The Influence of Peptizers on the Efficiency of a Plodder in SOV/72-59-7-3/19
Manufacturing Faience Materials and Kaolin-bentonite-suspensions

plodder the current consumption being measured by means of a self-recording wattmeter of the system D-333. The test results are represented in figure 1 till 5 and subsequently explained. The influence of the peptisation on the processing conditions is evident both from the former investigations of the authors of this paper and F. D. Ovcharenko (Footnote 4) and from the investigations of G. V. Kukolev and Ya. M. Syrkin (Footnote 5). The maximum output of the plodder is attained by constant number of revolutions of the worm shaft at the optimum suspension viscosity. The test results agree with the former studies of the authors of this paper and G. V. Kukolev and A. N. Korol' (Footnotes 6 and 7). Conclusions. Bentonite additions to kaolin suspensions and faience materials increase the output of plodders considerably and lower the current consumption. An even greater effect is caused by the addition of some peptizers. There are 5 figures, 2 tables, and 11 references, 9 of which are Soviet

Card 2/2

PITAK, N. V.

Cand Tech Sci - (diss)"Effect of bentonite on the properties of clayey suspensions, faience dross, mass and finished articles." Khar'kov, 1961. 20 pp; (Ministry of Railways USSR, Khar'kov Inst of Railroad Transport Engineers imeni S. M. Kirov ; 150 copies; free; list of author's works at text's end (10 entries); (KL, 6-61 sup, 225)

KUKOLOV, G.V.; STRELETS, V.M.; PITAK, N.V.; AMERIKOVA, T.A.

Sectional nozzles for the continuous pouring boiling steel. Ogneupory 25 no.8:352-356 '60. (MIRA 13:9)

1. Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov.
(Steel--Metallurgy)

KUKOLEV, G.V., [Kukoliov, H.V.]; PITAK, N.V. [Pytak, M.V.]

Change in the properties of bentonite suspensions due to the effect of peptizers. Dop.AN URSR no.6:772-775 '61.
(MIRA 14:6)

1. Khar'kovskiy politekhnicheskiy institut. Predstavleno akademikom AN USSR P. P. Budnikovym.
(Bentonite)
(Colloids)

15(2) V/72-[illegible]

AUTHORS: Kukolev, G. V., Professor, Doctor of Technical Sciences,
Pitak, N. V.

TITLE: Utilization of Bentonite in the Production of Faience Products
(Ispol'zovaniye bentonita dlya proizvodstva fayansovykh izdeliy)

PERIODICAL: Steklo i keramika, 1[illegible], Nr [illegible], pp [illegible] - 26 (USSR)

ABSTRACT: The addition of bentonite improves the plasticity of the pastes and increases the solidity and water stability of the semifinished products in the air-dry state, whereby a transition to a single burning of the products is rendered possible. Moreover, bentonites as well can reduce the burning temperature of porcelain products, as may be seen from papers published by G. P. Fili[illegible]tsev, M. A. Bezborodov, [illegible] Pumanov, and V. P. Shvayko (Ref 1). In the field of the use of bentonite in faience pastes there exist only a few papers by M. A. Bezborodov, Ye. [illegible], [illegible], [illegible], and I. Ya. Piven' (Ref 2). It may be seen therefrom that bentonites can be used for the production of faience tiles and plates. The authors of this article made experiments in the [illegible] field. The chemical composition of the raw materials used herein is shown in table 1. The viscosity of clay was determined by means of the viscosimeter V- , (Figures 1, ,

Card 1/2

Utilization of Bentonite in the Production of Faience Products [illegible]

and 3 show the effect of the type and the quantity of additions on viscosity. Table 1 shows the compositions and essential properties of the clays and kaolins. In connection with the performance of these experiments the authors of this article refer to papers published by G. V. Kukolev, Ya. M. Syrkin (Ref [illegible]), I. A. Kryukov, and N. A. Komarov (Ref 1). Figure 4 shows the dependence of the ability to retain water on pressure and figure 5 the volumetric changes of the samples in drying at 110°. The filterability of the clays was determined by means of a vacuum filter which is described in papers published by Ya. M. Syrkin, L. N. Bernshteyn, and K. L. Kiseleva (Ref 5). The best filterability of clay mixtures with an increased kaolin content and a bentonite addition as may be seen from table 3. Conclusions: Products of this clay show less shrinkage after drying and burning than products of faience with a content of Chasov-yarskiy clay and exhibit a considerable whiteness. The water absorption of the products can be reduced to [illegible] by the addition of [illegible] feldspar to the clay. There are [illegible] figures, [illegible] tables and 5 Soviet references.

STRELETS, V.M., PITAK, N.V.

Increasing the strength of stoppers of 140-ton steel-pouring ladles. Ogneupory 25 no.4:171-175 '60. (MIRA 13:8)

1. Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov.
(Steelworks--Equipment and supplies)
(Refractory materials)

KUKOLEV, G.V.; PITAK, N.V.

Effect of the type and amount of peptizators on the modification of structural and mechanical properties of a bentonite suspension. Izv. vys. ucheb. zav.; khim. i khim. tekh. 2 no.2:244-246 '59.
(MIRA 12:9)

1. Khar'kovskiy politekhnicheskiy institut imeni V.I. Lenina. Kafedra keramiki, stekla, ogneuporov i emalirovaniya.
(Bentonite)

69592

S/131/60/000/04/05/015
B015/B008

18 4000 15.2200

AUTHORS: Strelets, V. M., Pitak, N. V.

TITLE: Increasing the Stability of Stoppers of 140 t Steel-casting Ladles

PERIODICAL: Ogneupory, 1960, Nr 4, pp 171-173

TEXT: In the paper under review the authors describe the function of the chamotte pipes SP-8-2, SP-8-4 and the chamotte stoppers SP-13-1 of the Zaporozhskiy ogneupornyy zavod (Zaporozh'ye Works for Refractories), the quartz-kaolin pipes SP-8 of the Prosyanovskiy kaolinovyy kombinat (Prosyanaya Kaolin Kombinat), magnesite sleeve bricks of the Chasov-Yarskiy kombinat ogneupornykh izdeliy (Chasov-Yar Kombinat for Refractories) and sleeve bricks of the Konstantinovskiy ogneupornyy zavod "Krasnyy Oktyabr'" (Konstantinovka Works for Refractories "Krasnyy Oktyabr'"). I. I. Druzhinin, Yu. Z. Babaskin, and A. N. Slin'ko participated in the experiments. The physicochemical properties of the materials used are mentioned in table 1. The pipes are corroded most by slag (Fig. 1). Examples of the wear of the pipe seams and the sleeve bricks are shown in Figs. 2 and 3 and the varied insulation of the stopper rods in Fig. 4. Mortar of varied composition was tested in the experiments (Table 2) in order to

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Increasing the Stability of Stoppers of
140 t Steel-casting Ladles

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S/131/60/000/04/05/015
B015/B008

eliminate the corrosion of the pipe seams The authors in conclusion underline that the amount of slag in the ladle constitutes one of the main factors for the corrosion of the stopper pipes The tearing-off of the spherical part of the stopper, caused by the formation of a crust between sleeve brick and stopper, can be eliminated by a graphite covering The corrosion of the pipe seams may be reduced by using quality mortar for the insulation of the stoppers A highly aluminous coating of the stopper pipes eliminates their wear There are 4 figures, 2 tables, and 9 references, 8 of which are Soviet

ASSOCIATION Ukrainskiy nauchno issledovatel'skiy institut ogneuporov (Ukrainian Scientific Research Institute of Refractories)

Card 2/2

PI[illegible]K, N.V.

Nozzles for the semicontinuous casting of stainless steel under synthetic slag. Ogneupory [illegible] no.3[illegible]

(MI[illegible])

1. Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov.

5(1,2) SOV/153-2-2-19/31

AUTHORS: Kukolev, G. V., Pitak, N. V.

TITLE: Change of the Structural and Mechanical Properties of the Bentonite Suspension in Its Dependence Upon Kind and Quantity of Peptizers (Izmeneniye strukturno-mekhanicheskikh svoystv bentonitovoy suspensii v zavisimosti od roda i kolichestv peptizatorov)

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Khimiya i khimicheskaya tekhnologiya, 1959, Vol 2, Nr 2, pp 244 - 246 (USSR)

ABSTRACT: The questions of the influence of various electrolytes and surface-active substances on the suspension mentioned in the title (Refs 1-3) have not been investigated sufficiently. Some electrolytes cause the development of coagulation structures (Ref 4). Alkaline electrolytes accelerate and harden the thixotropic structures of the bentonite suspension (Ref 5). NaOH liquefies such a suspension, but only in the absence of CO_2 of the air.

Pyzhevskiy bentonite was examined (Khmel'nik area UkrSSR). According to Ovcharenko (Ref 7), the compound water here amounts to 20% and the specific surface to 736 m^2/g. A rotary viscosimeter of the type RV - 8 (Ref 8) served for its determination at room

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Change of the Structural and Mechanical Properties of the SOV/153-2-2-19/31
Bentonite Suspension in Its Dependence Upon Kind and Quantity of Peptizers

temperature. Peptizers were: soda, caustic soda, soda extracts of peat and straw, water glass, peat extract with water glass, vinasse of sulfite spirit and tannin. The concentration of solid substances in the system amounted to 33%. The suspension was left standing for 8-10 hours. The structure developed in that time (Ref 9), was carefully destroyed by shaking. Figure 1 and 2 show the results of the definition. From them one can see that the peptizers change the viscosity and the threshold shear stress of the bentonite suspension in a much larger field of sizes, with the same moisture content. According to their effect, peptizers may be divided into 3 groups: 1. those which reduce the solidity of the structure - liquefier; 2. those which increase this solidity; 3. surface-active admixtures which take an intermediate position between 1. and 2. and which have little influence on the indices of the structural mechanical properties. 1. includes: water glass and water glass extract of peat. The bentonite in suspension, together with these admixtures, is peptized under the influence of alkali developed due to the hydrolysis of the alkaline electrolyte. Thus the penetration of water into the interior of the structure is favored.

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Change of the Structural and Mechanical Properties of the SOV/153-2-2-19/31
Bentonite Suspension in Its Dependence Upon Kind and Quantity of Peptizers

Colloidal silicic acid however envelops the bentonite particles or their aggregates with a protective film of sufficient strength. In this way the penetration of water mentioned before is prevented. Thus conditions are created under which the liquefying influence of the alkaline cations and OH ions on the bentonite suspension is made effective. That is how a considerable reduction of viscosity and of the threshold shear stress develops. 2. Peptizers of this group: soda, caustic soda, soda extracts of peat and straw increase the dispersion of the bentonite pools most. Thus the mechanical properties of the suspension are increased (curves 1-4, figures 1 and 2). Na^+ and OH^- ions liquefy the suspension only in the absence of CO_2 (Ref 6). 3. Among them there are the surface-active organic substances: sulfite spirit, vinasse and tannin. The curves 5 and 6 show a weak effect on the reduction of the structural and mechanical properties. There are 2 figures and 10 references, 9 of which are Soviet.

ASSOCIATION: Khar'kovskiy politekhnicheskiy institut imeni V. I. Lenina; Kafedra keramiki, stekla, ogneuporov i emalirovaniya (Khar'kov Polytechnic Institute imeni V. I. Lenin, Chair of Ceramics, Glass, Refractories,

Card 3/4

Change of the Structural and Mechanical Properties of the SOV/153-2-2-19/31
Bentonite Suspension in Its Dependence Upon Kind and Quantity of Peptizers

and Enamelling)

SUBMITTED: March 5, 1958

Card 4/4

21-58-5-21/28

AUTHORS: Kukolev G V and Pitak, N V

TITLE: Water Retention Properties of Kaolin, Bentonite and Faience Masses (Vodouderzhivayushchaya sposobnost' kaolina bentonitov i fayansovykh mass)

PERIODICAL: Dopovidi Akademii nauk Ukrains'koi RSR 1958, Nr 5 pp 549-553 (USSR)

ABSTRACT: The authors describe their experiments in determining the water tetention properties of various materials such as kaolin, bentonite obtained from different regions clay and faience masses The experiments have shown that bentonite possess the greatest retainability These experiments were carried out under various pressures and their results are represented by graphs showing the amount of water (V) plotted versus the pressure applied (P). The P V curves of kaolin suspensions and faience masses show horizontal or sloped sections in certain ranges of pressure Peptizers increase the water retention properties of pure kaolin and bentonite suspension at all pressures, as well as their mixtures, and of faience masses at low pressure (up to 30 kg/sq cm) It is shown that the P-V curves are described by empirical formulas. Equations for the calculation of the quantity μ (being a derivative

Card 1/2

21-58-5-21/28

Water Retention Properties of Kaolin Bentonite and Faience Masses

of pressure with respect of water amount (V) are derived from these formulas Given is the dependence of Ω on the values of P and the kind of the peptizers used There are 4 graphs 1 table and 9 Soviet references

ASSOCIATION Khar kovskiy politekhnicheskiy institut (Khar kov Polytechnic Institute)

PRESENTED: By Member of the AS UkrSSR P P Budnikov

SUBMITTED: October 24 1957

NOTE: Russian title and Russian names of individuals and institutions appearing in this article have been used in the transliteration

[illegible]

Card 2/2

S/131/62/000/006/[illegible]
B117/B101

AUTHORS: Strelets, V. M., Pitak, N. V., Kulik, A. I., Logachev, [illegible]

TITLE: Laboratory investigations of the technology of zircon products

PERIODICAL: Ogneupory, no. 6, 1962, 265-268

ABSTRACT: The influence of the following factors on the physico-chemical properties of zircon products was studied: grain composition, molding pressure, burning temperature, admixtures of clay, raw zircon concentrate ([illegible] -47 ([illegible]-47)), and raw non-ferrous zircon ([illegible]-54 ([illegible]-54)), the object being to establish optimum masses and working standards for the production of proportioning ladles for use in continuous steel-casting foundries. The lowest apparent porosity and the highest weight by volume were determined after drying (at 120°C) of samples made up of 1.5-0.5 mm grains (50%) and of < 0.060 mm grains (50%), and after burning (at 1550°C for 2 hrs) of samples made up of 1.5-0.5 mm grains (30%) and of < 0.060 mm grains (70%). A pressure of 500 kg/cm² was found sufficient for the production of dosing cups, as an increase in

Card 1/2

Laboratory investigations of ...

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B117/B101

pressure from 500 to 1250 kg/cm² reduced the apparent porosity by [illegible] only. The fine grain size (< 0.088 mm) of burned zircon [illegible] be replaced by the same grade of raw zircon. An increase of the [illegible] temperature from 1550 to 1650°C raised the linear shrinkage from [illegible] and the compressive strength from [illegible] to [illegible] kg/cm². [illegible] of [illegible] clay improved the plasticity and made molding easier. [illegible] strength products ([illegible] kg/cm²) were obtained at lower temperature ([illegible]°C). Raw zircon and zircon concentrate may be used for small [illegible] products, which must be burned at < 1550°C to avoid [illegible]. Addition of clay reduces the temperature of sample destruction under [illegible] kg/cm² by [illegible]°C. This temperature reduction is smaller [illegible] of burned zircon. There are [illegible] figures and [illegible] tables.

ASSOCIATION: Ukrainskiy nauchno-issledovatel'skiy institut [illegible] (Ukrainian Scientific Research Institute of Refractory Materials) (Strelets, V. [illegible], Pitak, N. V.); Chasov-[illegible] kombinat ogneupornykh izdeliy (Chasov Yar Combine of Refractory Products) (Kulik, A. I., Logachev, M. S.

Card 2/[illegible]

S/131/60/000/008/001/003
B021/B058

AUTHORS: Kukolev, G. V., Strelets, V. M., Pitak, N. V., Amerikova, T. A.

TITLE: Compound Pouring Ladle Nozzle Lining for the Casting of Rimmed Steel in Installations for Continuous Steel Casting

PERIODICAL: Ogneupory, 1960, No. 8, pp. 352-356

TEXT: It was the authors' task to elaborate a ladle nozzle lining, which undergoes only slight wash-out, is not clogged by metal, and warrants a satisfactory jet without spattering or eddies. Highly aluminous zirconium- and magnesite inserts for the compound pouring ladle nozzle lining were produced at the Opytnyy zavod (Experimental Plant) of the UNIIO (Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov - Ukrainian Scientific Research Institute of Refractories). The pouring ladle nozzle linings were produced at the Chasov Yarskiy kombinat ogneupornykh izdeliy (Chasov Yar Kombinat of Refractories), the working processes having been previously elaborated at the Experimental Plant of the Ukrainian Scientific Research Institute of Refractories. Technical alumina of type Г 1 (G1) and Chasov

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Compound Pouring Ladle Nozzle Lining for the
Casting of Rimmed Steel in Installations for
Continuous Steel Casting

S/131/60/000/008/001/003
B021/B058

Yar clay Ч 1 (Ch1) were used for the production of highly aluminous inserts. Zirconium inserts were produced from finely ground zirconium with a ZrO_2 content of 69%. Chamotte pouring ladle nozzle linings were produced at the Experimental Plant of the Ukrainian Scientific Research Institute of Refractories from a mass containing 40% chamotte from Chasov Yar clay Ч 1 (Ch1), 40% Chasov Yar clay Ч 1(Ch1) and 20% foundry coke. The highly aluminous and magnesite inserts, as well as chamotte pouring ladle nozzle linings were pressed in the "Tagilets" friction press. A press mold (Fig. 1) was used at the Chasov Yar Kombinat. A total view of the two parts of the compound pouring ladle nozzle lining is shown in Fig. 2. The inserts and linings were fired in periodic furnaces. The firing curves are shown in Fig. 3 and the properties of the fired products are tabulated. The compound linings were tested at the Stalinskiy metallurgicheskiy zavod (Stalino Metallurgical Plant) and the zavod "Krasnoye Sormovo" ("Krasnoye Sormovo" Plant) during the casting of rimmed steel. The experiments were conducted by collaborators of the Ukrainian Scientific Research Institute of Refractories, the Ukrniimetallov (Ukrainskiy nauchno-issledovatel'skiy

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Compound Pouring Ladle Nozzle Lining for the Casting of Rimmed Steel in Installations for Continuous Steel Casting

S/131/60/000/008/001/003
B021/B058

institut metallov - Ukrainian Scientific Research Institute of Metals), the TsNIIChM (Tsentral'nyy nauchno-issledovatel'skiy institut chernoy metallurgii - Central Scientific Research Institute of Ferrous Metallurgy), the Stalino Metallurgical Plant and the "Krasnoye Sormovo" Plant. Fig. 4 shows highly aluminous inserts after their use in 50 t pouring ladles. They were tested at the "Krasnoye Sormovo" Plant with apertures of 30 mm diameter. The aperture of the insert was washed out by 1-2 mm in diameter when casting rimmed steel of type 3кп (3kp). The wear amounts to 4-6 mm when casting weld steel of type СВ 08А (Sv08A), which is explained by its higher content of iron oxides. The authors state in conclusion that the production technology of compound nozzle linings was elaborated for continuous rimmed-steel casting. The compound lining consists of a porous chamotte pouring ladle nozzle as a carrying part, and a highly aluminous magnesite- or zirconium insert as working part. The highly aluminous inserts showed the best wear resistance during tests. There are 4 figures, 1 table, and 5 references: 1 Soviet, 2 British, and 2 US.

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Compound Pouring Ladle Nozzle Lining for the Casting of Rimmed Steel in Installations for Continuous Steel Casting

S/131/60/000/008/001/003
B021/B058

ASSOCIATION: Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov (Ukrainian Scientific Research Institute of Refractories)

Card 4/4

15(2) [illegible]

AUTHORS: Kuz'mi[illegible], [illegible], [illegible], Strelets, V. [illegible]

TITLE: A[illegible] [illegible] n [illegible] C[illegible] [illegible] Bushing [illegible] C[illegible]

PERIODICAL: [illegible]ry, [illegible]

ABSTRACT: I[illegible] t[illegible] [illegible] o" W[illegible] [illegible] consi[illegible] - a[illegible] [illegible]n [illegible]f [illegible] the Ilrosyanaya [illegible], [illegible]f fire[illegible] [illegible] [illegible]vichi Kombinat [illegible]f Refractories, [illegible] clay-[illegible] [illegible] te[illegible] [illegible]t [illegible] these [illegible] alumi[illegible] [illegible] [illegible] [illegible] [illegible] of Refractories. The [illegible]-per [illegible] [illegible] [illegible]f [illegible] were [illegible]duc[illegible] of th[illegible] [illegible] remaining on[illegible] [illegible] m[illegible]ns [illegible] semi-dr[illegible] method. The [illegible] [illegible] chemical properties of [illegible] are listed in table 1, their wear may [illegible] seen from table [illegible]. In fi[illegible] [illegible] [illegible]re clay-kaoli[illegible] - and the [illegible] [illegible] according to their use. The chemical [illegible]-[illegible]itio[illegible] [illegible] [illegible]ings [illegible] [illegible]ter [illegible] is indicated in [illegible] [illegible]. The micr[illegible]structure of [illegible]-kaolin bushings [illegible] with a high [illegible] content is given in figures [illegible] their a[illegible]licatio[illegible]. In conclusio[illegible] th[illegible] [illegible] the [illegible] [illegible]er bushings is brought

Card 1/[illegible]

Application and Variation of Phase Composition of the Stopper Bushing of Casting Ladles in Continuous Steel Casting SOV/131-59-12-6/15

about mainly by the action of the slag and of the molten metal. The greatest stability is found with bushings of high alumina 15 content. It is considered interesting to investigate the possibility of prolonging life of fire clay lining of the casting ladle and stoppers by the addition of grog. The possibility of using covers for casting ladles should be investigated in order to be able to cast with a minimum slag cover. There are 4 figures, 3 tables, and 9 references, 8 of which are Soviet.

ASSOCIATION: Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov (Ukrainian Scientific Research Institute of Refractories)

Card 2/2

15(2)

AUTHORS: Streletz, V. M., Pitak, N. V.

S/131/60/000/01/009/017
B015/B001

TITLE: Experiments on the Use of Sleeve Bricks for Continuous Steel Casting

PERIODICAL: Ogneupory, 1960, Nr 1, pp 30 - 32 (USSR)

ABSTRACT: In this paper, the authors describe experiments with sleeve bricks with different sleeves (Fig 1). N. P. Mayorov, N. S. Agazor'yants, A. V. Khribkov, A. M. Makushin, L.B.Shenderov, V. G. Barsukov, and Z. D. Abuladze participated in the experiments. Table 1 shows the chemical composition of the sleeve bricks and the sleeves. The casting conditions of steel and the wear of the sleeve bricks in a plant for continuous steel casting are given in table 2. Figure 2 shows a biceramic sleeve brick with a layer of high alumina content after use. In conclusion, the authors mention that unburnt sleeve bricks with a magnesite layer show a higher wear resistance than those with a clay-graphite layer. Sleeves of highly refractory materials showed the highest durability. There are 2 figures and 2 tables.

Card 1/2

STRELETS, V.M.; PITAK, N.V.

Service characteristics of stoppers during the continuous pouring of steel. Ogneupory 25 no.2:64-69 '60. (MIRA 13:10)

1. Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov.
(Refractory materials) (Steel--Metallurgy)

STRELETS, V.R.; PITAK, N.V.; KULIK, A.I.; LOGACHEV, N.S.

Laboratory investigation on the technology of zircon [illegible]
Ogneupory 27 no.6:283-288 '62.

1. Ukrainskiy nauchno-issledovatel'skiy institut ogneuporov (for Strelets, Pitak). 2. Chasov-Yarskiy kombinat ogneupornykh izdeliy (for Kulik, Logachev).

(Zircon—Testing)

PITAMIC, Tomo, doc. dr.

Treatment of rheumatoid arthritis in childhood. Reumatizam 12 no.3:83-88 '65

1. Klinika za djecje bolesti Salata medicinskog fakulteta u Zagrebu.

PITAMIC, T., doc. dr.; GRGIC,M., dr.; SPIDLA,M., dr.

Sedimentation of erythrocytes in the treatment of rheumatic fever. Reumatizam 12 no.1:7-11 '65

1. Klinika za djecje bolesti Salata Medicinskog fakulteta u Zagrebu.

[illegible], [illegible]ea, prof. dr.; LITAMIC, Tomo, doc. dr.; GRGIC, Miljenko, dr.;
[illegible], Marijana, dr.

[illegible]anges in cardiac findings in the course of recurrent rheumat.
fever. Reumatizam 12 no.6:211-216 '65.

[illegible]ka za djecje bolesti Salata Medicinskog fakulteta,
Zagreb.

OBERHOFFR-SIK, Tea, prof. dr. PITAMIC, Tomo, doc. dr.; GRGIC, Miljenko, dr.; MARK, Bruno, doc. dr.; HUNETA, Dragutin, dr.

Changes in the development of carpal bones in congenital heart defects. Reumatizam 12 no.2:41-47 '65

1. Klinika za djecje bolesti Salata i Zavod za radiologiju Medicinskog fakulteta u Zagrebu.

MAMLIN, G.A., inzh.; PITANOVA, N.S., inzh.

Span for a new bridge in Leningrad. Transp.stroi. 14 no.12:29-32 D '64 (MIRA 19:1)

BOROVIKOV, V.N., inzh.; MAMLIN, G.A., inzh.; PITANOVA, N.S., inzh., REUT, Z.V., inzh.

Preparing welded, box elements for span structures. Transp. stroi. 14 no.7:23-26 Jl '64. (MIRA 18:1)

L 12953-63 EWD(k)/EWP(q)/EWT(m)/EWT(1)/BDS/T-2/EEC(b)-2/ES(t)-2 AFFTC/
ASD/ESD-3 Ps-4/Pm-4 IJP(C)/JD S/109/63/008/004/029/030 75

AUTHORS: Logunov, L. A., and Pitanov, V. S.

TITLE: Volt-ampere characteristics of tunnel diodes 25 made of gallium 21 arsenide 21

PUBLICATION: Radiotekhnika i elektronika, v. 8, no. 4, 1963, 723-725

TEXT: The authors report on their research into the inverted and direct branches of the volt-ampere characteristic of pn-junctions obtained with gallium arsenide of the p-type, alloyed with zinc [in a concentration of $(4-10)\cdot 10^{19}\text{cm}^{-3}$]. The drop in voltage r_s in the series resistance of the diode was taken into account in plotting the characteristics of the pn-junction. The measurements were taken while passing, through the diode, currents of from ~100 to 300 ma, for a duration of ~1 μ-sec. The voltage drop was measured in the diode, while the impulse current was determined on the basis of the amount of voltage drop when using a resistance of 10 ohms connected in series with the diode. On the basis of two measurements of the voltage at various high current values, the value of r_s could thus be determined. Two graphs accompany the article. One shows the relationship between the logarithm of conductivity of the pn-junction and the respective pn-junction voltage. This relationship is very close to rectilinear. The other graph shows the relationship between the logarithm of the direct current and the

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Volt-ampere characteristics .....

shift in the pn-junction. In the negative sector of the characteristic, this relationship is closely approximated by an exponential curve.

SUBMITTED: December 18, 1962

Card 2/2

LOGUNOV, L.A.; PITANOV, V.S.

Voltampere characteristics of gallium arsenide. Radiotekh.i elektron. 8 no.4:723-725 Ap '63. (MIRA 16:4)

(Tunnel diodes)

Pitateleva, R. A.

3

*Influence of Camphor on the Electrode Potential of the Dropping Amalgam Electrode. A. G. Stromberg and R. A. Pitateleva (*Doklady Akad. Nauk S.S.S.R.*, 1953, 89, (6), 1071–1074; errata, 1954, 97, (5), 866).—[In Russian]. The potentials of dropping electrodes of Pb, Sn, Cd, and Zn amalgams in 0·005*M* soln. of ions of the metals in various indifferent electrolytes (0·1*N*-KNO_3 or 0·1*N*-HNO_3; 6·2*N*-HCl or 0·1*N*-KOH; 0·1*N*-KCl; 0·1*N*-KCl or 0·5*N*-KOH, resp.) shifted in the positive direction on saturating the soln. with camphor; there was no change with Bi amalgam and 0·6*N*-HCl, whilst with Cu amalgam and 0·1*N*-H_2SO_4 there was a slight shift in the negative direction. Reducing the drop period from 2 to 1 sec. (thus increasing the rate of formation of a new electrode surface from 0·013 to 0·026 cm.^{2}/sec.) in experiments with Cu, Bi, and Pb amalgams led to shifts of −0·005, 0, and +0·010 V., resp. In the case of Cd amalgam, shifts of +0·120, +0·041, and +0·003 V. were produced when the soln. was saturated, $\frac{1}{2}$-saturated, and $\frac{1}{10}$-saturated, resp., with camphor. Increasing the Cd content in the amalgam (0·0013*M*) by 10× and 100× reduced the shift from 0·112 V. to 0·043 and 0·005 V., resp. Camphor did not affect the equilibrium potentials of stationary amalgam electrodes. If camphor is absent, the potentials of dropping and stationary electrodes are identical. All these observations can be explained in terms of the theory that the electrode processes are governed by exchange currents.—G. V. E. T.

MC

①

PITAS, V.

2
[illegible]

Strojirenstvi (Machinery)
Vol. 8, Nr. 1, 21. 1958

Pitaš V.: Trichlorethylene filtering Installations.

Strojirenstvi, Vol. 8, No. 1, 1958, p. 53—54

The article deals with a novel type of filter to be used in trichlorethylene installations. The filter has many advantages over conventional filters, centrifugal cleaning and evaporating devices The filter is very economical and cheap in operation requiring only 4 % soap solution.

11 13

PINATELEVA, R.A.

USSR.

Influence of camphor on electrode potential of dropping amalgam electrode. A. G. Stromberg and R. A. Pinateleva (A. M. Gor'kii Ural State Univ., Sverdlovsk). *Doklady Akad. Nauk S.S.S.R.* 89, 1071-4(1953).—Electrode potentials (I) of dropping or stationary electrodes of Cu, Bi, Pb, Sn, Cd, and Zn amalgams were measured in 0.005 *M* solns. of salts of corresponding metals in aq. HCl, H_2SO_4, HNO_3, KOH, KCl, and KNO_3 solns., both in the presence or absence of camphor in the electrolyte. Camphor caused shifts in I: in the case of Cu, the shift was in a neg. direction; Bi had no influence; and with all other metals the shift was in a pos. direction. Increase in the dropping rate in camphorated solns. shifted I in the case of Cu amalgam in a neg. direction and in the case of Pb amalgam in a pos. direction, and had no influence in the case of Bi amalgam. The magnitude of the shifts increased with increase in camphor concn. With increase of Cd concn. in the amalgam, the deviations caused by camphor decreased. With stationary amalgam electrodes, I in camphorated solns. were not different from I without camphor. I of dropping amalgam electrodes were equal to that of the stationary electrodes if camphor was not present. These observations agree with predictions which follow from the theory that the I of the amalgam electrodes are governed by exchange currents. Camphor retards the exchange currents and thus shifts I in the direction dependent on the relative position of I of the metal with respect to the zero point of the dropping electrode. With faster dropping, less time is available for a full buildup of the exchange currents. If enough time is allowed, as with the stationary electrode, camphor has no influence on I since it forms no complexes. Without camphor, the buildup of the exchange currents is fast and I of the dropping amalgam electrode become equal to that of the stationary one. Increase in concn. of the metal in Hg intensifies the exchange currents so that camphor has less influence.

Andrew Dravnieks

(1)

62

PITANIYE I.

42648. Obmen Veshchesty Pri Fosfornom Otravlenii. Soobshch.ll. G.P. Yeremin. Obmen Kal'ts'ya, Fosforal Obshchego Kolichestva Osnovaniy U Otravlennykh Fosforom Zhivotnykh Pri Razlichnom Pitanii. Gigyena I Sanitariya, 1948, No. 12, S. 25-32.

PITAYEVSKIY L P

SUBJECT [illegible]

AUTHOR [illegible]

TITLE On the [illegible]

[illegible]

PERIODICAL [illegible]

[illegible]

It is known that [illegible] the spectrum [illegible] wave function. Here [illegible] following Hamiltonian [illegible] Here n denotes the [illegible] the Hamiltonian which [illegible] by a function [illegible] order of δn. The term [illegible] $\int \hat{v}^2 d\tau + \vec{r}$ [illegible] with respect to [illegible] and consider the [illegible] $\vec{v} = 0$ and also [illegible] the fact that [illegible] the expression [illegible] the Hamiltonian [illegible] oscillators with the [illegible] it is assumed that [illegible] in the basic state [illegible]

ARKHIPOV, R.O. [translator]; GOR'KOV, L.P. [translator]; DZYALOSHINSKIY,
I.Ye. [translator]; PITAYEVSKIY, L.P. [translator]; KHALATNIKOV,
I.M., red.; BEKKERMAN, I.M., red.; KHOMYAKOV, A.D., tekhn.red.

[New properties of the symmetry of elementary particles. Translated from the English] Novye svoistva simmetrii elementarnykh chastits; sbornik statei. Perevod s angliiskogo R.O.Arkhipova i dr. Moskva, Izd-vo inostr.lit-ry, 1957. 97 p. (MIRA 11:1)

(Particles, Elementary)

PITAYEVSKIY, L. P.

Derivation of the formula for the energy spectrum of liquid helium-4. L. P. Pitaevskii.

Pitayevskiy L.P.

56-2-35/47

AUTHORS Lifshits, Ye.M., Pitayevskiy, L.P.

TITLE On the Absorption of the Second Sound in Rotating Helium II.
(O pogloshchenii vtorogo zvuka vo vrashchayushchemsya gelii II)

PERIODICAL Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol. 33, Nr 2(8), pp 535-537 (USSR)

ABSTRACT The authors are inclined to look upon the good qualitative agreement of theory with the experiment, which was obtained by H.E. Hall and W.F. Vinen (Proc. Roy. Soc., Vol. A, 238, pp. 204, 215) as largely due to chance. Besides, an indefinite empirical constant occurs in this calculation.

The authors computed the scattering of rotons by the vortex threads in quasiclassical approximation. For the force acting upon the unit of length of the thread the following result is obtained (the method of denotation being the same as with H.E. Hall and W.F. Vinen):

$$F = D(\vec{v}_n - \vec{v}_L) + D'[\vec{\omega}, \vec{v}_n - \vec{v}_L]/\omega, D \sim 1,2 \sqrt{\mu k T/p_0}, D' = \chi \rho_n.$$

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56-2-35/47

On the Absorption of the Second Sound in Rotating Helium II.

Circulation round the vortex is assumed to be equal to $\chi = 2\pi \hbar/m$. Next, two further coefficients are computed. Comparison with experimental data is, of course, possible only in that domain in which it is possible to speak of a "roton gas" and in which the range of the rotons is small in comparison with the spacings between the vortex threads. The computed values of coefficients are shown in form of a diagram. Though they agree well with the measurements carried out by Hall and Vinen at high temperatures, they are already too low at 1,3°. This tends to confirm the complicated character of the interaction of the rotons with the vortices, which is not reduced to simple scattering. When the rotons fly past at a small distance from the axis of the vortex processes apparently take place which have the character of "strong interaction". They lead to the transmission of an impulse of the order of the total roton impulse. Also the "smearing out" of the vortex because of its eigenoscillations may play an essential part. The attempt can be made to describe this interaction in a phenomenological manner by introducing a temperature-independent cross section ("breadth")

CARD 2/3

On the Absorption of the Second Sound in Rotating Helium II. 56-2-35/47

of the vortex, which corresponds to the transmission of the total roton impulse to the vortex. The determination of further experimental data would be desirable.
There is 1 figure and 1 Slavic reference.

ASSOCIATION: Institute for Physical Problems AN USSR.
(Institut fizicheskikh problem Akademii nauk SSSR)
SUBMITTED: May 10, 1957.
AVAILABLE: Library of Congress.

CARD 3/3

GOR'KOV, L.P.; PITAYEVSKIY, L.P.

Concerning scattering of light in He^3 and He^4 mixtures. Zhur. eksp. i teor. fiz. 33 no.3:634-636 S '57. (MLRA 10:11)

1. Institut fizicheskikh problem AN SSSR.
(Light--Scattering) (Helium--Isotopes)

PITAYEVSKIY, L. P. and GINZBURG, V. L.

"The Theory of Superfluidity,"

report submitted but not presented at the Kamerlingh Onnes Conference on Low Temperature Physics, Leiden, [illegible] Jun

PITAYEVSKIY, L. P., Cand Phys-Math Sci -- (diss, "Studies on the Hyper-Viscosity of Liquid Helium. Theory." Mos, 1958. 10 pp, (Acad Sci USSR, Inst for Phys Problems). 185 copies. Bibliography at the end of the text (12 titles), (KL 46-58,115)

4

AUTHOR: Pitayevskiy, L. P. 56-34-4-21/60

TITLE: On the Problem of the Anomalous Skin Effect in the Infrared Range (K voprosu ob anomal'nom skin-effekte v infrakrasnoy oblasti)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, [illegible], Vol. 34, Nr 4, pp. 942 - 946 (USSR)

ABSTRACT: The aim of this work is the consideration of the influence of the collisions between the electrons upon the optical properties of the metals in the infrared spectrum range; it computes the impedance of the metals at low temperatures. The frequency of the incident light is assumed to satisfy the conditions $\omega l/v \gg 1$ and $\omega\delta/v \gg 1$. v - denoting the velocity of the electrons, l - the free path, and δ the depth of penetration of the field into the metal. Furthermore the metal is assumed to have a high negative dielectric constant. The absorption be small and be considered as disturbance. This condition limits the validity of the formulae towards the side of the high frequencies. The computations were made for the case of very low temperatures, where $kT \ll \hbar\omega$ is valid. The

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On the Problem of the Anomalous Skin Effect in the Infrared Range [illegible]-4-4-[illegible]

author makes no assumptions as to the law of the dispersion of electrons, the form of the scattering probabilities, and on the intensity of the interaction between the electrons. Above all there is no reason for regarding the law of the dispersion of the electrons to be almost square and their interaction to be weak. Furthermore above all the current of an excited electron or - strictly speaking - of a Fermi excitation - must be computed. The author starts with the computation of the dielectric constant. The so-called "number of free electrons" N depends essentially on the interaction of the electrons. The electrons in the metal can absorb the light in the collisions with the atoms of the admixture (or with the lattice defects), in the collisions with one another or with the surface of the metal, or also in the simultaneous absorption or emission of a phonon. In the case investigated the total absorption plainly is equal to the sum of the terms which correspond to these processes. For the energy which in case of isometric symmetry is absorbed in the time unit a formula is given. Subsequently the author computes the collisions with the admixtures and with the surface as well as the interelectronic collisions. The author thanks

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On the Theory of the Anomalous Skin Effect in the [illegible] [illegible]-1-13/[illegible]
Infrared Range

L. D. Landau, Member, Academy of Sciences, USSR, for Physics and Mathematics. Three [illegible] Prize [illegible], [illegible] of [illegible] Soviet

ASSOCIATION Institut fizicheskikh problem Akademii nauk SSSR (Institute for the Study of Problems in Physics, AS USSR)

SUBMITTED November [illegible], [illegible]

1. Metals--Optical properties

Card 2/2

AUTHORS: [illegible] SOV/[illegible]

[illegible]: [illegible] fluid [illegible] [illegible]

[illegible] 1958, [illegible])

[illegible] deals with the [illegible] the [illegible] problem investigated [illegible] the [illegible] must be correlated to the [illegible] the superfluid part of the liquid [illegible] different from zero in He II and equal to zero in He I. Taking into account the quantum character of the phenomena in liquid helium, it is natural to choose as such a parameter the [illegible] function $\psi(x,y,z) = \eta e^{i\varphi}$ which plays the rôle of [illegible] "wave function" of the superfluent part of the liquid. This paper deals only with those states in which the normal part of which is assumed to be at rest. The [illegible] $\vec{v}$ of the superfluent part is zero [illegible] $_n$ [illegible] the thermodynamic potential [illegible] is given [illegible] thermodynamic potential is given as

[illegible]

$\int$ [illegible] h [illegible] m [illegible] 7 ψ [illegible] $_0$ [illegible] T $|\psi|$ [illegible]. By varia[illegible] with [illegible] ψ^* and ψ considering the boundary [illegible] ψ [illegible] that is an analogon of the equation [illegible] in the phenomenological theory of superconduction is obtained. [illegible] the equation $-h$ [illegible] m $\Delta\psi$ [illegible] $|\psi|$ [illegible] ψ [illegible] tained. To this equation belongs also the boundary condition ψ [illegible] which is to be used also for the free surface of [illegible]. The thermodynamic potential [illegible] is expanded [illegible] phase transitions into powers of

$|\psi|$ [illegible] $|\psi|$ [illegible] $|\psi|^4$.

The theory used in this paper can be used only in the immediate neighborhood of the [illegible]-point. The second section of this paper [illegible] special problems. First the [illegible] the properties of helium near a [illegible] In this case an additional surface energy appears. Then a [illegible] layer with the density [illegible] investigated. The temperature of the [illegible]-transition [illegible] is [illegible] in great masses of helium. Fina[illegible] investigated. There are [illegible] figure and [illegible].

SOV/

[illegible]

([illegible] for Problems on Physics, AS USSR)

1. Helium (Liquid)--Properties 2. Helium (Liquid)--Mathematical analysis 3. Low temperature research

24 (0), 10 (4)

AUTHOR Pitayevskiy, L. P. SOV/56-35-2-14/60

TITLE Phenomenological Theory of Superfluidity Near the λ-Point (Fenomenologicheskaya teoriya sverkhtekuchesti vblizi λ-tochki)

PERIODICAL Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 2, pp 408-415 (USSR)

ABSTRACT

The present paper aims at generalizing the equation by Ginzburg and Pitayevskiy (Ref 1) for the non-steady case of superfluid helium II in the immediate neighborhood of the point of λ-transition. Proceeding from the energy- and momentum conservation theorem, the author derives the complete system of phenomenological equations which describe the behavior of superfluid helium at $T_\lambda - T \ll T_\lambda$. The normal and the superfluid part are dealt with separately. The normal part is dealt with by the usual hydrodynamic method, and the superfluid part with the aid of an "effective wave function" formulated by the author. In conclusion, the author thanks L. D. Landau and V. L. Ginzburg for their valuable help and advice. There are 9 references, 7 of which are Soviet

Card 1/2

Phenomenological Theory of Superfluidity Near the λ-Point SOV/56-3[illegible]-[illegible]-14/[illegible]

ASSOCIATION Institut fizicheskikh problem Akademii nauk SSSR (Institute for Physical Problems, AS USSR)

SUBMITTED March 1[illegible], 1958

Card 2/2

SOV/56-[illegible]

24(7)

AUTHOR: Pitayevskiy, L. P.

TITLE: Calculation of the Phonon Part of Mutual Frictional Force in Superfluid Helium (Vychisleniye fononnoy chasti sily vzaimnogo treniya v sverkhtekuchem gelii)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 5, pp 1271-1275 (USSR)

ABSTRACT: Hall and Vinen (Kholl, Vaynen) (Ref 1) showed that in rotating helium II mutual frictional forces are active between the normal and the superfluid part of the liquid. For the purpose of calculating these forces it is necessary to investigate the scattering of elementary excitations consisting of the normal component of the liquid, i.e. of phonons and rotons, on the vortex lines. At temperatures $\lesssim 0.6^{\circ}$K the phonon component in ρ_n is considerably smaller than that of rotons. In consequence, every mutual friction is dependent on the rotons at such temperatures. Calculation of this friction component was carried out by Hall and Vinen (Ref 2) as well as by Lifshits and Pitayevskiy (Ref 3). However, at such low temperatures the number of rotons decreases

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SOV 56-[illegible]

Calculation of the Phonon Part of Mutual Frictional Force in Superfluid Helium

considerably, and the share contributed by phonons in mutual friction may be considerable. This contribution made by the phonon component for temperatures T $\leq$ 0.5°K towards mutual friction is investigated by the present paper, i.e. the scattering of sound on vortex lines is calculated on the basis of ordinary hydrodynamical equations. It was found that the phonon component of mutual friction becomes comparable with the roton component. For the ratio between roton and phonon coefficients B_r and B_{ph} the following is obtained: $(B_{ph}\rho_{n\,ph} + B_r\rho_{n\,r})/(\rho_{n\,ph} + \rho_{n\,r}) =$ $= B$ (total coefficient) ($\rho_n \ll \rho$). In conclusion, the author thanks Professor Ye. M. Lifshits and L. D. Landau, Academician, for their help and their discussions. There are 4 references, 2 of which are Soviet.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute for Physical Problems of the Academy of Sciences, USSR)

SUBMITTED: June 13, 1958

Card 2/2

24(5) SOV/56-[illegible]

AUTHOR: [illegible]

TITLE: On the Properties of Elementary Excitation Spectrum Near the Disintegration Threshold of the Excitations (O svoystvakh spektra elementarnykh vozbuzhdeniy vblizi poroga raspada vozbuzhdeniy)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 4, pp 1168-1176 (USSR)

ABSTRACT: In the present paper the author investigates the properties of the excitation spectrum at its end for a Bose fluid. In the case of small momenta, excitation in a Bose liquid occurs in form of phonons, i.e. the excitation energy depends linearly on the momentum. With growing momentum, the spectrum more and more deviates from the linear spectrum, and finally its course depends on certain interaction properties of the particles of the fluid and can no longer be theoretically calculated in a general form. Whereas, e.g., the energy spectrum of liquid He^4 at $p = 2.10^{-19}$ g·cm/sec has a complex form, the excitation energy, with a further increase of momentum, attains a certain threshold value, above which excitation is unstable and may decompose into two or more excitations with lower energies

Card 1/[illegible]

n the Properties of Elementary Excitation Spectrum S07/[illegible]
Near the Disintegration Threshold of the Excitations

This [illegible] continuous spectrum has interesting [illegible] features which are investigated in the present [illegible] This investigation can be carried out in a general [illegible] means of quantum field theoretical methods without it being necessary to assume weak interaction. First, the [illegible] spectrum near the threshold value is investigated. Three possible types of decay thresholds are found to exist. [illegible] Excitation energy is equal to the velocity of sound [illegible] the excitation leads to the production of phonons, which results in excitation damping proportional to $(p_c$ [illegible] At $p > p_c$ the excitation energy has a negative minimum [illegible] to $-a$[illegible]$(\Delta p)^2$ [illegible] excitation in the center of mass [illegible] into two excitations with parallel momenta which are [illegible] from zero [illegible] decomposition of excitation into two excitations, the momenta of which form an angle (cf graphs figure [illegible]) In these two cases the spectral curves end at threshold, [illegible] the excitation velocity at this point is equal to that [illegible] of the excitations produced in the decay. In the last part of the paper the author investigates the inelastic s[illegible]

Card 2/3

of neutrons. The case is investigated in which neutron energy losses are assumed to be $\varepsilon \approx \varepsilon_c$ and momentum losses $p \approx p_c$, i.e. excitations with energies near decay threshold are investigated. All theoretical deliberations are based upon the laws of conservation. The author finally thanks Academician L. D. Landau for his advice, and V. M. Galitskiy, L. P. Gor'kov, and I. Ye. Dzyaloshinskiy for discussions. There are 3 figures and 5 Soviet references.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute for Physical Problems of the Academy of Sciences, USSR)

SUBMITTED: October 6, 1956

Card 3/3

24(3) SOV/56-36-6-25/66

AUTHORS: Dzyaloshinskiy, I. Ye., Pitayevskiy, L. P.

TITLE: Van der Waals Forces in an Inhomogeneous Dielectric (Van-der-Vaal'sovy sily v neodnorodnom dielektrike)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 6, pp 1797-1805 (USSR)

ABSTRACT: In the present paper the forces are calculated which result from the interaction of particles in an inhomogeneous dielectric with the fluctuations of a long-wave electromagnetic field (in which the dielectric is located). These forces may be described as Van der Waal forces, because they are of a similar nature. The contribution made by long-wave fluctuations to the free energy is small compared to the total free energy of the body, but it represents a new effect, namely that of the non-additivity of the free energy of the body. The calculation of the (non-additive) correction to the free energy of an inhomogeneous dielectric carried out by the authors cannot be performed in the usual manner by determination of the field energy in the medium because of the dissipation occurring in the absorbing medium e.g. in the case of variable fields. The authors used the diagram technique developed by

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Van der Waals Forces in an Inhomogeneous Dielectric SOV/56-36-6-25/66

Matsubara (Ref 4), which was used also in the papers by Abrikosov, Gor'kov, Dzyaloshinskiy, and Fradkin (Ref 5). The authors first investigate the properties of the Green functions of an electromagnetic field in an inhomogeneous absorbing medium. In the second part of this paper the correction to the free energy of the system is derived by summation of the Matsubara graphs (Fig 2), and the corresponding part of the stress tensor (stress tensor of Van der Waal forces) is calculated. In an appendix the authors derive formulas for the Green functions in a homogeneous absorbing medium with complex dielectric constant. In conclusion, they thank Academician L. D. Landau and Ye. M. Lifshits for their interest and discussions. There are 2 figures and 8 references, 7 of which are Soviet.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute for Physical Problems of the Academy of Sciences, USSR

SUBMITTED: December 17, 1958

Card 2/2

10 (4)

AUTHORS: Dzyaloshinskiy, I. Ye., Lifshits, Ye. M., Pitayevskiy, L. P. SOV/56-37-1-36/64

TITLE: Van der Waals' Forces in Liquid Films (Van-der-Vaal'sovy sily v zhidkikh plenkakh)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 1(7), pp 229 - 241 (USSR)

ABSTRACT: The authors find general formulas for the determination of the thermodynamic quantities (chemical potential) of a liquid film, and they find the limiting laws for the dependence of the chemical potential on the thickness of the film. The difficulties in the generalization of the formulas derived for the vacuum in the case in which the interspace between the bodies is filled with any medium, are now eliminated because of the general formulas (Ref 2) already derived for that part of the thermodynamic quantities of any absorbing medium which is conditioned by the electromagnetic fluctuation field with the wave lengths $\lambda \gg a$ (a denoting the interatomic distances). This field corresponds to those forces which have the same nature as the van der Waals' forces between the single molecules at large distances. At first, the stress tensor in a stratified absorbent medium is

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calculated, and in the next part the forces of molecular interaction between solids are determined. In the case of a metallic "intermediate layer" between the bodies, the force of molecular attraction passes from the law 1^{-3} at "small" distances to the law 1^{-5} at "large" distances. The authors then investigate a liquid film on the surface of a solid body. This film is assumed to be applied to a wall vertically arranged in the field of gravity. $F(1) + \rho gz = \text{const}$ is the condition for the constancy of the chemical potential along the system, for $F(1)$ is the part of its chemical potential μ depending on the film thickness. Thus, $\mu = \mu_o + F(1)$, μ_o denoting the chemical potential of the "massive liquid". Further, $\mu(1) + \rho gz = 0$, the function $\mu(1)$ determining all thermodynamic properties of the film. The authors then investigate some typical cases which may be present according to the character of the function $\mu(1)$: (a) If $\mu(1)$ is a monotonely falling, everywhere positive function, the liquid does not moisten the solid surface, and no field is formed. (b) If $\mu(1)$ is a monotonely increasing, everywhere negative function, this usually corresponds to a liquid which completely moistens a solid surface. On a vertical wall, a film with a thickness tending to zero at $z \rightarrow \infty$ is particularly formed. This decrease in thickness takes place at first according to the law $l \sim z^{-1/4}$, then according to $z^{-1/3}$. Subsequently, the contribution to the chemical potential caused by forces of nonelectromagnetic origin is estimated. Finally, some films of liquid helium are specially investigated. The authors thank the Academician L. D. Landau for the discussion of the problems investigated here, and Professor B. V. Deryagin for the supply of his papers. There are 3 figures and 21 references, 10 of which are Soviet.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Physical Problems of the Academy of Sciences, USSR)

SUBMITTED: February 12, 1959 (initially), and March 27, 1959 (after revision)

Card 3/3

SOV/56-37-2-48/56

24(6)

AUTHOR: Pitayevskiy, L. P.

TITLE: The Attraction of Small Particles Suspended in a Liquid Over Wide Distances

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 2(8), pp 577-578 (USSR)

ABSTRACT: The present "Letter to the Editor" is intended to derive a formula describing the interaction energy of particles suspended in a liquid, which is in interrelation with the Van der Waals forces. The distance separating the particles from one another should be large compared to their dimensions. In principle, this task may be solved on the basis of the general theory of Van der Waals forces in dielectrics. The expression for the interaction forces of an arbitrary body in a medium may be obtained by a simple transformation from the corresponding expression for the interaction forces in the vacuum. The expression for the additional pressure in a medium with the dielectric constant ε may be obtained from the expression for the pressure in the vacuum. By using the formulas by Landau and Lifshits for the interaction energy in the vacuum, the following formulas are

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The Attraction of Small Particles Suspended in a Liquid Over Wide Distances

deduced for a medium containing N-particles per unit of volume:

$$U = \frac{3\hbar}{16\pi^3 R^6} \int_0^\infty \left(\frac{\partial\varepsilon(i\xi)}{\partial N}\right)^2 \frac{\partial\xi}{\varepsilon^2(i\xi)} \quad \text{at } R \ll \lambda_0$$

$$U = \frac{23\hbar c}{64\pi^3 R^7 \varepsilon^{5/2}(0)} \left(\frac{\partial\varepsilon(0)}{\partial N}\right)^2 \quad \text{at } R \gg \lambda_0 .$$

These formulas describe not only the interactions between macroscopic particles in suspension, but also e.g. of molecules in solution. There are 3 Soviet references.

ASSOCIATION: Institut zemnogo magnetizma, ionosfery i rasprostraneniya radiovoln Akademii nauk SSSR (Institute for Terrestrial Magnetism, Ionosphere, and the Propagation of Radiowaves of the Academy of Sciences, USSR)

SUBMITTED: May 15, 1959

Card 2/2

PITAYEVSKIY, L.P.

Superfluidity of liquid He^3. Zhur.eksp.i teor.fiz. 37 no.6:1794-1807 D '59. (MIRA 14:10)

1. Institut zemnogo magnetizma, ionosfery i rasporstraneniya radiovoln AN SSSR.
(Superfluidity) (Liquid helium)

30.37
S/570/60/000/017/007/012
E032/E114

9.9845(1538)

AUTHORS: Gor'kov, L.P., Dzyaloshinskiy, I.Ye., and Pitayevskiy, L.P.

TITLE: Calculations of fluctuations in quantities described by transport equations

SOURCE: Akademiya nauk SSSR. Institut zemnogo magnetizma, ionosfery i rasprostraneniya radiovoln. Trudy, no.17(27). Moscow 1960. Rasprostraneniye radiovoln i ionosfera. 203-207

TEXT: The authors discuss fluctuations in quantities which can be described by transport equations, e.g. the equations of Boltzmann, Fokker-Planck and Landau in the case of a Coulomb interaction between the particles. The knowledge of these fluctuations is essential to the theory of scattering of electromagnetic waves in rarefied gases and electron plasma. The method employed is analogous to that used by L.D. Landau and Ye.M. Lifshits (Ref.2: Electrodynamics of uniform media M., Gostekhizdat 1957, Ref.3: ZhETF v.32 618, 1957). It consists in the introduction into the transport equation of additional random

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terms whose correlations are then determined on the basis of the general theory of fluctuations. For example, the Boltzmann equation is modified to read

$$\frac{\partial \nu}{\partial t} + (\underline{v} \nabla)\nu = J + y \tag{1}$$

where the collision integral J is given by

$$J = \iint w(p_1, p_1' \; p, p') \{n_o(p_1)\nu(p_1') + n_o(p_1')\nu(p_1) - n_o(p')\nu(p) - n_o(p)\nu(p')\} d^3p_1 d^3p_1 d^3p' \tag{2}$$

and y is the "random" collision integral. The problem consists in the evaluation of the average of $y(p\ r\ t)y(p', r'\ t')$. It is shown that this average is in fact given by:

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$$\overline{y(p, r, t)\, y(p', r', t')} = 2\delta(r - r')\delta(t - t') \times$$

$$\times \Big\{ - n_0(p') \iint w(p', p_1; p_1, p_1')\, n_0(p_1)\, d^3p_1 d^3p_1' -$$

$$- n_0(p) \iint w(p', p_1; p_1, p_2)\, n_0(p_2')\, d^3p_1 d^3p_1' +$$

$$+ \delta(p - p')\, n_0(p) \iiint w(p_1, p_1''; p, p_1)\, n_0(p_1)\, d^3p_1' d^3p_1'' d^3p_1 +$$

$$+ n_0(p)\, n_0(p') \iint w(p_1, p_1'; p, p')\, d^3p_1 d^3p_1' \Big\} \qquad (9)$$

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which is equivalent to the results obtained by B.B. Kadomtsev (Ref.5: ZhETF, v.32, 943 1957). It can be shown that the introduction of the "random" collision integral into Eq.(1) does not upset the conservation of the number of particles, energy and momentum. Another transport equation considered is the following

$$\frac{\partial \nu}{\partial t} + (\underline{v}\nabla)\nu = - \operatorname{div} j \qquad (10)$$

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Calculations of fluctuations in ... S/570/60/000/017/007/012
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where j is the current density in the momentum space. Here it is convenient to introduce a "random" current y so that

$$\frac{\partial j}{\partial t} + (\underline{v}\nabla)j = -\mathrm{div}(j + y)$$

Expressions analogous to Eq (9) are then derived. An account of the general theory of fluctuations on which these calculations are based is given in "Statistical Physics" by L.D. Landau and Ye.M. Lifshits (Ref.4 izd. 3 M., Gostekhizdat 1951). The method can be used for fluctuations in the equations for fermi and bose gases. A.A. Abrikosov and I.M. Khalatnikov (Ref.7. ZhETF v.34, 198 1958) have used it to study light scattering in liquid He^3. Acknowledgments are expressed to L.D. Landau and Ye.M. Lifshits for discussions. S.M. Rytov and B.B. Kadomtsev are mentioned in connection with their contributions to the theory of fluctuations. There are 7 Soviet-bloc references.

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Card 4/4

82610

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AUTHOR: [illegible]itayevskiy, [illegible]

TITLE: The [illegible] of the Shape of the Spectrum of Elementary Excitations of Liquid Helium II

79

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, Vol. [illegible], No. [illegible], pp. [illegible]

TEXT: Data on the shape of the energy spectrum of liquid helium II [illegible] the range of energy $\varepsilon \approx \Delta$ = 1[illegible]°K were published in the paper [illegible] Ref. [illegible]. These data had been obtained by a study of inelastic neu[illegible] scattering. It was found that the function $\varepsilon(p)$ has a negative [illegible] derivative in this range. The authors of the above-mentioned publication believe that this is indicative of the existence of a second maximum of $\varepsilon(p)$. The present "Letter to the Editor" however shows that this fact cannot be explained in this way. In the paper [illegible] Ref. [illegible] the writer has shown that the curve of the energy spectrum [illegible] liquid helium II usually does not exceed ε [illegible] 2Δ. This [illegible]

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The Problem of the Shape of the Spectrum of [illegible]
Elementary Excitations of Liquid Helium II [illegible] B [illegible]

fact that an elementary excitation with $\varepsilon \geqslant 2\Delta$ can split [illegible]
excitations with $\varepsilon = \Delta$ at an energy of $\varepsilon = 2\Delta$ [illegible]
after which it discontinues since the spectrum ends at [illegible]
the spectrum has the form $\varepsilon(p) = 2\Delta - a\exp[a/(p-p_1)]$, where [illegible]

momentum for which $\varepsilon = 2\Delta$, a, and a are constants. The [illegible]
Fig. shows the entire course of $\varepsilon(p)$. The probability that a [illegible]
will produce an excitation with an energy ε tends to zero with

$\varepsilon \to 2\Delta$ according to the law $w = A\dfrac{\Delta - \varepsilon}{a}$ or $\dfrac{a}{2\Delta - \varepsilon}$ [illegible]

energy attained [illegible] K, w really amounts to [illegible] per cent [illegible]
probability of an excitation with ε [illegible] Δ. There are 1 figure and
references [illegible] Soviet and [illegible]

ASSOCIATION: Institut zemnogo magnetizma, ionosfery i rasprostraneniya radiovoln AN SSSR (Institute of [illegible] Terrestrial Magnetism, Ionosphere, and Propagation of Radio Waves of the AS USSR)

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The Problem of the Shape of the Spectrum of Elementary Excitations of Liquid Helium II

S/056/60/039/[illegible]
B006/B0[illegible]

SUBMITTED: May 11, 1960

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86923

24.2120

S/056/60/[illegible]/[illegible]
B006/B077

AUTHOR: Pitayevskiy, L. P.

TITLE: Electric Forces in a Transparent Dispersive Medium

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 5(11), pp. 1450 - 1458

TEXT: The present work deals with an examination of the form of the stress tensor of a variable electric field in a fluid transparent dispersive medium; the tensor is averaged over the oscillation period. In a dielectric of an isotropic fluid which is in a constant electric field the tensor assumes the form:

$$\sigma_{ik} = -p_0\delta_{ik} - \frac{E^2}{8\pi}\left[\varepsilon - \rho\left(\frac{\partial\varepsilon}{\partial\rho}\right)_T\right]\delta_{ik} + \varepsilon\frac{E_iE_k}{4\pi}$$

$p_0 = p_0(\rho,T)$ denotes the pressure in the fluid without an electric field, ρ density, and ε the dielectric constant of the fluid. Now the author examines how this relation changes if a dispersion is assumed, that

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Electric Forces in a Transparent Dispersive Medium

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is ε is considered a function of the field frequency. $\varepsilon(\omega)$ is a real function (a typical example of such a medium is e.g. an electron plasma where ω is large as compared to the effective collision number). It is found that for σ_{ik} the same expression is obtained, but averaged, that is E^2 is substituted by $\overline{E^2}$ and E_iE_k by $\overline{E_iE_k}$. The following expression is obtained for the energy flux: $\vec{S} = \frac{c}{4\pi}\left[\vec{E}\vec{H}\right] + \frac{\overline{E^2}}{8\pi}\left(\omega\frac{\partial\varepsilon}{\partial\omega} - \rho\frac{\partial\varepsilon}{\partial\rho}\right)\vec{v}$, where $\vec{v}$ is the flow rate of the medium. This expression is exact except for terms $\sim(v/c)^2$. The behavior of the dielectric constant of a medium with time dependent parameters is investigated: $\varepsilon = \varepsilon(\omega,\lambda)$, $\lambda = \lambda(t)$; it is found that the expression for ε contains an imaginary term (which is real in the case of time-independent parameters):

$$\varepsilon(\omega, t) = \varepsilon_0(\omega,t) + \frac{i}{2}\,\frac{\partial^2\varepsilon_0(\omega,t)}{\partial\omega\partial t}.$$

Finally, the case is examined where the fluid is in a variable electric and in a strong constant magnetic field. The following expression is obtained:

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Electric Forces in a Transparent Dispersive Medium

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$$\sigma_{ik} = -\left(p_{00} + \frac{H^2}{8\pi}\right)\delta_{ik} + \frac{1}{4\pi}H_iH_k + \frac{1}{16\pi}\left\{E^*_{0l}E_{0m}\left(\rho\frac{\partial\varepsilon_{lm}}{\partial\rho} - \frac{\varepsilon_{lm} + \varepsilon^*_{lm}}{2}\right)\right\}\delta_{ik} - $$
$$+ \frac{1}{16\pi}(\varepsilon_1E^*_{0i}E_{0k} + \varepsilon_2(\mathbf{E}_0\mathbf{H})(E^*_{0i}H_k + H_iE^*_{0k}) + \text{к. с.}) -$$
$$+ \frac{H_iH_k}{8\pi}\left\{\frac{\partial\varepsilon_1}{\partial H^2}\mathbf{E}_0\mathbf{E}^*_0 + \frac{\partial\varepsilon_2}{\partial H^2}|[\mathbf{E}_0\mathbf{H}]|^2 + i\frac{\partial\varepsilon_3}{\partial H^2}[\mathbf{E}^*_0\mathbf{E}_0]\,\mathbf{H}\right\} \qquad (46)$$

The author thanks L. D. Landau for his advice and discussion, V. L. Ginzburg and I. Ye. Dzyaloshinskiy for their discussions, and M. A. Leontovich for his suggestions concerning the last part of this work. There is 1 Soviet reference.

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SUBMITTED: July 27, 1960

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S/169/61/000/010/
D228/D304

AUTHOR: Pitayevskiy, L. P.

TITLE: The question of the disturbance induced in the plasma by a rapidly moving body

PERIODICAL: Referativnyy zhurnal, Geofizika, no. 10, 1961, 14, abstract 10G86 (Geomagnetizm i aeronomiya, 1, no. 2, 1961, 194-208)

TEXT: Expressions were found by means of the kinetic equation for the Fourier component of the electron density disturbance arising during the movement of a body with a velocity much greater than the thermal rate of ions in the plasma. It is suggested that the plasma is situated in a constant magnetic field in which the Larmov radius of ions is much greater than the body's dimensions. The effective area of dispersion of electromagnetic waves with a wavelength much greater than the body's size was found on the basis of these formulas. [Abstracter's note: Complete translation.]

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AUTHORS: Al'pert, Ya. L., Pitayevskiy, L. P.

TITLE: On the scattering of electromagnetic waves by perturbations caused by a rapidly moving body in a plasma

PERIODICAL: Geomagnetizm i aeronomiya, v. 1, no. 5, 1961, [illegible] - [illegible]4

TEXT: Information is given on results of a theoretical analysis made of the effective scattering cross section of electromagnetic waves from the trail of a body moving rapidly through a magnetized plasma. The formulae, developed previously by Pitayevskiy, take into account the effect of the magnetic field, the number of ion collisions, the size of the body (especially those smaller than the wavelength) and to some extent the electrical field in the vicinity of the body. Due to the complexity of the formulae used, calculations were made with electronic computers for a number of concrete cases. The results obtained make it possible to obtain quantitative and qualitative concepts of the nature of scattering effects in a rarefied plasma (particularly in the ionosphere) for the case when the length of the particle path considerably exceeds the dimensions of a body moving at a velocity greater than the thermal velocity of ions $\sqrt{8kT/\pi M}$ and considerably lower

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On the scattering of...

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than the thermal velocity of electrons $\sqrt{8kT/\pi m}$. It is shown that the cross section of scattering is a sharply directed multilobe function; its main maximum lies in the direction of the image "reflection" of the wave from the [illegible] permanent magnetic field. The dependence of the cross section of scattering on the wavelength at different altitudes of the ionosphere is analyzed. In [illegible] cases the differential effective cross section attains [illegible] when the body moves in a direction forming a small angle with the magnetic [illegible] The nature of the scattering is found to be a function of the [illegible] dimensions of the body, and depends [illegible] on its properties, shape [illegible] surface. There are 1[illegible] figures, [illegible] tables and 4 [illegible] references.

ASSOCIATIONS: Institut zemnogo magnetizma, ionosfery i rasprostraneniya [illegible] AN SSSR (Institute of Terrestrial Magnetism, Ionosphere and Propagation of Radio Waves, AS USSR) Institut [illegible] I. Vavilova AN SSSR (Institute of Physical [illegible] Vavilov, AS USSR)

SUBMITTED: August 4, [illegible]

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B[illegible]/B[illegible]

AUTHORS: Pitayevskiy, L. [illegible], Kresin, V. [illegible]

TITLE: Disturbances which [illegible] when bodies are moving in a plasma

PERIODICAL: Zhurnal [illegible] fiziki, v. [illegible]
[illegible]

TEXT: A problem which lately has become topical is the scattering of electromagnetic waves by the track of a body moving in an isotropic electron-ion plasma. The present paper deals with the theoretical study of this problem. The plasma is assumed to be diluted to such an extent that the mean free path of ions is large compared with both the length of the scattered electromagnetic wave and the dimensions of the body ($l \gg \lambda$, R). The scattering problem in question can be divided into two parts: Scattering on the body itself (e.g., a metal sphere) and scattering on a track formed by the sphere in the plasma, i.e., in the region of disturbed electron concentration. The scattering by the body itself can be described by conventional formulas of the diffraction theory and is not investigated here any further; however, it [illegible] that the part of a track of the

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Disturbances which [illegible]

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same length. Scattering [illegible] eable [illegible] the total scattering effect [illegible] R [illegible] the perturbation [illegible] the basis of the change of the dielectric constant [illegible] It is assumed that [illegible] is described by the relation [illegible] plasma with a disturbed density

$\Delta\varepsilon(\vec{r}) = -\frac{4\pi e}{m\omega^2}$ [illegible] and [illegible] $\vec{E}' = \frac{[illegible]}{[illegible]}\frac{e^{ikR}}{R}$ [illegible] $\vec{k}'\ \vec{k}'\ \vec{E}$, with [illegible] denoting the amplitude of the [illegible] wave, $\vec{k}'$ the wave vector of the scattered wave [illegible] the Fourier component of the disturbance of the electron density [illegible] by

$n_q = \int \delta n$ [illegible] where $\vec{k}$ is the wave vector of the incident wave, Ψ the scattering angle between $\vec{k}$ and $\vec{k}'$. The cross section [illegible]

$d\sigma = \frac{[illegible]}{16\pi^2\varepsilon}\left(\frac{\omega}{\omega}\right)^4 \frac{|q|}{[illegible]} k^4 \sin\Psi$ [illegible] determine [illegible] it is necessary

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to know $n_{\vec{q}}$. $n_{\vec{q}}$ may be determined by formulas of A. V. Gurevich, but here it is shown that it is easier to determine it directly from the equation of motion. The method brought here to determine $n_{\vec{q}}$ is also more exact, and it is possible to take into account effects occurring at small $\vec{q}$, which is not possible with the Gurevich method. General formulas are first derived for the case where the body is moving much slower than the thermal electrons ($V_0 \ll \sqrt{kT/m}$). In this case the electron density is a function of the potential according to Boltzmann: $n = n_0 \exp(e\psi/kT)$. After extensive calculations the following expressions are obtained:

$$n_{\vec{q}} = \frac{1}{iq}\int \frac{I(\vec{u})}{n(\vec{u}-\vec{V}_0)-i\delta}\, d^3u \Big/ \left[2 - 2a\left(\int_0^a e^{x^2} dx - i\sqrt{\pi/2}\right)e^{-a^2}\right];\quad a = \vec{n}\vec{V}_0\sqrt{M/2kT};$$

$\vec{u} = \vec{v} + \vec{V}_0$, $\vec{v}$ is the ion velocity in a coordinate system moving with the body, M is the ion mass. The electron density decreases in proportion to $1/r^2$; this agrees with Gurevich. Furthermore, a formula is derived for $I(\vec{u})$; its calculation requires the knowledge of the law of ion scattering on a body with the electric field being taken into account. Though this

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formula does not permit the computation of I($\vec{u}$) in the general case, it is possible to determine I($\vec{u}$) for some special cases, as shown next. The calculation of the "collision integral" I($\vec{u}$) is done for a) a slowly moving body ($V_0 \ll \sqrt{kT/M}$); b) a fast moving body ($V_0 \gg \sqrt{kT/M}$) with dimensions that are not small compared to the Debye radius; c) a small charged body ($eQ \ll R_D M v_i^2$). After this, dσ and $n_{\vec{q}}$, respectively, is calculated for a slowly moving body, a fast moving large body

$$n_q = \frac{n_0 q_0}{q}\left\{\left[\frac{\pi}{2} - \sqrt{\pi}\left(\frac{MV_0^2}{2kT}\right)^{1/2} e^{-a^2}\right] + i2\left(\frac{MV_0^2}{2kT}\right)^{1/2} e^{-a^2}\int_0^a e^{x^2}dx\right\} \times$$

$$\times\left[2\left(1 - ae^{-a^2}\int_0^a e^{x^2}dx\right) - ia\sqrt{\pi}e^{-a^2}\right]^{-1} \qquad (41)$$

и

$$d\sigma = \frac{\sin^2\psi_1}{16\pi^2}\left(\frac{\omega_0}{c}\right)^4 \frac{\sigma_0^2}{q^4}\left\{\left[\frac{\pi}{2} - \sqrt{\pi}\left(\frac{MV_0^2}{2kT}\right)^{1/2} e^{-a^2}\right]^2 + 4\left(\frac{MV_0^2}{2kT}\right)\left(e^{-a^2}\int_0^a e^{x^2}dx\right)^2\right\} \times$$

$$\times\left[4\left(1 - ae^{-a^2}\int_0^a e^{x^2}dx\right)^2 + a^2\pi e^{-2a^2}\right]^{-1} \qquad (42)$$

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and a fast moving small body

$$n_q = \frac{2\pi Q^2 e^2 n_0}{q\,(2k^2 T^2 M V_0^2)^{1/2}} \ln\frac{R_D}{r_0}\left[V_0^2 - (\mathbf{V}_0\mathbf{n})^2\right]\left[(1 - 2a^2)\left(\sqrt{\pi} + 2i\int_0^a e^{x^2}dx\right)e^{-a^2} + 2ia\right]\times$$
$$\times\left[2 - 2a\left(\int_0^a e^{x^2}dx - i\frac{\sqrt{\pi}}{2}\right)e^{-a^2}\right]^{-1}. \qquad (45)$$

The authors thank Ya. L. Al'pert and A. V. Gurevich for discussions. A. G. Sitenko and S. N. Stepanov are mentioned. There are 8 references: 6 Soviet-bloc and 1 non-Soviet-bloc.

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SUBMITTED: July 27, 1960

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[illegible]

167660

AUTHOR: Pitayevskiy, L. ..

TITLE: Vortex filaments in an imperfect Bose gas

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. [illegible], no. [illegible], [illegible], [illegible]

TEXT: According to Onsager (Nuovo Cim., 6, [illegible], [illegible]) and Feynman a superfluid liquid may contain vortex filaments, i.e., singular lines around which the superfluid part of the liquid rotates with the velocity v = s$\hbar$/mr (m - mass of an atom of the liquid, r - radial distance from the vortex axis, s - an integer). The existence of these vortex filaments in rotating He II which has been proved experimentally by Hall and Vinen, is undoubted. The theoretical prediction of these vortex filaments has, however, been made on the basis of semiquantitative considerations; the wave function applied could not be derived from general principles. An attempt is made here to find a mathematical description of the processes leading to the formation of vortex filaments by using a simple model. The model chosen is an imperfect Bose gas with

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weak pairwise repulsion of the atoms. This has been accurately studied by N. N. Bogolyubov. Bogolyubov's method is generalized and used for spatially inhomogeneous states, so as to study the vortex filaments in the Bose gas. The start is made from the Hamiltonian of the system in second-quantization representation (4). It is assumed that a short-range potential is concerned here and that the gas is correspondingly diluted, so that the effective radius of the potential is small compared with the particle distance. One then obtains from

$$\hat{H} = \int\left\{-\frac{\hbar^2}{2m}\psi^+\Delta\psi + \frac{1}{2}\int U(\mathbf{r}-\mathbf{r}_1)\psi^+\psi_1^+\psi_1\psi d\tau_1\right\} d\tau \qquad (4)$$

$$\hat{H} = \int\left\{-\frac{\hbar^2}{2m}\psi^+\Delta\psi + \frac{1}{2}g\psi^+\psi^+\psi\psi\right\} d\tau. \qquad (5)$$

$$g = \int U(r)\, d\tau. \qquad (6);$$

this Hamiltonian corresponds to an equation of motion for the

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Vortex filaments in a nonideal ... [illegible]

Heisenberg operator ψ: $i\hbar\frac{\partial\psi}{\partial t} = -\frac{\hbar^2}{2m}\Delta\psi + g\psi^+\psi\psi$. This operator is decomposed into two parts: $\psi = a_0 + \psi'$, $\psi' \ll a_0$; a_0 is a number, ψ' a small additional operator. One therefrom obtains $i\hbar\frac{\partial a_0}{\partial t} = -\frac{\hbar^2}{2m}\Delta a_0 + g|a_0|^2 a_0$. If $a_0 \sim e^{-iE_0t/\hbar}$ one obtains $-\frac{\hbar^2}{2m}\Delta a_0 - E_0a_0 + g|a_0|^2a_0 = 0$. An equation of this kind has already been examined by V. L. Ginzburg and Pitayevskiy (ZhETF, 34, [illegible], 1958) in connection with the phenomenological theory of superfluidity near the λ point. The vortex filaments correspond to a solution of this equation, which is symmetrical with respect to a given axis. If one puts $a_0 = e^{i\varphi}F(r)$ and passes over to cylindrical coordinates, one obtains

$$-\frac{\hbar^2}{2m}\frac{1}{r}\frac{d}{dr}r\frac{dF}{dr} + \frac{\hbar^2}{2mr^2}F - E_0F + gF^3 = 0. \qquad (10)$$

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(10) has a solution vanishing with r → 0, and tending to a constant, $\sqrt{n_0}$, with r → ∞; n_0 corresponds to the particle density at r_∞ and coincides with the total gas density except for the terms $\sim g^{3/2}$. $E_0 = gn_0$, and the vortex filament at s = 1 is given by

$a_0 = \sqrt{n_0}\exp\left[i(\varphi - gn_0 t/\hbar)\right]\psi_0(r/r_0)$, $r = \hbar/\sqrt{2mgn_0}$, $\psi_0(\xi)$ is a real function, for $\xi \to 0$ $\psi_0 \sim \xi$, and for $\xi \gg 1$ $\psi_0(\xi) \approx 1 - \xi^2/2$. r_0 denotes the thickness of the vortex axis. The mean rotational velocity of the particles about the vortex filament is correctly found to be $\hbar/mr$. The approximation made with $\nu \ll a_0$ is justified if the scattering amplitude of the particles is small compared with their distance: $mg/\hbar^2 \ll n_0^{-1/3} \approx n^{-1/3}$, n - particle density; therefrom one has $r_0 \gg n^{-1/3}$, which constitutes a necessary condition. In what follows, the oscillation of a vortex line is examined and a branch with a dispersion

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law is shown to appear in the energy spectrum of a Bose gas if there is a vortex filament. The energy spectrum of weakly excited states is determined from

$$i\hbar \frac{\partial\theta}{\partial t} = -\frac{\hbar^2}{2m}\Delta\theta + 2g\,|a_0|^2\theta + a_0^2\theta^* \qquad (10)$$

with

$$\theta = e^{i(\varkappa z - E_l t/\hbar)} \sum_{l,k} b_l(k, r)\, e^{i(kz + l\varphi)} \qquad (l = 0, \pm 1, \pm 2, \ldots).$$

A system of linear equations

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Vortex filaments in a nonideal ...

$$i\hbar\frac{\partial b_l(k)}{\partial t} = -\frac{\hbar^2}{2m}\left[\frac{1}{r}\frac{\partial}{\partial r}r\frac{\partial}{\partial r} - \frac{(l+1)^2}{r^2} - k^2\right]b_l(k) + gn_0(2\psi_0^2 - 1)b_l(k) + gn_0\psi_0^2 b^*_{-l}(-k),$$

$$-i\hbar\frac{\partial b^*_{-l}(-k)}{\partial t} = -\frac{\hbar^2}{2m}\left[\frac{1}{r}\frac{\partial}{\partial r}r\frac{\partial}{\partial r} - \frac{(l-1)^2}{r^2} - k^2\right]b^*_{-l}(-k) + gn_0(2\psi_0^2 - 1)b^*_{-l}(-k) + gn_0\psi_0^2 b_l(k)$$

is obtained for $b_l(k)$ and $b^*_{-l}(-k)$. It is shown that among the solutions of (20) there is actually one such that corresponds to longwave oscillations (corresponding to macroscopic vortices with thick vortex filaments in the diluted gas). The dispersion law:

$$\omega = \frac{\hbar k^2}{2m}\ln\frac{1}{kr_0} = \frac{\hbar k^2}{2m}\ln\frac{\sqrt{2gmn_0}}{k\hbar}.$$

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Vortex filaments in [illegible] ideal [illegible] [illegible]

is obtained, which corresponds to that of an ideal fluid. Academician L. D. Landau is thanked for his discussions. There are [illegible] references, 4 Soviet-bloc and [illegible] non-Soviet-bloc.

ASSOCIATION: Institut zemnogo magnetizma, ionosfery i rasprostraneniya radiovoln Akademii nauk SSSR (Institute of Terrestrial Magnetism, Ionosphere, and Propagation of Radiowaves, Academy of Sciences, USSR)

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AUTHORS: Dzyaloshinskiy, I. Ye., Lifshits, Ye. M., and
Pitayevskiy, L. P.

TITLE: General theory of the Van der Waals forces

PERIODICAL: Uspekhi fizicheskikh nauk, v. 73, no. 3, 1961, 381-422

TEXT: A brief report is first given of the methods of the quantum field theory, and the general theory of the Van der Waals forces is then explained on this basis. Such a theory has been developed for the first time by Ye. M. Lifshits. The application of the methods of the quantum field theory to the problems of statistical physics at finite temperature is based on a paper by Matsubara. According to it, the free energy can be calculated by the rules of Feynman's graph technique. Matsubara's technique can be appreciably improved by taking account of some general properties of the Green functions (A. A. Abrikosov, L. P. Gor'kov, I. Ye. Dzyaloshinskiy, ZhETF 33, 799 (1959), Ye. S. Fradkin, ZhETF 36, 1286 (1959). The following series presented schematically must be summed

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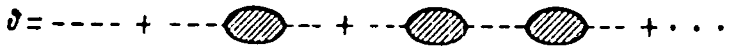
to calculate the total Green function of the photon:



In the case of a spatially inhomogeneous system it has the form

$$\mathfrak{D}_{\alpha\beta}(\mathbf{r}_1, \mathbf{r}_2; \xi_n) = \mathfrak{D}^0_{\alpha\beta}(\mathbf{r}_1, \mathbf{r}_2; \xi_n) + \int \mathfrak{D}_{\alpha\gamma}(\mathbf{r}_1, \mathbf{r}_3; \xi_n)\, \Pi_{\gamma\delta}(\mathbf{r}_3, \mathbf{r}_4; \xi_n) \times$$
$$\times \mathfrak{D}^0_{\delta\beta}(\mathbf{r}_4, \mathbf{r}_2; \xi_n)\, d\mathbf{r}_3\, d\mathbf{r}_4 + \int \mathfrak{D}^0_{\alpha\gamma}(\mathbf{r}_1, \mathbf{r}_3; \xi_n)\, \Pi_{\gamma\delta}(\mathbf{r}_3, \mathbf{r}_4; \xi_n)\, \mathfrak{D}^0_{\delta\mu}(\mathbf{r}_4, \mathbf{r}_5; \xi_n) \times$$
$$\times \Pi_{\mu\nu}(\mathbf{r}_5, \mathbf{r}_6; \xi_n)\, \mathfrak{D}^0_{\nu\beta}(\mathbf{r}_6, \mathbf{r}_2; \xi_n)\, d\mathbf{r}_3\, d\mathbf{r}_4\, d\mathbf{r}_5\, d\mathbf{r}_6 + \dots \qquad (2,8)$$

Eq. 2.8

$(r_1, r_2;\ _n)$ signifies the so-called polarization operator of the system. (2.8) or, in another form,

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