int}$ is rewritten using production and annihilation operators and taking account of the magnetic

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anisotropy in $\mathcal{H}_0$:

$$\mathcal{H}_0 = \sum_k 2\varepsilon_k c_k^+ c_k + \sum_{f_\nu} \hbar\omega_{f_\nu} b_{f_\nu}^+ b_{f_\nu}^+ ,$$

$$\mathcal{H}_{int} = \sum_{kk'} \Phi_{kk'} U_k U_{k'} c_k^+ c_{k'} + \sum_{kk'f_\nu} \Psi_{kk'f_\nu} U_k U_{k'} c_k^+ c_{k'} b_{f_\nu} +$$

$$\varepsilon_k = \mu \sqrt{H_A^2 + H_E^2 (ak)^2}, \qquad + \sum_{f_\nu f'_\nu} \chi_{f_\nu f'_\nu} b_{f_\nu}^+ b_{f'_\nu} . \qquad (2)$$

$\mu$ - Bohr's magneton, $H_E^2 = 2(J_1/\mu)^2$, $H_A^2 = 2\beta J_1/a^3$, $\hbar\omega_{\vec{f}_\nu} = \hbar c_\nu f$ is the energy of a phonon with momentum $\vec{f}$ and polarization $\nu$, $c_k^+$, $c_k$, $b_{\vec{f}_\nu}$, $b_{\vec{f}_\nu}^+$ are the production and annihilation operators of spinwaves and phonons; $a_{\vec{k}} = U_{\vec{k}} c_{\vec{k}} + V_{\vec{k}}^+ c_{\vec{k}}^+$, where $U_{\vec{k}}$ and $V_{\vec{k}}$ are the Bogolyubov amplitudes.

$$|U_k| \simeq |V_k| \simeq \frac{1}{2}\left[\frac{A_k - \varepsilon(\mathbf{k})}{\varepsilon(\mathbf{k})}\right]^{1/2}; \quad A \simeq J_1.$$

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$$\Phi_{kk'} = \frac{4J_1 s a^2}{N} \sum_{n \subset B_1} kk' e^{-i(k-k', R_n)} + \frac{2J_{12} a^2}{N} \sum_{n \subset B_1} \sigma_n^z e^{-i(k-k', R_n)},$$

$$\Psi_{kk'f_\nu} = -\frac{4iJ_{12}}{N^{1/2}} \left(\frac{h}{m}\right)^{1/2} \sum_{n \subset B} \sigma_n^z \frac{e_{f_\nu} f_\nu}{\omega_{f_\nu}^{1/2}} e^{i(k-k'-f_\nu, R_n)},$$

$$\chi_{\vec{f}_\nu \vec{f}'_{\nu'}} = -\frac{\hbar}{4} (\omega_{\vec{f}_\nu} \omega_{\vec{f}'_{\nu'}})^{1/2} \left[\frac{\Delta m}{m} e_{\vec{f}_\nu} e_{\vec{f}'_{\nu'}} + \chi(\vec{n}_1 \vec{n}_2)\right] \frac{1}{N} \sum_{n \subset B} e^{-i(\vec{k}-\vec{k}', \vec{R}_n)}$$

In this representation $\mathcal{H}_{int}$ describes spinwave scattering from dia- and paramagnetic impurities, spinwave decay into spinwave plus phonon and also phonon - impurity scattering. The heat flow is calculated as usual, by determining the additions to the equilibrium distribution functions of spinwaves and phonons. The relations obtained are used to calculate the spin-component of the heat-conduction coefficient; for diamagnetic impurities:

$$\varkappa_s \simeq 10 \frac{J_1 s}{ha\xi_d} \left(\frac{J_1 s a^3}{\beta \mu^2}\right)^{1/2}; \quad \mu \left(\frac{\beta J_1 s}{a^3}\right)^{1/2} \ll T \ll J_1 s.$$



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and for paramagnetic impurities:

$$\varkappa_s \simeq \begin{cases} 48 \frac{T}{\hbar a \xi_p} \left(\frac{T}{J_{12}a}\right)^2; & T \ll \theta_0, \\ \frac{mc^2}{\hbar a \xi_p} \left(\frac{\theta_0^2}{J_{12}a}\right) \frac{\theta_0}{T}, & \theta_0 \ll T \ll J_1 s. \end{cases} \quad (12)$$

$\Theta_o$ is the Debye temperature. The phonon component is given by

$$\varkappa \simeq \frac{J_1 s}{\hbar a \xi_d} \left(\frac{J_1 s a^3}{\beta \mu^2}\right)^{1/3}, \quad \mu \left(\frac{\beta J_1 s}{a^3}\right)^{1/3} \ll T \ll J_1 s. \quad (15)$$

for diamagnetic impurities ($J_1 \gg \Theta_o$) and

$$\varkappa \simeq \frac{mc^2}{\hbar a \xi_p} \left(\frac{J_1 s}{J_{12}a}\right)^{1/2} \frac{J_1 s}{\theta_0} \frac{J_1 s}{T}; \quad \mu \left(\beta \frac{J_1 s}{a^3}\right)^{1/3} \ll T \ll J_1 s, \quad (16)$$

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for paramagnetic impurities ($J_1 \ll \Theta_o$) or

$$\varkappa \simeq \begin{cases} \frac{\theta_0^2}{\hbar a \xi_p T}; & \mu\left(\beta \frac{J_{12}}{a^3}\right)^{1/4} \ll T \ll \theta_0, \\ \frac{mc^2}{\hbar a \xi_p}\left(\frac{\theta_0}{J_{12^3}}\right)^2 \frac{\theta_0}{T}; & \theta_0 \ll T \ll J_1 s. \end{cases} \quad (17)$$

if $J_1 \gg \theta_0$. As may be seen, the heat conduction coefficient is highly dependent on the kind of impurity. A. I. Akhiyezer, A. S. Borovik-Romanov and V. G. Bar'yakhtar are thanked for discussions. J. Pomeranchuk (Journ. Phys. USSR, 6, 247, 1942) is mentioned. There are 13 references: 10 Soviet and 3 non-Soviet. The two references to English-language publications read as follows: T. Ziman. Proc. Phys. Soc. 65, 540, 1952; P. Klemens. Proc. Roy. Soc. 208, 108, 1951.

ASSOCIATION: Institut kibernetiki AN Gruz.SSR Tbilisi (Institute of Cybernetics AS Gruzinskaya SSR, Tbilisi)

SUBMITTED: July 27, 1961

45378
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24.1200
24.7000

AUTHOR: Urushadze, G. I.

TITLE: Theory of sound absorption in ferromagnetics at low temperatures

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 1, 1963, 258 - 260

TEXT: The effects of paramagnetic impurities on sound absorption in a ferromagnetic dielectric are studied. Whereas in an ideal dielectric only exchange interactions between the spin waves and relativistic interactions (spin wave splitting) affect sound absorption, in a dielectric with paramagnetic impurities an exchange interaction between spin waves and impurities (concentration $\xi$) will be possible also. In this case the kinetic equation for the number of spin waves, $\dot{n}_k = L_k^{(\xi)}\{n\} + L_k^{(e)}\{n\} + L_k^{(r)}\{n\}$, has three components, these being the collision integrals for the three possibilities of interactions. The temperature and concentration dependence of these components is investigated. For the effect caused by the paramagnetic impurities

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Theory of sound absorption in...

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$$L_k^{(\xi)}\{n\} = \frac{2\pi}{\hbar}\sum_{k_1k_2}|\Phi_{k_1k_2}|^2[(n_{k_1}+1)n_{k_2} - n_{k_1}(n_{k_2}+1)]\,\delta(\varepsilon_{k_1}-\varepsilon_{k_2}),$$

$$\Phi_{k_1k_2} = \frac{J_{12}\sigma}{2N}\sum_{m\subset p}\exp[-i(k_1-k_2)R_n]. \quad (2)$$

(cf. ZhETF, 39, 355, 1960); the sites p are those among m that are occupied by the paramagnetic atoms, N is the total number of atoms, $J_{12}$ the exchange integral and σ the spin of the paramagnetic atom. The mean relaxation times are

$$\frac{1}{\tau^{(\xi)}} \approx \xi\,\frac{(J_{12}\sigma)^2}{\hbar\theta_C}\left(\frac{T}{\theta_C}\right)^{1/2}, \qquad \frac{1}{\tau^{(e)}} \approx \frac{\theta_C}{\hbar}\left(\frac{T}{\theta_C}\right)^4,$$

$$\frac{1}{\tau^{(r)}} \approx \frac{(\mu M)^2}{\hbar\theta_C}\left(\frac{T}{\theta_C}\right)^{1/2}, \quad (3)$$

$\theta_C$ is the Curie temperature, μ Bohr's magneton and M the saturation magnetic moment. For $T \ll \theta_C(\xi^{1/2}J_{12}\sigma/\theta_C)^{4/7}$, $\tau^{(\xi)} \ll \tau^{(e)}$ and for $\xi \gg (\mu M/J_{12}\sigma)^2$

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$\tau^{(\xi)} \ll \tau^{(r)}$. The sound absorption coefficient is calculated from the entropy variation S caused by the sonic field. One obtains $k = B\xi(\omega/c)^2 A/mc$, where c is the sound velocity, $m = Qa^3$, and B a numerical coefficient.

ASSOCIATION: Institut kibernetiki Akademii nauk Gruzinskoy SSR (Institute of Cybernetics of the Academy of Sciences Gruzinskaya SSR)

SUBMITTED: July 12, 1962

L 23743-66 EWT(1)/EPF(n)-2/ETC(m)-6 IJP(c) WW/GG

ACC NR: AP6007222 SOURCE CODE: UR/0056/66/050/002/0404/0410

AUTHOR: Urushadze, G. I.

ORG: Institute of Physics, Academy of Sciences, Georgian SSR (Institut fiziki Akademii nauk Gruzinskoy SSR)

TITLE: Contribution to the theory of absorption of sound in current-carrying superconductors

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 50, no. 2, 1966, 404-410

TOPIC TAGS: sound absorption, superconductivity, paramagnetic absorption, temperature dependence, electron interaction, Green function

ABSTRACT: The quantum field theory methods developed by Abrikosov and Gorkov (ZhETF v. 39, 1781, 1960 and elsewhere) are used to investigate sound absorption in current-carrying impurity superconductors. The purpose of the investigation is to determine the conditions under which superconductivity can be destroyed by a flow of

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current, in analogy with the effect of paramagnetic impurities. Expressions are obtained for the coefficient of sound absorption as functions of the temperature, the Fermi momentum ($p_0$), and the pair velocity ($v_s$), since the product of the last quantities determines the current flow in the sample. The calculation is based on expressing the interaction between the sound field and the electrons in Hamiltonian form and determining the energy absorption density in terms of the appropriate Green's functions. The calculations show that in the superconducting phase there exists a range of $s = p_0 v_s$ for which the energy gap disappears. The author thanks A. A. Abrikosov for interest in the work and useful remarks. Orig. art. has: 30 formulas.

SUB CODE: 20/ SUBM DATE: 08Jul65/ ORIG REF: 003/ OTH REF: 004

Card 2/2 ULR

URUSHADZE, G.K.

22568 Urushadze, G.K. Effektivnost' Torfonavoznykh Kompostov Podchai I Tsitrusovye Kul'tury. Trudy Gruz S.-Kh In-ta im. Beriya, T. xxx, 1949, S. 177-86-Bibliogr: 22 Nazv.

SO: Letopis No. 30, 1949

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22568. Urushadze, G. K. Effektivnost' Torfonavoznykh kompostov podchai i tsitrusovye kul'tury. trudy gruz S.-Kh in-ta im. Beriya, t. XXX, 1949, S. 177-86- Bibliogr: 22 nazv.

SO: LETOPIS' No. 30, 1949

SARISHVILI, I.F.; URUSHADZE, G.K.; SALIYEVA, N.V.

Using fertilizers for corn. Pochvovedenie no.12:38-47 D '56.
(MLRA 10:2)

1. Sel'skokhozyaystvennyy institut Gruzii, Kafedra agrokhimii.
(Corn (Maize)) (Fertilizers and manures)

URUSHADZE, Igor' Apollonovich

IAkov Nikoladze. Tbilisi, Zaria Vostoka, 1958. 87 p. (MIRA 13:4)

(Nikoladze, IAkov Ivanovich, 1876-1951)

KOROLEV, Dmitriy Amosovich; CHEKAN, Lev Ivanovich; DENSHCHIKOV, Mikhail Tikhonovich; ZAZIRNAYA, M.V., retsenzent; URUSHADZE, M.G., retsenzent; MALCHENKO, A.L., prof., spetsred.; KOVALEVSKAYA, A.I., red.; SOKOLOVA, I.A., tekhn. red.

[Technology of the production of soft drinks]Tekhnologiia bezalkogol'nykh napitkov. Moskva, Pishchepromizdat, 1962. 514 p. (MIRA 15:11)

(Soft drinks)

URUSHADZE, M.I.; DEMURISHVILI, N.V., kand. tekhn. nauk, starshiy nauchnyy sotrudnik

Mechanization of the unloading of bleached cotton fibers from the tank. Tekst. prom. 23 no.10:36-39 O '63. (MIRA 17:1)

1. Rukovoditel' otdela avtomatizatsii i mekhanizatsii Nauchno-issledovatel'skogo instituta tekstil'noy promyshlennosti (NIITekstil'prom) Soveta narodnogo khozyaystva Gruzinskoy SSR (for Urushadze). 2. Nauchno-issledovatel'skiy institut tekstil'noy promyshlennosti Soveta narodnogo khozyaystva Gruzinskoy SSR (for Demurishvili).

URUSHADZE, M. Sh.

DADIANI, E. N.; URUSHADZE, M. Sh.

Comparative evaluation of various therapeutic technique in taeniasis. Med. paraz. i paraz. bol. 24 no.4:306-308. O-D '55. (MLRA 9:1)

1. Iz kafedry epidemiologii s meditsinskoy parazitologiyey Tbilisskogo instituta usovershenstvovaniya vrachey (dir. instituta - prof. G.R. Zundadze, zav. kafedroy - prof. N. G. Kamalov)
(TAPEWORM INFECTION, therapy
comparison of various methods)
(ANTHELMINTICS, therapeutic use,
taeniasis, comparison of various drugs)

URUSHADZE, T. Ya. Cand Med Sci -- (diss) "On the Problem of Resection for Elimination Purposes With Regard to ~~Low-Seated~~ crateriform and ~~Complex~~ indolent Ulcers." Tbilisi, 1957. 13 pp 21 cm. (Tbilisi State Medical Inst), 200 copies (KL, 25-57, 119)

URUSHADZE, T.Ya.

Three cases of diaphragmal hernia. Nov.khir.arkh. no.4:80
Jl-Ag '57. (MIRA 10:11)

1. Tbilisskyy meditsinskoy institut
(DIAPHRAGM--HERNIA)

M.

USSR/Cultivated Plants - Subtropical. Tropical.

Abs Jour : Ref Zhur - Biol., No 4, 1958, 15823

Author : U.D. Urushadze

Inst : The All-Union Scientific Research Institute for Tea and Subtropical Cultures.

Title : The Growth and Development of Young Lemon Plants with Different Methods of Soil Maintenance in the Spaces Between the Rows.
(Rost i razvitiye molodnykh rasteniy limona pri raznykh sposobakh soderzhaniya pochvy v mezhduryad'yakh.)

Orig Pub : Byul. Vses. n.-i. in-ta chaya i subtrop. kul'tur, 1956, No 4, 55-71.

Abstract : At the Experimental Base of the All-Union Scientific Research Institute for Tea and Subtropical Cultures three years were spent in the study of the development

Card 1/2

URUSHADZE, U. D. Cand Agr. Sci -- (diss) "The Growth and Development of Young ~~Citrus~~ [Lemon] Plants ~~[illegible]~~ [with] Various Soil Contents [between] ~~in the~~ Rows ~~[illegible]~~." Tbilisi, 1957. 15 pp 22 cm. (Min of ~~[illegible]~~ Agriculture USSR, Georgian Order of Labor Red Banner Agricultural Inst), 100 copies (KL, 18-57, 97)

CA

13

**Plastic masses.** B. V. Maksorov, V. L. Urushadze and A. G. Natradze. Russ. 41,182, Jan. 31, 1935. Addn. to Russ. 37,847 (*C. A.* 30, 1001[8]). In the prepn. of a plastic mass from wood sawdust, bark, corn stalks, etc., according to Russ. 37,847, the materials after heating in an autoclave in a stream of steam or an inert gas are mixed with water glass, dried and pressed.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

CA

21

**Catalysts for flameless-combustion burners.** Urusbev. *Novosti Tekhniki, Ser. Gornorudnaya Prom.* 1955, No. 10, 7-8.—Four catalysts were prepd. and tested with satisfactory results: (1) alundum 60, clay 25 and refractory clay 15%; (2) alundum 80, clay 20%; (3) alundum 60, clay 20, refractory clay 20%; (4) alundum 80, clay 10, "dinas" (90-98 quartz + binder) 30), refractory clay 10%. The highest surface temp. of catalysts was 1480-1500°, and their softening temp. was 1630-1650°. A detailed prepn. of the catalysts is given. A. A. P.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PAKHALUYEV, Donstantin Mikhaylovich; URUSHEV, Konstantin Vasil'yevich; TOLSTYKH, F.S., redaktor; KEL'NIK, V.P., redaktor; KOVALENKO, N.I., tekhnicheskikh redaktor

[Heating furnace welder] Svarshchik nagrevatel'nykh pechei. Sverdlovsk, Gos. nauchno-tekhn. izd-vo lit-ry po chernoi i tsvetnoi metallurgii, Sverdlovskoe otd-nie, 1954. 183 p. (MLRA 8:6)
(Furnaces--Welding)

Urushev, V. M.

DOLGOLENKO, Pavel Valer'yanovich, kandidat tekhnicheskikh nauk, dotsent; RUSEYKIN, Boris Petrovich, dotsent; OSIPOVICH, F.A., redaktor; URUSHEV, V.M., retsenzent; POKROVSKIY, D.D., retsenzent; BEGICHEVA, M.N., tekhnicheskiy redaktor

[Technology of marine engine construction] Tekhnologiia sudovogo mashinostroeniia. Moskva, Izd-vo "Rechnoi transport," 1955. 373 p. (MLRA 9:2)

(Marine engineering)

ZBIGNIEW, YLRUSKI Z.

POLAND/Chemical Technology - Chemical Products and Their Application. Wood Chemistry Products. Hydrolysis Industry I-9

Abs Jour : Ref Zhur - Khimiya, No 1, 1958, 2663

Author : Uruski Zbigniew

Inst : Gdansk Polytechnic

Title : Investigation of the Possibilities of Decolorization of Domestic Extraction Rosin.

Orig Pub : Zesz. nauk. Politechn. gdansk., 1957, No 7, 29-46

Abstract : It is shown that the most effective physico-chemical method of decolorization of rosin is a treatment of its solutions with activated charcoal. The suitability of domesrically produced charcoal varieties, for this purpose, is noted.

Card 1/1

ROZMEJ, Zbigniew; RYBINSKI, Stanislaw; URUSKI, Zbigniew

Investigations on the sorption of uranium on peats. Nukleonika 5 no.10:661-670 '60.

1. Politechnika Gdanska, Gdansk, Katedra Technologii Chemicznej Drewna i Torfu

VOSTROKNUTOV, Ye.G.; BODAK, N.M.; URUSOV, A.A.

New equipment in the tire repair industry. Kauch.i rez. 19 no.12: 13-18 D '60. (MIRA 13:12)

1. Nauchno-issledovatel'skiy institut shinnoy promyshlennosti. (Tires, Rubber)

URUSOV, A.I., redaktor; SACHEVA, A.I., tekhnicheskiy redaktor;
ROMANOVA, Z.A., tekhnicheskiy redaktor.

[Topic plan for books to be published by "Medgiz" during 1956]
Tematicheskii plan vypuska izdanii Medgiza na 1956 g. Moskva,
Gos.izd-vo meditsinskoi lit-ry, 1955. 122 p. (MLRA 8:12)

1. Russia (1923- U.S.S.R.) Ministerstvo zdravookhraneniya.
(BIBLIOGRAPHY--MEDICINE)

URUSOV, A. P.

Collective experiments in the Central Chernozem Oblast in 1927-28. Voronezh, Kommuna, 1929. 88 p.



M. N., jt. au. II. Voronizh, Russia. Voronexhskaia oblastnaia sel'skokhoziaistvennaia opytnaia stantsiia.

SOV/92-58-6-8/30

AUTHOR: Urusov, A.V., Director of the Geological and Prospecting Office of the Stalingradneftegazrazvedka Trust

TITLE: Structural Drilling Crews Need Living Quarters (Strukturnomu bureniyu nuzhno obustroystvo)

PERIODICAL: Neftyanik, 1958, Nr 6, pp 9-11 (USSR)

ABSTRACT: The search for petroleum or gas usually begins with structural drilling. Since the structural drilling crew has to move very often from one place to another, the problem of accomodating its members calls for special consideration. In the Stalingrad region where prospecting is rapidly increasing, and where populated centers were partly ruined during the last war, the problem of housing is particularly acute. The lack of accomodations in this region was responsible for an excessive labor turnover. Drilling teams engaged in prospecting operations were scattered over a large territory. However, between 1954 and 1955 structural drilling activities were concentrated in the most promising areas of the Don and Medveditsa rivers. The first attempt to build a camp for a structural drilling crew was made near Archeda, the center of one of the richest petroliferous areas. Nine houses with 500 $m^2$ of living space were built there from light panel sections and elements of houses dismantled in other areas. Moreover, an office, repair shop, garage, electrical station and welfare premises were built there in the same manner. The construction

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Structural Drilling Crews Need (Cont.) SOV/92-58-6-8/30

cost of this camp amounted to 600,000 rubles. Although some people maintained that this expenditure was not justified, it is recommended that this example be followed in other areas because drillers accomodated with their families in such a camp may work in an area of some 100-150 km. surrounding the camp. The advantage of having living quarters for drillers engaged in exploratory operations, has been recognized and many structural drilling crews have started to build similar well organized camps. It is expected that in 1957-1958 the housing program will be further developed and implemented in the Stalingrad region. However, construction methods used for building drillers camps should be revised and improved. The panel assembly should consist mostly of uniform elements, the weight and size of which would permit their easy transportation. It is also necessary to develop a standard type of shelter for rigs and other drilling equipment. Efforts made in this regard by certain trusts, engaged in exploratory drilling, were not very successful. Problems connected with the accomodation of exploratory drilling crews still deserve serious attention.

ASSOCIATION: Geologo-razvedochnaya kontora tresta Stalingradneftegazrazvedka (Geological and Prospecting Office of the Stalingradneftegazrazvedka Trust)

Card 2/2 1. Petroleum industry—USSR 2. Personnel—Performance
3. Housing projects—Construction

URUSOV, A.V.; KETAT, O.B.; KOL'TSOVA, V.V.

Stratigraphic scheme of Permian and Triassic sediments in the Volga Valley portion of Volgograd Province. Trudy VNIING no.1:91-110 '62. (MIRA 16:10)

URUSOV, A.V.

Age and lithological complexes of the sulfate-carbonate series of the Lower Permian in the Volgograd region of the Volga Valley. Dokl.AN SSSR 145 no.2:396-399 Jl '62. (MIRA 15:7)

1. Volgogradskiy nauchno-issledovatel'skiy institut nefti i gaza. Predstavleno akademikom N.M.Strakhovym.
(Volgograd Province--Geology, Stratigraphic)

URUSOV, A.V.

Schwagerina horizon of the Volgograd region of the Volga Valley. Dokl.AN SSSR 145 no.3:646-649 Jl '62. (MIRA 15:7)

1. Volgogradskiy nauchno-issledovatel'skiy institut neftyanoy i gazovoy promyshlennosti. Predstavleno akademikom D.V.Nalivkinym.
(Volgograd Province--Geology, Stratigraphic)

KORENEVSKIY, S.M.; TRUSOV, A.V.; KOL'ISOVA, V.V.

New data on the Kungurian potassium potential in the western part of the Caspian syneclise and Volga Valley monocline. Lit. i pol. iskop. no.4:121-124 Jl-Ag '64. (MIRA 17:11)

1. Vsesoyuznyy nauchno-issledovatel'skiy geologicheskiy institut, Leningrad i Vsesoyuznyy nauchno-issledovatel'skiy institut i Volgogradskiy nauchno-issledovatel'skiy institut neftyanoy i gazovoy promyshlennosti.

URUSOV, A.V.; KETAT, O.B.; KOL'TSOVA, V.V.

Find of reef facies in the Permian sediments of the Northern Caucasus. Dokl. AN SSSR 160 no.5:1168-1171 F '65. (MIRA 18:2)

1. Volgogradskiy nauchno-issledovatel'skiy institut nefti i gaza. Submitted July 13, 1964.

UL'MISHEK, G.F.; KHENVIN, T.I.; LATSKOVA, V.Ye.; URUSOV, A.V.

Lower-Permian sediments of the western and northern parts of the north-Caspian oil- and gas-bearing basin. [Trudy] NIILneftegaza no.10:223-235 '63. (MIRA 18:3)

1. Nauchno-issledovatel'skaya laboratoriya geologicheskikh kriteriyev otsenki perspektiv neftegazonosnosti; Nizhnevolzhskiy nauchno-issledovatel'skiy institut geologii i geofiziki i Volgogradskiy nauchno-issledovatel'skiy institut neftyanoy i gazovoy promyshlennosti.

DUBOVSKOY, I.T.; LATYKOVA, V.Ye.; MAYNBERG, S.V.; URUSOV, A.V.; UL'MISHEK, G.F.; KHENVIN, T.T.

Upper-Permian and Triassic sediments of the western and northern parts of the north-Caspian oil- and gas-bearing basin. [Trudy] NIIneftegaza no.10:236-256 '63. (MIRA 18:3)

1. Nauchno-issledovatel'skaya laboratoriya geologicheskikh kriteriyev otsenki perspektiv neftegazonosnosti; Nizhnevolzhskiy nauchno-issledovatel'skiy institut geologii i geofiziki i Volgogradskiy nauchno-issledovatel'skiy institut neftyanoy i gazovoy promyshlennosti.

[illegible], [illegible] Ya.

New data on the [illegible] Triassic [illegible] slope of the Voronezh anteclise [illegible] Caspian syneclise. Izv. AN SSSR. [illegible] 1. [illegible] '65 [illegible]

1. Volgogradskiy nauchno-issledovatel'skiy [illegible] gazovoy promyshlennosti i Upravleniye [illegible]. Submitted June 13, 1964.

URUSOV, I. D. 178T46

USSR/Electricity - Generators Feb 51

"Economical Design of a Vertical Low-Power Hydroelectric Generator," I. D. Urusov, Cand Tech Sci, G. I. Shur, Engr, "Uralelektroapparat" Plant

"Elektrichestvo" No 2, pp 33-38

Results of search made by authors for economical design of hydroelectric generators for rural electrification. Found use of external rotor would be advantageous for this type mach. Generator is suitable for replacing 160- to 500-w VGS4-213 series. Submitted 4 Aug 50.

[redacted] 178T46

URUSOV, I.D.

Analysis of the stator current for a harmonically pulsating torque of a synchronous machine. Elektrichestvo '53, No.2, 29-36. (MLRA 6:3)
(EEA 56 no.672:4731 '53)

URUSOV, I.D.

The Committee on Stalin Prizes (of the Council of Ministers USSR) in the fields of science and inventions announces that the following scientific works, popular scientific books, and textbooks have been submitted for competition for Stalin Prizes for the years 1952 and 1953. (Sovetskaya Kultura, Moscow, No. 22-40, 20 Feb - 3 Apr 1954)

| Name | Title of Work | Nominated by |
|---|---|---|
| Kostenko, M.P. | "An Electrodynamic Model of a Power System" | Institute of Automatics and Telemechanics, Academy of Sciences |
| Latmanizov, M.V. | | |
| Urusov, I.D. | | |
| Ivanov, V.I. | | |
| Ryzhov, P.I. | | |
| Sokolov, T. N. | | |
| Semenov, V.V. | | |
| Zherebin, F.I. | | |

SO: W-30604, 7 July 1954



Authors : Kostenko, M. P., Academician, and I. D. Urusov, Kand. of Tech. Sci.

Title : Electrodynamic models of water-wheel generators of the Kuybyshev hydroelectric power station

Periodical : Elektrichestvo, 8, 11-19, Ag 1955

Abstract : Considering the imminent placing in operation of the Kuybyshev Hydroelectric Power Station, the Leningrad Branch of the Institute of Automation and Remote Control of the Academy of Sciences, USSR, undertook the study of certain problems emerging under conditions of long distance transmission of electric power. These problems arise particularly when loads near the limits of system stability requirements. Since many of these problems cannot be solved by computation or by mathematical analog methods, electrodynamic modeling was applied. The most difficult problem was to

AID P - 2937

Elektrichestvo, 8, 11-19, Ag 1955

Card 2/2 Pub. 27 - 2/15

design synchronous machine analogies of powerful turbo- and water-wheel generators and synchronous condensers. The authors present basic principles of such designs [illegible]

URUSOV, I.D.(Leningrad).

Analysis of vibration processes in synchronous motors accounting for excitation control. Izv.AN SSSR.Otd.tekh.nauk no.10:77-89 O'56. (MIRA 10:1)

1. Institut elektromekhaniki Akademii nauk SSSR.
(Electric motors, Synchronous) (Vibration)

IL'IN, V.A. KASHTELYAN, V.Ye.; POZIN, N.V.; URUSOV, I.D.

Electronic excitation regulator for synchronous generators operating on long-distance transmission lines. Izv.AN SSSR.Otd. tekh.nauk no.12:14-29 D '56. (MLRA 10:1)
(Electronic instruments) (Electric generators)

URUSOV, K.V.

YASTREMS'KIY, I.S., kandidat ekonomichnikh nauk; URUSOV, K.V.

Technological progress is the basis for the economical use of society's labor under socialism. Nauk.zap.Kiev.un. 15 no.9:21-31 '56. (MIRA 10:7)

1. Golovniy inzhener Kiivs'kogo mashinobudivnogo zavodu "Chervoniy ekskavator."
(Technology) (Efficiency, Industrial)

Urusov, I. D.

ELECTRICAL ENGINEERING

AUTHORS: Sukhanov, L.A. and Urusov, I.D. (Leningrad). 24-4-2/34

TITLE: Investigation of the movement of a rotor of a ...nchronous salient pole generator in the case of a sudden three-phase short-circuit. (Issledovanie dvizheniya rotora sinkhronnogo yavnopolyusnogo generatora pri vnezapnom trekhfaznom korotkom zamykanii).

PERIODICAL: "Izv. Ak. Nauk, Otd. Tekh. Nauk" (Bulletin of the Ac. Sc., Technical Sciences Section, 1957, No.4, pp.5-13 (USSR).

ABSTRACT: Calculation of the dynamic stability by methods generally used does not take into consideration the braking torques produced by the super-transient and aperiodic components of the short-circuit current. Investigations of this problem by Kazovskiy, E. Ya. (Elektrichestvo, 1954, No.7) showed that these moments affect appreciably the acceleration of the rotor during a short-circuit near to the terminals of the generator. The aim of the work described in this paper was to work out a sufficiently general and accurate analytical method of determination of the changes in the speed and the displacement angle of the relative movement of the rotor in three-phase short-circuits, taking into consideration a number of important factors, e.g. the speed and displacement angle components caused by the additional moment, eq.(2.5), p.7, the pulsation moment in

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APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001858110005-2"

the case of a three-phase short-circuit, eq.(3.2), p.7, the components of the speed and the displacement angle caused by the pulsation moment in the case of a three-phase short-circuit from the no-load state, eq.(4.1), p.8 and for the case of a three-phase short-circuit from a loaded state, eq.(4.2), p.8. On the basis of the derived formulae, the movement of a rotor during a short-circuit of a generator of a model simulating the Kuibishev-Moscow transmission system is calculated and the obtained results are compared with an oscillographic recording of the rotor displacement angle. The movement of a rotor of a synchronous generator incorporating a full longitudinal-transverse damping winding is investigated for the case of a three-phase short-circuit at the beginning of the transmission line Kuibishev-Moscow, comparing the calculated results with the results of experimental data obtained on the model. The here applied method of calculation of the movement of the rotor of a synchronous generator can be extended to any short-circuit provided the respective formulae are used for the additional and the pulsation moments (3). In this paper one of the authors investigated the components of the speed and the changes in the displacement angle of the rotor of the generator

Investigation of the movement of a rotor of a synchronous salient pole generator in the case of a sudden three-phase short-circuit.(Cont.). 24-4-2/34

during sudden short-circuits and obtained formulae for the pulsation moment which take into consideration the generator load. The other author has applied an earlier published formula (3) for analysing the components of the additional moment and derived a function for approximating this formula and proposes a method of simulating the boundary conditions in the case of a short-circuit. The experimental part of the work was carried out on an electrodynamic model of the Institute of Electromechanics of the Ac.Sc. under the guidance of M.P. Kostenko. Fig.1 shows a plot of the additional moments of the generator under consideration fitted with a damper winding; plot Fig.2 shows the influence of forcing the excitation voltage of a model generator with a damper winding on the increase in the displacement angle of the rotor; Fig.3 shows the moment-displacement angle characteristic of the transmission system; Fig.4 shows a schematic diagram of the transmission line; plot Fig.5 shows curves of the increase of the displacement angle of the rotor; plot Fig.6 shows the speed of the generator rotor in absence of active losses, with active losses and on taking into consideration the periodic speed component; plot Fig.7 shows the influence

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Investigation of the movement of a rotor of a synchronous salient pole generator in the case of a sudden three-phase short-circuit (Cont.).

24-4-2/34

of the aperiodic component of the stator current on the increase in the displacement angle; plot Fig.8 shows the components of the rotor displacement angle for the generator equipped with a full damper winding; plot Fig.9 shows the influence of various parameters on the increase of the rotor displacement angle of a model generator without a damping winding; Fig.10 shows an oscillogram of a three-phase short-circuit from nominal load at the beginning of the line of the model of the Kuibishev-Moscow transmission line; Fig.11 shows the method of determination of the necessary holding time of the short-circuit based on the condition of equality of the speeds of the rotor of the model and of the simulated machine at the instant of disconnection on the basis of calculations as well as on the basis of the oscillogram of the model.

Card 4/4

There are 5 Russian references.

SUBMITTED: May 3, 1956.

AVAILABLE:

URUSOV, I.D., kand.tekhn.nauk.

Asynchronous characteristics of synchronous machines. Vest. elektroprom. 28 no.8:1-7 Ag '57. (MIRA 10:10)

1. Institut elektromekhaniki AN SSSR.
(Electric motors, Synchronous)

URUSOV, I.D.

105-58-5-25/22

AUTHOR: Sergeyev, A.S., Docent

TITLE: Dissertations (Dissertatsii)

PERIODICAL: Elektrichestvo, 1958, Nr 5, pp. 91-92 (USSR)

ABSTRACT: For the Degree of Candidate of Technical Sciences.
At the Ural Polytechnic Institute imeni Kirov (Ural'skiy politekhnicheskiy institut im. Kirova):
S.D.Levintov on June 27, 1949 "Electromechanic Transition Processes in a Synchronous Motor in the Case of Periodic Load (of the Compressor Type)". Official opponents: N.S.Siunov, Professor, Doctor of Technical Sciences, I.D.Urusov, Docent and A.T.Blazhkin, Candidate of Technical Sciences.
I.S.Pinchuk on June 27, 1949 "Electromechanic Transition Processes in Asynchronous Motors". Official opponents: N.S.Siunov, Professor, Doctor of Technical Sciences. A.A.Yanko-Trinitskiy, Docent, Candidate of Technical Sciences and P.M.Chudnovskiy, Engineer.
I.D.Urusov on June 27 1949 "The Mechanical Strength of the Casing of Electric Machines Subjected to the Action of Electromagnetic Loads". Official opponents: I.B.Sokolovskiy, Doctor of Technical Sciences and M.V.Belyayev, Docent, [illegible]

Card 1/4

Dissertations

105-58 5-25/28

S.P.Sitnikov on March 6, 1950 "Some Problems Connected with the Theory of Arc-Extinguishing Devices". Official opponents: N.S.Siunov, Professor, Doctor of Technical Sciences, V.G.Stepanov, Docent, Candidate of Technical Sciences and V.M.Sin'kov, Docent, Candidate of Technical Sciences.
D.M.Shakhray on June 26, 1950 "The Investigation of a Special System for the Electric Equipment of Dredges". Official opponents: I.B.Sokolovskiy, Professor, Doctor of Technical Sciences, M.V. Belyayev, Docent, Candidate of Technical Sciences and A.Ye.Tropp, Candidate of Technical Sciences.
G.P.Kropachev on June 30, 1953 "Investigation of an Asynchronous Starter in Synchronous Machines with Salient Poles and Without Starter Cage". Official opponents: N.S.Siunov, Professor, Doctor of Technical Sciences, S.A.Volotkovskiy, Doctor of Technical Sciences and M.A.Pirumyan, Docent.
V.P.Shasherin on January 18, 1954 "Some Problems of Cathode-Oscillographic Measurements when Testing High-Frequency Apparatus". Official opponents: N.S.Siunov, Professor, Doctor of Technical Sciences and V.G.Stepanov, Candidate of Technical Sciences.
R.N.Urmanov on June 7, 1954 "Investigation and Calculation of Circuits with a Three-Phase Welding Arc". Official opponents: S.A.Volotkovskiy, Professor, Doctor of Technical Sciences and G.P.Mikhaylov, Professor, Doctor of Technical Sciences.

Card 2/4

[illegible]

At the [illegible]

[illegible]). G.F.Pukhova on March 20, 1947 "On the Problem of the Automatic Re-Connection of Individual Lines in the Case of Electric Trans-mission with Bilateral Feed". Official opponents: V.A.Voronov, Professor, Doctor of Technical Sciences and I.D.Kutyavin, Candi-date of Technical Sciences.

Card 3/4

Dissertations

105-58-5-25/28

A.N.Zhilin on April 26, 1950 "Transition Processes in Three-Phase Circuits in the Case of Non-Simultaneous Phase Connection". Official opponents: V.K.Shcherbakov, Professor, Doctor of Technical Sciences and Yu.Ye.Nebolyubov, Docent, Candidate of Technical Sciences.

V.A.Abakumov on June 30, 1950 "Automation of a Series-Wound Motor According to the Leonard Circuit with Shunt-Wound Generator". Official opponents: I.A.Balashev, Professor, Doctor of Technical Sciences and L.I.Gandzha, Docent, Candidate of Technical Sciences.

V.U.Kostikov on March 13, 1954 "Methods of Determining Equivalent Specific Electric Conductivity". Official opponents: V.K.Shcherbakov, Professor, Doctor of Technical Sciences and V.N.Titov, Docent, Candidate of Technical Sciences.

AVAILABLE: Library of Congress

PERIODICAL: Elektrichestvo, 1958, Nr 12, pp 34 - 38 (USSR)

ABSTRACT: Here a criterion of stability and a method are proposed to ascertain roots of a characteristic equation. The method depends on the immediate use of the so-called instantaneous frequency characteristic $M(j\omega)$ of a synchronous machine with distinct poles. To strengthen the damping qualities [illegible] device, the so-called block for the attenuation of the oscillation. The first and the second derivation of the angle are realized in this block. The following is established on the basis of the investigation carried out here: 1) To analyse the stability it is possible to use a criterion which depends on the application of a fractional function of a closed system

Card 1/2

$m(p) = \frac{L(p)}{R(p)}$. M(p) is the moment characteristic of the system.

$p = j\omega$. 2) The characteristic for the stability of the system is the rotation of the vector of the moment frequency characteristic $M(j\omega)$ round the angle

$\varphi = (n - k)\frac{\pi}{2} = \frac{\pi}{2}$, independent of the number of the circuits at the rotor, that is to say, independent of the degree "n" of the characteristic polynomial of the system. 3) The real and the imaginary component of the vector $M(j\omega)$ contain the synchronizing and the specific damping moment at [illegible] "m" [illegible]

URUSOV, I.D., Doc Tech Sci -- (diss) "Linear theory of ~~vibrations~~ oscillations of a synchronous machine." Len, 1959. 32 pp with ill. (Len Polytech Inst im M.I. Kalinin). 175 copies. Bibliography at end of text (17 titles) (KL, 37-59, 108)

21



(Electric networks--Electromechanical analogies)

S/024/59/000/06/004/028
E194/E255

AUTHOR: Urusov, I. D. (Leningrad)

TITLE: Methods of Extending the Limiting Output of Turbo-Alternators

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1959, Nr 6, pp 22-33 (USSR)

ABSTRACT: The use of forced cooling in turbo-alternators offers new prospects of increasing the unit output. There is a limit beyond which the output cannot be further increased without increasing the size of the machine; this limit is set by the overload capacity and efficiency of the alternator. It has been calculated that with alternators of current dimensions it will not be possible to exceed outputs of the order of 400 to 500 MW. Further increase in unit output when using forced gas or liquid cooling will involve the use of new rotor diameters and lengths, that is, there will be a general increase in mechanical stress. Thus, in considering the possibility of designing machines of the order of 750 to 1000 MW the use of forced cooling should be considered in combination with increase in dimensions. The present article offers basic

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considerations for the design of generators of 750 to 1000 MW and some information is given about a tentative design for such a machine. The article is based on a report presented at a general meeting of the Technical Science Division of the Ac. Sc. USSR on 26 May, 1959. There are optimum values of rotor diameter and length for any type of electrical machine. Increasing the diameter beyond the optimum value increases the losses and consumption of material, and influence the overload factor, or synchronous reactance as shown, by expression (1.1). In turbo-generators with forced cooling, and particularly with liquid cooling, the main factor governing the heating of the copper is the maximum temperature-rise of the cooling medium. Assuming that all the heat is removed by the water, heating of the water is given by expression (1.3). Here one term corresponds to axial flow of heat along the conductor, and the second corresponds to heat transfer from the copper to the cooling liquid. A graph of the copper temperature distribution along the length of the hollow conductor cooled by water under particular experimental

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conditions is given in Fig 4. This case is typical in that the influence of axial flow of heat along the conductor is small, so that expression (1.3) can be simplified. An expression is then given for the rate of flow of water in the conductor. It will be seen from the curves plotted in Fig 4 that the temperature varies linearly along the length of the conductor, so that heat flow along the conductor is really negligible. Therefore, machines of similar geometry will be thermally similar provided that the temperature and the current density are constant. Thus the linear current-loading is proportional to the pole pitch and so to the diameter. This is also true for machines of standard construction, as will be seen from Fig 5 where linear loading and air-gap induction in large turbo-alternators are plotted against diameter. The relationship between the rotor diameter and the main electrical characteristics is then considered, including the static and dynamic overload capacity, the efficiency and the consumption of iron and copper. Equations are derived which show that on

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increasing the rotor diameter with constant current density and air-gap induction, there is a reduction in the main losses and in the consumption of active material. An assessment of static overload capacity is then made, and expression (1.12) is derived for the maximum static torque. It follows from this equation that the synchronous reactance must be maintained constant when comparing the main characteristics of machines of different diameters. The linear loading of the rotor follows the same law as the linear loading of the stator, and the transient reactance is related to the linear dimensions of the machine by the approximate expression (1.16). This means that the transient reactance is proportional to the diameter. Hence arises one of the main difficulties in ensuring dynamic stability on increasing the unit output of turbo-alternators. The inertia constant, which is one of the most important characteristics governing the dynamic properties of the machine, is given by expression (1.17) and it is shown that this too is proportional to diameter. This simple analysis is used as a basis to compare two methods of

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increasing the unit output. Firstly, by increasing the current density while maintaining the diameter and length constant and, secondly, by increasing the diameter and length while maintaining a constant current density. The comparison shows that when the first of these two methods was used, the specific consumption of material and consequently the capital cost was less, but the total costs, including the cost of annual losses were much higher. The main characteristics of the machine in the two cases are compared graphically in Fig 7. It will be seen that increasing the output by increasing the rotor diameter gives better static and dynamic stability and is much more economical. These considerations are based on analysis of a number of geometrically similar machines. Actual machines are not always similar because there are practical reasons against increasing the rotor diameter. However, the relationships are qualitatively valid and confirm the advantages that result from increasing the rotor diameter. The influence of mechanical strength on rotor diameter is then considered. It is stated that the higher unit outputs obtained in the USA are not due to the

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use of 60 c/s, which confers no benefit in this respect when the rotor size is limited by considerations of strength. The reason is rather the acceptance of lower factors of safety in respect of mechanical strength than in the USSR. A general discussion of the mechanical strength of rotors follows, and a graph of stress distribution in a rotor is given in Fig [illegible]. A particular American Westinghouse rotor has a factor of safety of 1.15, which is 30% less than is used in the USSR. Consideration of the theory of elastic-plastic strains indicates that it may in fact be permissible to reduce the apparent safety factors and further investigation of this question is undoubtedly required. After the rotor has reached the plastic condition, remanent stresses when it is stationary have the effect of reducing the maximum stress on the rotor when it is next run up to speed, so increasing the safety factor. Calculations on this problem have been made by the method of successive approximations, either using the condition of equilibrium, as in Eq (2.5), or the condition of plasticity, as in Eq (2.6). Further investigations may reveal the possibility of increasing rotor diameters by making use

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of this effect. The strength of rotor end-bells is of particular importance, and allowing for stress due to centrifugal force of the end windings, the safety factor may be calculated by expression (2.8). The mechanical properties and stresses set up in end bells of nickel-steel, duralumin and titanium are compared in Table 1. A Societ 200 MW alternator has an end bell of steel 1075 mm diameter. Using the same safety factor, an end bell of titanium alloy could have a diameter of 1240 mm. The opinion has been expressed that a most important characteristic of titanium alloy for use in end bells is its plasticity, which should be comparable with that of the best grades of nickel-steel for end bells. Vibration questions are then considered. Increasing the rotor diameter to 1240 mm increases the second critical speed well above the rated speed but the stator may be near to resonance at a frequency of 100 c/s. This question has been studied at the Institute of Electro-Mechanics of the A. S. of the USSR using physical models made of

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transparent plastic on a scale of [illegible] to [illegible]. A

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photograph of a typical model is shown in Fig 9. These models were used in designing a 750 MW turbo-alternator, the cross-section of which is given in Fig 10, the natural frequency of the stator being near 100 c/s. It was considered that when the magnetic steel had been assembled this frequency would be somewhat reduced. Arising out of the considerations discussed in this article, a draft design was made for a 750 MW turbo-generator with the possibility of forcing the output to 1000 MW. The rotor was designed for a diameter of 1250 mm with a safety factor of 1.5 at runaway speeds. The length of the cylindrical part of the rotor is 6500 mm and the air gap is 150 mm. The stator voltage is 27 kV and the stator current 17825 A. The stator and rotor windings are cooled directly by water which is heated by 30°C. The steel is cooled by hydrogen flowing in a closed circuit. A number of features of the machine design require experimental checking and further development. Particularly, the possibility of using titanium and other light alloys for end bells

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AUTHORS: Urusov, I. D., Candidate of Technical Sciences,
Podrez, V. M., Engineer

TITLE: Physical Model Tests on the Rigidity and Vibration Strength of the Stator Casing of an Electric Machines

PERIODICAL: Elektrichestvo, 1959, Nr 10, pp 43-47 (USSR)

ABSTRACT: The authors investigated here the mechanical properties which cannot accurately be calculated on the model of a stator casing. The main principles of the model construction, the method of investigation, and the test results are given. V. K. Ferront and V. N. [illegible] assisted in the tests. It was concluded from the results that the method of physical model tests can be applied to [illegible]

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models as well as the measurement of deformations and characteristic vibration frequencies. The model tests indicated a great difference between calculated and experimental values of the rigidity and characteristic vibration frequency of casings with perforated transverse ring walls. Additional investigations of the perforated ring walls by the optical method disclosed the physical pattern of stress distribution and showed that the great decrease in the casing strength was due to the variation in the [illegible] ring, resulting from the holes in the transverse wall of the casing. The model tests revealed that the characteristic frequency of the casing depends to a large extent on the base rigidity and the manner in which the casing is mounted on the base. The tests proved the usefulness of an "elastic" casing, i.e. of a casing having a frequency of the fundamental characteristic vibrations below that of the exciting forces (100 cycles). There are 5 figures, 2 tables, and 3 Soviet references.

ASSOCIATION: Institut elektromekhaniki AN SSSR (Institute of Electromechanics of the AS USSR)

SUBMITTED: January 12, 1959

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URUSOV, Izmail Dzhankhotovich (Inst~~itute~~ of Electromechanics, Acad Sci USSR) - Leningrad Dept ~~Division~~) for Doc of Technical Sci on the basis of

ANEMPODISTOV, V.P.; KASHARSKIY, E.G.; URUSOV, I.D.; CHIZHOV, A.A., red. izd-va; KRUGLIKOVA, N.A., tekhn.red.

[Problems of the manufacture of large turbogenerators] Problemy krupnogo turbogeneratorostroeniia. Moskva, Izd-vo Akad.nauk SSSR, 1960. 73 p. (MIRA 13:1)

(Turbogenerators)

Lineynaya teoriya kolebaniy sinkhronnoy mashiny (Linear Oscillation Theory of Synchronous Machines) Moscow, Izd-vo AN SSSR, 1960. 365 p. Errata slip inserted. 5,000 copies printed.



Sponsoring Agency: Akademiya nauk SSSR. Institut elektromekhaniki.

Ed.: V.F. Fedorov; Ed. of Publishing House: I.V. Barkovskiy; Tech. Ed.: R.Ye. Zendel'.

PURPOSE: This book is intended for scientific and technical personnel concerned with the automation of industry.

COVERAGE: The book develops the bases of the oscillation theory of synchronous machines, and clarifies the effect of automatic control of self-excitation on certain important characteristics and indices of synchronous machines. The author thanks Academician M.P. Kostenko, and Engineers V.F. Fedorov and R.Kh. Safiullina. There are 49 references: 44 Soviet, 4 English and 1 French.

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Study of the slot geometry of a series of large synchronous machines using an electronic computers. Elektrotekhnika no.2:15-42 F '63. (MIRA [illegible])

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ACC NR: AP6025885

SOURCE CODE: UR/0292/66/000/005/0002/0006

AUTHOR: Urusov, I. D. (Doctor of technical sciences); Polyashov, L. I. (Engineer)

ORG: none

TITLE: Steady-state processes in a synchronous generator supplying a pulsed load

SOURCE: Elektrotekhnika, no. 5, 1966, 2-6

TOPIC TAGS: synchronous generator, pulsed load

ABSTRACT: Operation of a synchronous generator supplying a periodically discharging capacitor load is analyzed theoretically. Differential equations for stator and rotor circuits and flux linkages were solved on a digital computer with the ... (1) Stator current contains 3rd, 5th, 7th ... harmonics; (2) Higher harmonic amplitudes ... and rotor current ... [illegible]

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