FUSION Facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

ISSN 1051-8738 Offices located in the University of Utah Research Park

Fusion Facts Now Reports on Both Cold Fusion and Other Enhanced Energy Devices.

VOLUME 4 NUMBER 8 FUSION FACTS FEBRUARY 1993

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COMING IN MARCH, 1993 ISSUE

The March issue of *Fusion Facts* will recall the events of four years of living with cold fusion discovery.

> "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it."
> Max Planck

A. IS CAPILLARY FUSION THE ANSWER?

By Hal Fox

Peter Graneau from the Centre for Electromagnetic Research, Northeastern University in Boston; his son, Dr. Neal Graneau from the Department of Engineering Science at the University of Oxford; Dr. M. Rambaut from France, and Dr. J.P. Vigier from France have collectively been studying, experimenting, and inventing, using their growing knowledge about Ampere's force [1]. This reference [1] is reviewed on page 4 of this issue.

André-Marie Ampère was born June 10, 1838 in Marseille, France. He was the physicist who found and named the science of electrodynamics (now call electromagnetism). He was a child prodigy and had mastered all the existing math by the age of 12. He formulated Ampère's law that describes the magnetic force between two electrical currents. As now shown by the above named researchers, Ampère's mathematics shows that there are both longitudinal forces as well as transverse forces involved in the flow of electricity.

Ampère's force law will not be found in most of the modern textbooks as it has been replaced by simpler and less-accurate formulations. The end result is that we have been taught that there are no longitudinal forces developed when electrical current flows through a conducting medium. Vigier and Rambaut [2, 3] have recently shown that the original formulation by Ampère is a physical reality and that longitudinal forces not only exist but may be the explanation for cold fusion nuclear reactions.

The basic idea is that two elements of current flowing along the same straight streamline produce a repulsion force between the two current elements. Ampère's law shows that this force of repulsion is equal to $(\mu/4\pi)$ X i^2 X (l^2/r^2) where i is the same level of current in two current elements having the same length l and r is the distance vector between the two current elements along the same streamline.

It has been experimentally shown that this longitudinal force is sufficient to expel a column of salt water from a water-arc gun with sufficient force to pierce a 0.6 cm. thick aluminum plate. The water did not turn to steam and was recovered

with its original salt content [1]. The invention of the water-arc gun led to two French patent applications [4], one of which involves the production of nuclear fusion in deuterium-containing liquids.

The Ampère forces are cited as responsible for the manner in which a strong, short pulse of electrical energy can cause current-carrying wires to break into fragments. These same forces are thought to play a major role in cold fusion, especially where the fusible ions or elements are confined in a capillary. The basic idea is that the flow of electrical current through deuterium ions in a capillary can produce sufficient forces or accelerations to overcome the Coulomb barrier and result in the fusing of two deuterium ions or atoms. Vigier and Rambaut were especially delighted with the paper presented by Dr. K. Kaliev at the Nagoya cold fusion conference [5] where Kaliev presented experimental evidence for the generation of excess heat and the production of neutrons from deuterium ions in capillaries of tungsten bronze crystals.

There is a strong tendency on the part of experimenters and theorists to take a successful explanation and seek for wider applications. It is not surprising, therefore, to find that this excellent discovery of capillary fusion that appears to grandly explain the Kaliev results [5] can be applied to filaments of deuterium in gas plasma fusion and in explaining neutron production in exploding wires. Indeed, these explanatory successes may be applied to conceived filaments of current in heavy-water and in light-water cold fusion electrochemical cells [1].

It is suggested that the discoveries of the Graneaus, Rambaut, and Vigier may be closely related to the discovery and control of high-density electron clusters as taught by Ken Shoulders in his patent [6]. Shoulders shows that "beads" of electrons can be formed which consist of 10^8 or more electrons. The density of such electron clusters approaches the density of metals. The electron bead is highly energetic; travels at about 0.1 the speed of light; can be highly disruptive when colliding with a metal surface; can produce X-rays and other spectral energy when disrupted; are found in copious amounts in lightning and in arcs and sparks; and are probably present in unstable plasma discharges.

The following is quoted from [1]: "Haines [7] mentions that there is also a centre-of-mass ion motion, away from the central electrode (anode). The simplest explanation of this motion is longitudinal Ampère repulsion forces between the current elements in the anode and others in the plasma filament. Very high axial ion velocities, of the order of 100 km/s, have been mentioned in the literature." Compare this statement with Shoulders' teachings in the patent 5,018,180 in which he discusses that clouds of ions are produced with EVs (electron beads) and that these ions can be stripped away from the EVs by using properly-designed electrodes (anodes). Shoulders suggests that the EVs travel about 0.1 c but does not mention the speed with which the positive ions move.

Again from [1]: "This phenomenon forms a neck in the [electric flow] filament, and the consequent radial current components on both sides of the neck repel each other and fracture the plasma column." Could this be the explanation of how an EV is formed when Shoulders teaches the use of very short pulses of negative voltages (60 to 1,000) volts connected to a sharply-pointed cathode? Could the short current element have "consequent radial current components on both sides" that would pinch off a current element which then forms into a very energetic high-density charge cluster? Would the cold fusion theorists (Hagelstein, two Chubbs, Bass, Bush, Kim, et al,) please consider both the longitudinal forces as suggested by Graneau et al. and the high-density charge clusters as taught by Shoulders as having a prominent place in the explanation of various cold fusion phenomena.

It is strongly suggested that the experimental literature of cold fusion is now rich with phenomena and that explanations for cold fusion are beginning to surface. The combination of the periodicity of the deuterated metal lattice (lends to resonance); the effects of "screening" (how about the screening effects of an EV having 10^8 or more electrons); the longitudinal Ampère force (to overcome the Coulomb barrier); and the potential of the catalysis of nuclear reactions by selected metal lattices -- these should lead to one or more solid theories to explain the widely divergent experimental results now replete in the cold fusion literature.

Stay tuned for the "rest of the story". The theorists are hard at work. Please send them your latest experimental results.

REFERENCES

[1] Peter Graneau (Northeastern Univ, Boston) & Neal Graneau (Univ of Oxford, England), "The role of Ampère Forces in nuclear fusion," *Physics Letters A*, Vol 165, 1992, pp 1-13, 10 figs, 29 refs.

[2] M. Rambaut and J.P. Vigier, *Phys. Lett A*, Vol 142, 1989, page 442.

[3] M. Rambaut, *Phys. Lett. A*, Vol 154, 1991, page 210.

[4] M. Rambaut and J.P. Vigier, French patent applications Nos. 9003660 (March 22, 1990) and 9004886 (April 17, 1990).

[5] Kabir Kaliev, Aleksey Baraboshkin, A.L. Samgin, E. Golidov, A. Shalyapin, V. Andreev, & P.I. Golubnichy (Inst. of High-Temperature Electrochemistry, Ekaterinburg), "Reproduced Nuclear Reactions During Interaction of Deuterium with Oxide Tungsten Bronze," Presented at the

Third International Conference on Cold Fusion, October 21-25, 1992, Nagoya, Japan.

[6] Kenneth Shoulders, "Energy Conversion Using High Charge Density", U.S. Patent Number 5,018,180, Date of Patent: May 21, 1991, 42 claims, 38 drawing sheets with 97 drawings, 40 pages of explanatory text.

[7] M.G. Haines, *Philos. Trans. R. Soc. A*, Vol 300, (1981), pg 649.

B. NEWS FROM THE U.S.

CALIFORNIA - UPDATE ON COLD FUSION

Courtesy of Dr. Samuel Faile

Antony C. Sutton (Editor), "Update on Cold Fusion," *FTIR (Future Technology Intelligence Report)*, November 1992, Vol 3, No. 11, pp 5-6, no ref.

EDITOR'S COMMENTS

The article states that cold fusion will turn out to be **excess heat** not nuclear fusion as FTIR asserted at the start. Cold fusion is a process reflecting a previously unknown phenomena. SRI work is performed in tight secrecy but 39 experiments have achieved excess heat. FTIR's position, dating back three years, is that there is an excess heat phenomena but no fusion is involved. These comments from the short article indicates that the writer lacks considerable information that is contained in many published cold fusion papers. FTIR's address is P.O.Box 423652, San Francisco, CA 94142-3652. FTIR is a $150 per year monthly short (8-page issue) newsletter devoted to technological predictions. We'll send a copy of *Fusion Facts* just to provide Dr. Sutton with the knowledge that there is a good source of information available on cold fusion.

CALIFORNIA - WATER FUEL PATENT

Courtesy of Stephen A. Roen

Rudolph W. Gunnerman (Inventor), "Aqueous Fuel for Internal Combustion Engine and Method of Combustion," U.S. Patent No. 5,156,114; Date of Patent, Oct. 20, 1992; 113 claims, no drawings.

PATENT ABSTRACT

An aqueous fuel for an internal combustion engine is provided. The fuel comprises water from about 20 percent to about 80 percent by volume of the total volume of said fuel, and a carbonaceous fuel selected from the class consisting of ethanol, methanol, gasoline, kerosene fuel, diesel fuel, carbon-containing gaseous or liquid fuel in an internal combustion engine is provided. The method produces approximately as much power as the same volume of gasoline. The method comprises introducing air and aqueous fuel into a fuel introduction system for the engine. The fuel comprises water from about 20 percent to about 80 percent by volume of the total volume of the fuel, and a carbonaceous fuel from ethanol, methanol, gasoline, kerosene fuel, diesel fuel, carbon-containing gaseous or liquid fuel, or mixtures thereof, and introducing and combusting said air/fuel mixture in a combustion chamber or chambers in the presence of a hydrogen producing catalyst to operate the engine.

CALIFORNIA - WATER FUEL AUTO TESTS

Courtesy of Stephen A. Roen

William Liscom, "Environmental Report: Further Tests Lend Credence to Significant Potential of Water-Gasoline Fuel," *Oil Market Listener,* Document ID OML888, 22 Jan 1993, pp 1-5, 1 table.

EXECUTIVE SUMMARY

Paraphrased from the original: An independent research organization (SRI, Int'l, Menlo Park, CA) has used standard test equipment and produced startling new data about the water-gasoline fuel emulsion. Definitive conclusions require additional testing, however, the tests support the possibility of greatly increased fuel efficiency, reduction of pollution, and simplification of automobile engine manufacturing. The new fuel is called "A-55" because it used about 55% water with the remainder being gasoline. Based on current test data, the engines consume about one-half the amount of gasoline to provide the same mph and automobile performance. CO is reduced by about 90%, CO_2 is about the same, but the nitrogen oxides are reduced by about one-half. These reductions may be further improved with further testing and adjustments of engine parameters. An unusual finding was that hydrocarbon emissions were actually higher using the A-55. If further data is consistent with initial findings then there may be substantial savings not only in gasoline costs but also in the cost of manufacturing automobile and truck engines because the catalytic converters and the vapor canisters could be eliminated. In addition, the radiator can be downsized. Cold weather performance is a concern but may be resolved with further development. In February, 1993, a seven-car rally is planned to provide further operational data for A-55. A diesel engine is now being modified so that aqueous-diesel fuels may be tested.

EDITOR'S COMMENTS

One of the more interesting parts of the newsletter refers to the non-acceptance of this improvement in automobile fuel by some of the critics. To quote the newsletter, "Some of the more harsh critics have cited the dubious scientific basis

claimed and faulty arithmetic (apparently related to typographical error) in the newly-printed US patent as sufficient grounds for treating this purported "breakthrough" as nothing more than a promoter's hype -- **if not downright fraud.**" [Emphasis mine. Ed.] Pons and Fleischmann, please copy. You are not the only ones being falsely accused. The use of A-55 requires a special surfactant to ensure that the water/gasoline mixture remains combined. In addition, a "hydrogen-producing catalyst" is installed in the engine.

COLORADO - DISMANTLING EXPENSE

Robert Johnson & Ann de Rouffignac (Staff Reporters), "Closing Costs: Nuclear Utilities Face Immense Expenses in Dismantling Plants," *Wall Street Journal*, Jan. 25, 1993, pp A1 & A7.

EDITOR'S SUMMARY

In 1954 Lewis Strauss, chairman of the Atomic Energy Commission, predicted that electricity produced by nuclear facilities would become "too cheap to meter." This overly-optimistic view is contrasted with the shocking disclosure that nuclear power plants are costing huge sums to close and dismantle. The closing and planned dismantling of the nuclear power plant in Fort St. Vrain, Colorado has become an unplanned and unexpectedly large economic cost to the Public Service Company of Colorado. The plant cost $224 million to build in the 1970s. The cost for dismantling the plant is now estimated at $333 million. The utility will still be charging its customers for this cost in the year 2005. The plant never had any accidents or radiation leaks but the closing was caused by cracks in the reactor's steam tubes. [Probably the cracks were the results of hydrogen embrittlement, a problem of monstrous economic proportions being faced by many owners of nuclear facilities.] The American Electric Power Co., in Columbus, Ohio has recently raised its estimate of future dismantling costs for its 836-megawatt plant from the 1989 estimate of about $350 million to $1.15 billion. Plants that were designed to have a 40-year life have been closing down after an average life of 12.7 years. [This design, building, and dismantling of nuclear power plants has probably been the biggest energy fiasco ever foisted on the unwitting consumer of electrical power. And the same type of heavily-optimistic projections are being touted by some of the scientists, engineers, and bureaucrats involved in the development of hot fusion. Cold fusion is looking more promising every day! Ed.]

MASSACHUSETTS - AMPERE FORCES

Courtesy of Dr. Peter Graneau

Peter Graneau (Northeastern Univ, Boston) & Neal Graneau (Univ of Oxford, England), "The role of Ampère Forces in nuclear fusion," *Physics Letters A*, Vol 165, 1992, pp 1-13, 10 figs, 29 refs.

AUTHORS' ABSTRACT

Three different non-tokamak fusion mechanisms are examined, involving plasma filaments formed from gaseous, liquid or solid deuterium. Results from previous experiments, in which up to 10^{12} neutrons were produced, point to non-thermal fusion mechanisms. The role of electrodynamic forces, including those predicted by Ampere's force law, are investigated as the possible mechanism of ion acceleration.

[See article beginning on page 1 about capillary fusion. Ed.]

MASSACHUSETTS - NAGOYA SUMMARY

Courtesy of Dr. Peter Hagelstein

Peter L. Hagelstein (MIT), "Summary of ICCF3 in Nagoya," submitted to *Fusion Technology*, 37 manuscript pages, 85 refs.

AUTHOR'S ABSTRACT

We review highlights of the international cold fusion conference that was held recently in Nagoya, Japan. Excess heat results in heavy water electrolysis experiments constitute the observations with the most important potential applications. Experiments in gas phase systems exhibit fast particle and gamma emission that make progress toward elucidating mechanisms. The evidence in support of a light water heat effect has improved.

AUTHOR'S "WHAT SHOULD BE DONE?"

1. Verification of a heat effect: I am convinced that the Pons-Fleischmann cells can produce excess energy of a nuclear origin, based on the amount of energy per atom evolved. The scientific community does not accept this [verification]. The issue really needs to be put to rest, and the associated controversy ended.

Pons and Fleischmann have been publishing further details of their own work in refereed journals and in readily available conference proceedings, and more papers are currently in the pipeline. Details of the work of many other groups is also readily available.

Much more is known about the Pons-Fleischmann cells than in 1989, and the reproducibility of the effect has been improved considerably. SRI has produced documentation of criterion which, if met, carries the guarantee that similar experiments at SRI have produced heat reproducibly with a high success rate. Palladium cathodes from sources other than Johnson-Matthey have now shown the effect.

Significant deficiencies have been identified in the most important negative experiments which were done in 1989; the main criticisms of these experiments was that a high loading was not achieved and held. For example, the method developed at SRI requires very high loading (D/Pd ratio near 0.90) to be maintained for about a week. Since positive results have been obtained at lower loadings, this constraint is likely not to be absolute; nevertheless, many in the field believe that quite high loadings do improve the reproducibility of the effect.

I do not know how this controversy is to be ended, but I know that it does need to be ended in a satisfactory manner. The basic experiments have been done, they have been repeated in many different ways by numerous groups, and the effect is observed with considerably better signal to noise ratio than in 1989.

Scientists in the field have gone to extremes in attempts to satisfy skeptics. Cells were stirred, blanks were done, extremely elaborate closed cell calorimeters have been developed (in which the effect has been demonstrated), the signal to noise ratio has been improved so that positive results can now be claimed at the 50 σ level, the reproducibility issue has been laid to rest; but still it is not enough. I have heard some skeptics saying that a commercial product is the next hurdle to be jumped through before any significant funding can be justified. This is simply not right.

2. Basic reaction mechanisms for heat production: To date the claims of the observation of heat anomalies in metal deuterides have not been accompanied by any clear positive evidence for reaction mechanisms. Anomalous heat generation would have to have a fuel, and would have to have ashes; the confirmed identification of either fuel or ashes would help tremendously towards a determination of a reaction mechanism.

I think that progress in this field is hindered by the absence of even a rudimentary understanding of the basic reaction mechanisms involved (there are, of course, theories, but to date there is no positive experimental confirmation of any proposed theory.) At some point, the principal experimentalists in the field simply must take this issue seriously. Having an understanding of what the reaction mechanisms are would provide numerous benefits: (1) guidance as to what experimental parameters are expected to be important for optimizing reaction rates; (2) improvement of the general quality of the science being done in the field, especially as perceived by those not in the field; (3) allow those working in the field to focus more clearly on the issues that are most important. From the point of view of funders or potential funders, a knowledge of how the effect works allows the possibility of assessing more accurately potential future applications.

The determination of fuel and ashes requires high sustained volume-averaged heat production. In the case of ^{4}He production, an assay of the gas stream is required; in the case of assays for other elements and isotopes, careful mass spectroscopy (and the presence of a small electrolyte volume) will likely prove to be most important.

3. Verification and reaction mechanisms for other anomalies: Quite a few anomalies have by now been associated with deuterium in metals experiments, including observations of neutrons, gammas, fast ions, tritium, and helium production.

None of these effects are currently accepted by the scientific community; as in the case of the heat effect, some way is needed to arrange for a consensus as to which of the effects are real. It would seem to me that the most dramatic claims come from the glow discharge experiments; most significant would be if these experiments could be further reproduced and verified.

I think that experiments which produce energetic (MeV-level) nuclear products provide essential information relevant to the issue of reaction mechanisms. For example, a confirmation of significant isotope shifts and strong gamma emission from heavy elements would place very strong constraints on proposed reaction mechanisms. A detailed study of precisely which gamma lines are produced would likely shed lights on how the gamma lines are excited, which provides further input on reaction mechanisms.

NEW YORK TIMES - ENERGY SUBSIDIES

Courtesy of Sam Faile

"U.S. finds energy industry subsidies are small," said a December 14, 1992 headline of page C2. But the content of the article seemed to go in a different direction. An Energy Dept. study of government subsidies was at odds with an evaluation by a prominent electricity analyst, Charles Komanoff, who has found enormous subsidies for the nuclear industry, and enormous costs incurred directly by the utilities. While the last two administrations have vigorously supported nuclear power, a change may be in the offing.

The Energy Dept. study, released in mid-December, claims that the oil industry pays more in taxes than it gets in benefits. Further, it concludes that government subsidies to the energy industry are equal to 1 to 3 percent of the value of all energy consumed, or $5 to $13 billion a year, depending on how you define a subsidy. It found the nation's total energy bill for a year to be $475 billion. "Contrary to what might be the popular impression energy is not heavily subsidized," said Calvin A. Kent, administrator of the Energy Information Administration of the Energy Dept.

Mr. Komanoff's study, released in December by the environmental group Greenpeace, concludes that taxpayers have spent nearly $100 billion to promote nuclear power. Since the first expenditures in the early 50's, the total subsidy amounted to 1.6 cents (all amounts stated in 1990 dollars) for every kilowatt-hour ever produced by nuclear power from 1968, when the first large plants came on line, to 1990. The study found the total cost of a nuclear kilowatt-hour to be just over 10 cents. This figure includes $347 billion to build, fuel and operate reactors, and to begin programs to tear them down when they retire. $48 billion has been spent on indirect utility costs, including waste disposal and investments in canceled plants.

The 10 cent (wholesale) figure contrasts with the average cost of a kilowatt-hour to all customers in 1992, which was 6.6 cents, according to the Energy Dept. The government study did not compare the subsidy costs to the costs per kilowatt-hour. It did find the direct appropriations for nuclear power in 1992 were $890 million for research and development and $9 million in regulatory costs paid by taxpayers. Nuclear power also enjoys a partial exemption from liability for reactor accidents, which translates into $3 billion a year in reduced insurance costs.
Utility subsidies, through subsidized loans and government sales at below-market prices total $1.8 billion to the electricity industry, $1.1 billion to the coal industry ($551 million for research in cleaner ways to burn the fuel) and 1.7 billion to the natural gas industry. $635 million was spent to subsidize conservation.

NEW YORK - CATALYTIC THEORIES

Courtesy of Charles Becker

E. Pennisi (Staff Writer), "Microscopic pillars test catalytic theories," *Science News*, vol 142, no 22, Nov 28, 1992, pg 375.

EDITOR'S COMMENTS

The article cites the work of Howard Saltsburg of the Univ. of Rochester and Ioannis Zuburtikudis with Eastman Kodak Research Labs in Rochester. Their work is described in the November 20, 1992 issue of *Science*. The researcher studied the effect of very small metal catalysts on the degree of catalysis provided. In larger particles, the rate of a chemical catalytic process increases in proportion to surface area. In small particles the relationship does not hold. The researchers have correlated the degree of catalysis with the height of the tiny strips of metal that they create. In the January 1992 issue of *Fusion Facts*, we reviewed an important article by L.P. Nielsen in which he showed that under some conditions a nickel surface would build or add to a row of nickel atoms. It may be that the catalysis of both chemical and nuclear reactions is related to the length of some array of atoms or combinations of atoms so that there is a stronger possibility of resonance along the line of the row of atoms. This speculation by this editor is consistent with the suggestion made by Leaf Turner in 1989 and the resulting work on his Transmission Resonance Model by Dr. Robert Bush. In addition, is suggested that Peter Glück's SURFDYN model may be improved by consideration of this newly discovered factor. H.Fox, Ed.

TEXAS - BIRTH OF COLD FUSION

Courtesy of Dr. John Bockris

John O'M Bockris (Texas A&M), "Hesitant Birth of Cold Fusion," *Forum for Applied Research and Public Policy*, Winter 1992, pp 91-93.

EDITOR'S COMMENTS

This article is an excellent review of the history and the problems in launching the new science of cold fusion. The article is directed toward a professional but not technical audience and begins with the following statement, "One of the principal objectives of applied physics is to fuse atoms in order to release energy." Dr. Bockris, an eminent electrochemist, admits that most physicists do not yet acknowledge the success of the Pons-Fleischmann approach to the production of energy. Bockris was one of the first to replicate cold fusion and relates how those who sought to replicate cold fusion were unaware of two facts not covered in the announcement by Pons and Fleischmann: The nuclear effects occur in bursts and it takes about six weeks of electrolysis to observe the effects. Most researchers tried for a few hours or a few days and announced that nothing could be observed. The result was a wave of resentment directed toward Pons and Fleischmann. Bockris relates that a researcher tells him in strict confidence, "My boss would kill me if he knew! You see, I have positive results." Bockris comments on this strange phase of a new science where such an emotional attitude prevails among some so-called scientists. Bockris relates, "The hostile atmosphere towards cold-fusion research in the U.S. may have been sparked by the hot-fusion lobby." Bockris suggests that the limited information provided by Fleischmann and Pons also had a negative effect.

Under the heading ***Tritium Test***, Bockris discusses the importance of finding tritium as the production of tritium cannot be a byproduct of chemical reactions. At the latest count, Bockris relates, tritium has been found to be a byproduct of successful cold fusion experiments in more than 40 laboratories in nine countries. Prof. Bockris concludes his article with a list of three observations about scientists:

1. They are no less driven by emotion than businessmen and politicians,

2. Decisions about research funding are usually political decisions, and

3. Ideas implanted in a young scientist's mind during training are often taken as "final truths."

Finally, Bockris observes that this last point has a direct impact on the peer-review process. He warns, "Experts in the field are the worst people to send a new idea; they usually will trash it. Just ask the pioneers of cold-fusion research."

WASHINGTON D.C. - NEW DIRECTION FOR SCIENCE
Courtesy of Carol White

Carol White, "Japan cold fusion conference sets new direction for science," and "Evidence of a nuclear event," *Executive Intelligence Review*, Dec 11, 1992, pp 20-27, illus., 1 fig.

EDITOR'S SUMMARY

Carol White reports on the results of the Third International Conference on Cold Fusion held in Nagoya, Japan, Oct. 21-25, 1992 and suggest that this conference can set a new direction for science. In the address prepared for the conference by Minoru Toyoda (who died in mid December, 1992), he writes about his dream of established centers of research in several parts of the world. The result has been the establishment of IMRA Europe, IMRA America, IMRA Japan, and, in the planning, IMRA Asia. Toyoda writes, "...Cold fusion is not just something to be studied by a single enterprise or a single nation. I am confident that it will become a precious asset to all mankind, as the ultimate, ideal form of energy, so that it must be shared among all of the nations of the Earth. Therefore, it is my hope, and my message to you, the cold fusion researchers: Please continue to work with all your might to make this new form of energy a reality, because you offer such hope to the coming generations of the twenty-first century."

In the second article, Carol discusses the Yamaguchi experiment that definitely demonstrates the presence of nuclear events in a cold-fusion type device. The following quote is significant: "This indicates that in condensed matter -- palladium lattice -- fusion occurs by an unusual route, producing low quantities of tritium and helium-3, but also producing helium-4. Such a reaction would have a negligibly small probability in a typical high-energy fusion reaction. The probable absence of high-energy gamma radiation is also anomalous from the point of view of hot fusion, but is explained by Fleischmann and Pons along the lines of the superradiance model of cold fusion of University of Milan physicist Giuliano Preparata, in terms of the existence of coherent phenomena which allow the interaction of the fusing deuterons with the palladium lattice."

WASHINGTON, D.C. - SECRECY ORDERS
Courtesy of Stephen Roen and Sam Faile

Staff, "Easing up on Secrecy Orders," *New York Times*, Feb. 1, 1993.

EDITOR'S SUMMARY

The Invention Secrecy Act of 1951 permits the DOD to decide which patents should be classified due to the nature of the invention. From 1979 to 1991 the number of secrecy orders rose from 3600 to 5893 according to the article. Industry and scientific groups have been registering increasing complaints with the results that there may be a decrease in the number of inventions that are classified. The secrecy order prevents the inventor(s) from licensing the invention to anyone except the U.S. government. A more lenient form would prohibit licensing to foreign companies. Cold fusion invention disclosures are even worse, because without a patent, the inventor has difficulty licensing to anyone.

C. NEWS FROM ABROAD

ARGENTINA - GAMMA DETECTION
Courtesy of Dr. Samuel Faile

A.R. López García, H. Vucetich (Dept. of Physics, Univ. Nacional de La Plata), A.E. Bolzán & A. Arvía (Dept of Exact Sciences, Univ. Nacional de La Plata), "Gamma-Radiation Detection Limits for Electrochemically Induced Deuterium Cold-Fusion Rates," *Il Nuovo Cimento*, Vol 105 A, No. 7, July 1992, pp 987-992, 3 figs, 2 tables, 7 ref, in English.

AUTHORS' SUMMARY

An experiment was performed in order to detect cold fusion in an electrochemical set-up similar to that described by Fleischmann et al. The detection of gamma-rays from deuteron formation was made with a NaI(Ti) scintillator. Upper bounds for the neutron production rate of 0.53 c/s and 0.23 c/s for the stationary and the transient processes, respectively, were determined.

EDITOR'S COMMENTS

The diagram of the electrolytic cell indicates that there was strong asymmetry between the anode and the cathode. Fleischmann and Pons claim that symmetry is important. Although the paper shows measurements for both alpha and beta phases of the Pd/D, there is no mention as to whether the D/Pd ratio was measured. D/Pd ratios over about 0.85 are reported to be necessary for positive cold fusion results. We would suggest that the authors follow the experimental procedures that have provided reproducible results. We are

sure that Drs. Pons and Fleischmann would be pleased to make some experimental suggestions. It would be important for the authors to monitor excess heat production during the experiment. We hope they can repeat the experiment.

AUSTRALIA - P-F CELL, NO HEAT
Courtesy of Dr. Samuel Faile

T.I. Quickenden & T.A. Green (Univ of Western Australia), "A calorimetric study of the electrolysis of D_2O and H_2O at palladium cathodes," *J. Electroanal. Chem.*, Vol 344, 1993, pp 167-185, 6 figs, 5 tables, 46 refs.

AUTHORS' ABSTRACT

A search for excess heat production during the electrolysis of D_2O or H_2O at palladium cathodes was conducted using a sensitive flow calorimeter. A total of 20 long-term experiments using 10 control cells and 10 test cells was performed and the effects of different electrode pretreatments and electrolysis conditions were examined. In all cases, the thermal output from the cell matched the Joule input energy within the experimental error of $\pm$ 1.5%. These results provided no evidence for any excess heat production over the aggregated cell operating time of 17762 hours.

EDITOR'S COMMENTS

This article reports on a careful study of the Pons-Fleischmann type cold fusion cell. One glaring, and crucial factor is not reported and that is the D/Pd ratio. By now it is well known how important the D/Pd ratio is to the operation of a P-F cell.

ENGLAND - ENERGY FROM ALGAE
Courtesy of Dr. Samuel Faile

Otis Port (Staff Editor/Writer), Empowering Algae -- to Make Electricity, That is," *Business Week*, February 8, 1993, page 96.

EDITOR'S COMMENTS

Prof. Paul Jenkins, Engineering Dept. at University of the West, Bristol, England, grows algae in a nutrient broth in a clear plastic tube warmed by sunlight. Algae are siphoned off, dried, pulverized, used as fuel in a diesel engine which drives an electric generator. The CO_2 is used to feed the algae. Plans to build a 600-kw pilot plant are being financed. Makes cold fusion energy systems seem downright simple.

ENGLAND - ANOTHER FIASCO
Courtesy of Dr. Sam Faile & 3 others.

David Williams (Prof. of Chemistry at Univ. College, London), "Proof, Process and Lessons from Cold Fusion," *Physics Today*, January 1993, pp 73-74, a book review.

EDITOR'S COMMENTS

Professor Williams was a research group leader at the Harwell Laboratory in England and was responsible for the well-publicized failure of his group to replicate the Pons-Fleischmann cold fusion experiment. From the video tapes shown by NOVA on public television of the Harwell handling of the experimental device, it is quite apparent that the cell being handled would be too contaminated to work properly. In this latest publication Dr. Williams reports on John R. Huizenga's book, Cold Fusion: The Scientific Fiasco of the Century. The most entertaining part of this book report is the following comment by Williams:
Indeed, it is important to say that there do seem to be some good measurements which indicate the possible occurrence of an interesting phenomenon. ***But what profit is there in such an inefficient, unreliable, dangerous and expensive energy storage method?"*** Please note that this statement is made by a hot fusion advocate who has helped to spend billions of dollars on a fusion device(s) which have yet to achieve breakeven; produce high levels of radioactivity in the walls of the device; and have certainly been shown to be the epitome of an inefficient, unreliable, dangerous, and expensive energy source. Perhaps Williams thought Huizenga wrote his book about hot fusion. As a measure of unbiased reporting, please note that Williams is publishing this comment in January 1993, well after the Nagoya conference on cold fusion and well after the approval by Japan's MITI organization to increase funding for "New Hydrogen Energy."

FRANCE - NEUTRONS & GAMMAS
Courtesy of Dr. Samuel Faile

S. Pons & M. Fleischmann (Technova-supported Research Lab near Nice), "Concerning the Detection of Neutrons and Gamma-Rays from Cells Containing Palladium Cathodes Polarized in Heavy Water," *Il Nuovo Cimento*, Vol 105 A, No. 6, June 1992, pp 763-772, 8 figs, 22 ref, in English.

AUTHORS' SUMMARY

It is shown that neutrons generated in "cold fusion" cells can be detected following thermalization by means of high-resolution spectroscopy of the gamma-rays generated by the (n,gamma) reaction in light water. It is further shown that to achieve this characterization it is essential to use data analysis procedures which do not discriminate against the steady-state or quasi-steady-state generation of neutrons in the cell.

EDITOR'S COMMENTS

The following paragraph, quoted from the paper, is important: "The detection of neutrons therefore poses formidable difficulties. Measurements have relied in the main on the use of BF_3 and ^3He counters (including the construction of special arrays and vetoing schemes, e.g. proton recoil as well as the application of time-of-flight and other energy discriminative systems. A different approach to the detection of neutrons was included in our first investigations: the fast (2450 kev) neutrons generated in reaction (ii) [D+D → ^3He] were thermalized in the water thermostats surrounding the experimental cells and the measurements of the gamma-rays resulting from the reaction of the thermal neutrons with water

$$n + {}^1H \rightarrow {}^2D + \text{gamma (2224 kev)}$$

was attempted by using an high-sensitivity NaI detector; this measurement is discussed further below. It rapidly became apparent, however, that the detection of the low levels of gamma-radiation generated by the low neutron flux was not feasible using such a detector system but that one should use instead an high-resolution (though lower sensitivity) Ge-detector in these measurements. Such measurements and their bearing on experiments using NaI detectors are discussed in this paper."

FRANCE - COLD FUSION ACCOMPLISHMENT

Carol White, "From Como to Nagoya: A Solid Year of Cold Fusion Accomplishment," *21st Century Science & Technology*, Winter 1992, vol 5, no 2, pp 66-68.

EDITOR'S COMMENTS

One of the highlights of the Nagoya cold fusion conference was the video produced by Pons and Fleischmann showing four different cold-fusion electrochemical cells boiling off all of the electrolyte out of the cell containers. The heat produced by the small palladium cathode is able to boil off all the electrolyte in about eleven minutes. The calculations show that the power density in the cathode of heat production is about 1.7 kilowatts per cubic centimeter. Using the input electrical power of about 37 watts, the boil-off would take about 40 minutes. Other developments on the road from Como to Nagoya is the broad array of excess heat results using light-water electrochemical cells. The large number of positive reports at Nagoya led Dr. Hideo Ikegami, (National Institute of Fusion Science at Nagoya) to state that cold fusion has been established, beyond doubt, as a nuclear reality. Many of the attendees called for an international collaboration to advance the science of cold fusion. In an inset on page 67, the closing remarks of Hideo Ikegami, "International and Interdisciplinary Collaboration Necessary" are reported.

FRANCE & ITALY - NEW WINDOW ON LAWS

Carol White, "A New Window on the Laws of the Universe," *21st Century Science & Technology*, Winter 1992, vol 5, no 2, pp 58-65.

EDITOR'S SUMMARY

This article reviews the relationship among Fleischmann and Pons and Guiliano Preparata and reports on the developing understanding of physics wrought by studying the new science of cold fusion. There are more than one reaction producing the cold fusion results and therefore more than one explanation. Fleischmann and Preparata both have and do share scorn from some of their "peers" because they both had and continue to promote new discoveries and new explanation that promise to change some of the cherished scientific beliefs. They are both working on the development of a quantum field theory that explains cold fusion phenomena. Fleischmann states, "This is something like catalysis with metals and superconductivity. They also are really not understood." These scientists believe that they are on the verge of explaining more fully some of the intriguing laws of nature. It is possible that their work may extend or promote new scientific experiments that are far beyond cold fusion.

ITALY - REPLICATING TAKAHASHI

Staff, "Dr. Francesco Celani: Replicating the Takahashi Experiment," *21st Century Science & Technology*, Winter 1992, vol 5, no 4, pp 70-71.

EDITOR'S SUMMARY

Dr. Francesco Celani, physics professor at the Frascati National Laboratory has replicated the Takahashi experiment. Although the amount of excess heat found by Celani was not as large as found by Takahashi, Celani considers this replication as important. Celani uses a special electronic circuit (diode) which limits high-frequency fluctuations during loading so that there is less high speed loading and deloading of the cathode. Using this device and technique, Celani reports that he achieved excess heat within one and a half hours after completing the calibrations. Celani also measures the amount of excess oxygen gas (not recombined due to the use of deuterium in loading the cathode) and estimates that he has achieved a D/Pd ratio greater than 0.75. During this experiment, the cell cooling water was held at 17 C and the cell "was maintained at 40 C". Celani notes that palladium hydrides are superconducting at temperatures up to 10 Kelvin and compares this fact with the fact that cold fusion successes are also strongly dependent on a D/Pd ratio of about 0.8. This fact could suggest that cold fusion and superconductivity have some common theoretical base.

ITALY - SOMETHING UNEXPECTED

Carol White, Editor-in-Chief, "Cold Fusion: 'Something Really Unexpected'", *21st Century Science & Technology*, Winter 1992, vol 5, no 2, pp 68-69

EDITOR'S COMMENTS

This report stems from an interview with Dr. Francesco Scaramuzzi at the Frascati National Laboratory near Rome. Scaramuzzi is quoted as urging, "I am also concerned to try to decrease the skepticism present within the scientific community, in order to bring more able scientists into the field. I am convinced that what we call cold fusion is a very complicated phenomenon that needs an effort much greater than has been possible up to now. In order to accomplish this [understanding cold fusion], we need to persuade more and more scientists to join with us in the investigation."

ITALY & GERMANY - ^{6}Li + d REACTION

Courtesy of Dr. Samuel Faile

Md. A. Rahman (Int'l Centre for Theoretical Physics, Trieste, Italy), M. Mecking & U. Strohbusch (Inst. for Experimental Physics, Univ. Hamburg), "(^{6}Li, d) Reaction on sd-, fp- and g-Shell Nuclei in ZR- and FR-DWBA Formalisms," *Il Nuovo Cimento*, Vol 105 A, No. 6, June 1992, pp 859-864, 3 figs, 2 tables, 12 ref, in English.

AUTHORS' SUMMARY

The (^{6}Li,d) reaction angular distributions on target nuclei $16 \leq A \leq 90$ have been analyzed using both ZR- [Zero Range] and FR-DWBA [Finite Range, Distorted-Wave Born Approximation] formalisms. The most prevalent method of analysis of alpha-transfer reactions such as (^{6}Li, d) and its reverse (d,^{6}Li) (where the wave function at zero distance in the p-state of relative cluster motion in the A = 6 nuclei will not have node) is the ZR-DWBA calculations due to the relatively short time of computation. It is of particular interest to verify whether FR-DWBA calculations result in similar S_x-values to those of ZR-DWBA or not. It is found that to derive similar S_x-values as in FR-DWBA calculations, one requires relatively large real well depth in ZR-DWBA calculations. Qualitative discussions have been made in this direction.

[This paper is included due to the possible cold fusion interest in hydrogen-lithium interactions. Ed.]

JAPAN - ONE-POINT COLD FUSION

Courtesy of Dr. Samuel Faile

Takaaki Matsumoto (Dept. of Nuclear Engr'g., Hokkaido, Univ., Sapporo), "Experiments of One-Point Cold Fusion," Submitted to *Fusion Technology*, dated Oct. 20, 1992, 12 figs, 13 refs, in English.

AUTHOR'S ABSTRACT

Experiments of one-point cold fusion have been performed by electrically discharging in ordinary and heavy waters mixed with 0.6 Mol/liter potassium carbonate. The anode of a platinum pin was located perpendicularly to the cathode of a copper plate. After the discharge, the surfaces of the copper plates were examined by an optical microscope. Many ring spots caused by the gravity decays of the single and di-neutrons were separately distributed on the plates. Furthermore, several kinds of traces that might be produced by itonic hydrogen-clusters, tiny black holes and white holes were observed. The mechanisms of the discharging cold fusion is also discussed by the Nattoh model.

EDITOR'S COMMENTS

Prof. Matsumoto describes an experimental procedure in which a platinum pin about 0.5 millimeter in diameter was placed about 1 to 2 mm from a single-crystal copper cathode. The author states that, "...pulsed AC current with about 70 V to 90 V was applied. The ON mode ran for 20 msec (50 Hz), and the OFF mode for 5 sec., respectively. The phase was fixed to zero such that the pulsed AC current started with th positive current. The discharge was maintained for 5 to 20 minutes." It is noted that the platinum "pin" electrode and the Cu electrode alternate as anodes and cathodes, although the positive loop of the AC current starts with the Pt pin being an anode. It is taught by Kenneth Shoulders in U.S. patent 5,018,180 that if the Pt pin is the cathode, then electron beads (EVs) can be formed in this type of circuit. Note also that Matsumoto reports, "...discharge was carried out in heavy water by changing the voltage from 70 V to 90 V. **The discharge with 100 V was tried, but the pin cathode was molten down in a couple of the AC shots.**" Later, Matsumoto reports, "...very strange traces were recorded on the polycrystalline plate (0.20 mm thick) with 70 V and 90 V, respectively. They were not found on nuclear emulsions in the previous experiment (Matsumoto, "Observation of meshlike traces on nuclear emulsions during cold fusion" *Fusion Technology*, Jan 1993), but first this time observed by discharging with the higher voltages. ... They seem to be the break up of some clusters." It is suggested to Dr. Matsumoto that he has inadvertently succeeded in creating high-density charge clusters as taught by Kenneth Shoulders. These charge clusters consist of about 10^6 to 10^{12} electrons in a highly dynamic cluster. For those of us who have seen the "witness plates" produced by Kenneth Shoulders, some of the figures

in Dr. Matsumoto's paper are highly suggestive of just such craters or holes in the "witness plates". It is suggested that Dr. Matsumoto place a small radio receiver close to the experiment. By tuning the radio receiver away from a station, so that the automatic volume control is increased in the absence of a strong radio signal, one should be able to hear the dramatic "lightning strike-like" noise when an electron bead is created and destroyed on the surface of an electrode. Unless I am mistaken, we can congratulate Dr. Matsumoto on the re-discovery of high-density charge clusters or EVs. We suggest that Dr. Matsumoto refers to earlier issues of *Fusion Facts* in which we have reported on the role of EVs in cold fusion. See, for example, *Fusion Facts*, May 1992, p. 17. In addition, see the lead article beginning on page 1 of this issue.

Researchers, please note: high-density electron charge clusters exist in nearly all electrical arcs, including lightning, and often sporadically in plasma discharges. The huge charge involved is considered large enough to induce accelerations of deuterons that can support "cold fusion" by locally swamping the magnitude of the Coulomb barrier!

JAPAN - Pd IN ALKALINE SOLUTIONS
Chem. Abstracts, Jan. 11, 1993

M. Enyo, P.D. Biswas (Catalysis Res. Cent., Hokkaido Univ., Sapporo), "Hydrogen absorption in palladium electrodes in alkaline solutions," *J. Electroanal. Chem.*, 1992, vol 335, No 1-2, pp 309-319, in English.

AUTHORS' ABSTRACT

The entry of H into a Pd electrode in alkaline solutions was studied. It is shown, from analysis of the overpotential components observed in transient polarization measurements, that the H electrode reaction of Pd obeys the Volmer-Tafel mechanism, similar to that in acidic solutions studied earlier. H pressures equivalent to H overpotentials are evaluated. They increase with the overpotential but the dependence is much less than that calculated by applying a Nernst type equation to the overpotential; this is also similar to the behavior observed in acidic solution. The equivalent H pressure is practically independent of the concentration of alkali but slightly dependent on the kind of alkali, being highest in KOH solutions.

JAPAN - FUSION IN ALUMINUM
Courtesy of the author.

Kohji Kamada (Nat'l Inst. for Fusion Science, Nagoya), "Electron Impact H-H and D-D Fusions in Molecules Embedded in Al. I. Experimental Results," *Jpn. J. Appl. Phys.*, Vol 31, Part 2, No. 9A, 1 Sept. 1992, pp L1287-L1290, 3 fig, 1 table, 9 refs, in English.

AUTHOR'S ABSTRACT

Both H-H and D-D fusion reactions, detected via high energy particle emission on CR-39, are shown to occur when 200 and 400 kev electrons are bombarded onto H^+ or D^+ ion-implanted Al thin crystals. Roughly 1-2 X 10^3 particle emissions, including both hydrogen and helium isotopes, in whole space were observed in each case. Collisions between recoiled D atoms due to the high energy electron impact give only 10^{-12} to 10^{-26} time smaller fusion rates than the experimental results. The present observations **suggest the presence of a new kind of fusion reaction which occurs with negligible kinetic energy of the reacting nuclei.**

JAPAN - H BUBBLE PRESSURE
Courtesy of the author.

Kohji Kamada (Inst. of Plasma Physics, Nagoya Univ.), "Hydrogen Implantation Effects in the Subsurface Layer of Aluminum-Bubble Pressure and Surface Modifications," *J. of Nuclear Materials*, vol 169, 1989, pp 141-150, 8 figs, 1 table, 24 refs, in English.

AUTHOR'S ABSTRACT

Energetic hydrogen ion implantations were performed on pure Al, and the microstructural change was investigated by use of transmission electron microscopy (TEM) together with the measurement of the implanted hydrogen distribution by use of the elastic recoil detection (ERD) method. A microstructure called "tunnel structure" (T.S.) was found in the fluence range of about (5-10 X 10^{17} H^+ per sq cm. Prior to the T.S. formation, numerous bubbles were formed in the fluence range of about (4-5) X 10^{17} H^+ per sq cm. In the latter fluence range, the molar volume of the hydrogen was determined from measurements of the total bubble volume and the hydrogen retained in the subsurface layer. Internal pressure of the bubbles was determined from the molar volume referring to the equation of state of high pressure hydrogen, and evaluated to be around 7 GPa for the specimen implanted up to 4 X 10^{17} H^+ per sq cm. The dislocation punching mechanism during the irradiation was discussed. This also predicted such high pressures exceeding the Greenwood et al.'s estimation of the dislocation punching pressure, supporting the experimentally observed high pressures. The pressurizing mechanism in the bubbles was discussed, predicting roughly the same pressure as measured experimentally.

JAPAN - SUPER-HYPERNUCLEI

Courtesy of Dr. Samuel Faile

Hidezumi Terazawa (Inst. for Nuclear Study, Univ. of Tokyo), "Are Super-Hypernuclei Found in Cosmic Rays?," *J. Phys. Society of Japan*, 1991, Vol 60, No. 6, pp. 1848-1851, 8 refs.

AUTHOR'S ABSTRACT

In order to determine whether or not the two events with the charge of Z = 14 and the mass number of A $\approx$ 370 recently observed in cosmic rays are super-hypernuclei (or strange quark matter) as claimed, the charge-to-mass-number ratio (Z/A) of the super-hypernuclei is investigated in the quark-shell model. Although a small Z/A ratio is always preferable for super-hypernuclei, such a small charge of 3 to approx. 30 may be realized as $Z \leq \sqrt{2/3} \times A^{1/2}$ if the nuclei are created spontaneously from bulk strange quark matter due to the Coulomb attraction.

[There has been some suggestions that cold fusion is triggered by strange or massive particles, therefore, this article has been included in our review. Ed.]

RUSSIA - GLOW DISCHARGE FUSION

Courtesy of Dr. Eugene Mallove

A.B. Karabut, Ya.R. Kucherov & I.B. Savvatimova (SIA LUTCH, Podolsk), "Nuclear product ratio for glow discharge in deuterium," *Physics Letters A*, Vol 170, 1992, pp 265-272, 9 figs, 2 tables, 6 refs.

AUTHORS' ABSTRACT

New results for glow discharge in deuterium calorimetry are presented. In separate experiments a heat output five times exceeding the input electric power was observed. The result for the charged particle spectrum measurement is presented. Charged particles with energies up to 18 MeV and an average energy of 2-4 MeV were seen. Beams of gamma-rays with energies of about 200 kev and a characteristic X-ray radiation were registered. The summed energy of the registered products is three orders short of the values needed to explain the calorimetric results.

AUTHORS' CONCLUSION

Many new questions arise with the latest results. The trigger mechanism of the nuclear reaction still remains unclear. As we already pointed out, charged particles with a good portion of alphas are found in quantities 3-4 orders [of magnitude] short of those needed to explain the excessive heat. We did not measure the electron flows in our work and this still leaves the possibility of K-electron capture with a radioactive isotope formation with a consequent beta decay with large energy release. A more plausible scenario is that the main mass of the charged particles does not leave the cathode. This leaves us with two possibilities: either they have a small energy or they are heavy. Judging from the transmitting microscopy results most of the cathode material damage takes place at a depth of 1000-10000 Å from the surface. If this is the region where the nuclear reaction takes place, most of the alphas must have an energy less than 1 MeV. Palladium fission products, even with a high energy, will have small paths in the cathode material and the alphas can be by-products. Anyway, the calorimetric results are promising by themselves.

EDITOR'S COMMENTS

This is the third paper reporting on the excess heat and nuclear byproducts from glow discharge using low-pressure deuterium gas and a palladium cathode. The authors report the details of their calorimetry and of their particle measurements. Of considerable interest is the fact that the CR-39 plates that were placed in the discharge chamber were calibrated and used to measure alpha particle tracks. The average energy found by examination of the CR-39 plates was about 4-5 MeV which is consistent with the average energy from the measured spectrum of 2-4 MeV. During the experiment about 100 neutrons per second (well above background) were measured. Another interesting result is that gamma "beams" appear to be produced by the cathode as shown by exposed X-ray film using a 2 mm lead screen. It was determined that most of the observed radiation lay in the 5 to 20 keV range. The mechanism that can produce a beam of energy emanating from the cathode is not fully understood. It is suggested that the surface of the palladium cathode may become pitted sufficiently to produce sharp points from which an EV (charge cluster of 10^8 electrons) could be formed. Such a charge cluster is really a small particle (of the order of 20 microns) and can produce copious amounts of X-rays when impacted against a metal surface (as taught by Kenneth Shoulders in U.S. patent 5,018,180.)

UKRAINE - NEGATIVE RESULTS

Chem Abstracts, January 11, 1993

V.F. Zelenskii, V.F. Rybalko, A.N. Morozov, S.V. Pistryak, G.D. Tolstolutskaya, V.G. Kulish, (KhFTI, Kharkov, Ukraine), "Preliminary results of the second-series of experiments on cold fusion," *Vopr. At. Nauki Tekh., Ser.: Fiz. Radiat. Povrezhdenii Radiats. Materialoved*, 1991, Vol 2, pp 48-53, in Russian.

AUTHORS' ABSTRACT

In the development of earlier completed studies, a new series of experiments was undertaken to measure the emission of fast charged particles of d-d reaction products (0.82 MeV, ^{3}He,

1.01 MeV T, and 3.02 MeV p) at the time of thermal cycling of Pd and Ti targets previously implanted with D. The range of temperature changes during thermal cycling was 78-400 K. A peculiarity of this series of experiments is the attempt to increase the signal/noise (background) ratio for a Si charged-particle detector. As a result of choosing detectors with low noise levels, screening, shortening the distance between the detector and the target, etc., the background was decreased by an order of magnitude, and the counting effectiveness of the detector was increased almost 100 fold. Moreover, in the given series of measurements, Ti targets were studied which were previously saturated with T and additionally implanted with D. The overall exposure time for each type of target to be studied (Pd, Ti, and $TiT_{1.8}$) amounted to about (5-7) X 10^4 second. The energy spectra of the particles in the range $E \leq$ 2 MeV were difficult to interpret as a consequence of the fact in this range, there was a rather high frequency of background signals. In the regions $E \geq 2$ MeV, in the background spectra, no signals of any kind were recorded. Over the course of all the combinations of measurements on Pd-D targets, only 12 signals were recorded in the energy window of the p and 3 signals for the $TiT_{1.8}$ target. The probability of the d-d reaction for Pd was estimated to be about 1.5 X 10^{-22} per second. This [result] is three orders of magnitude lower than in preceding estimates. The possible sources of scatter are discussed.

D. COLD FUSION PATENT APPLICATIONS

This list contains all the pertinent patents that we are aware of. We will be continuously updating it as we receive other patent information. Thanks to Dr. Peter Glück for supplying much of the following information:

[Format for Entries: List No.; Patent Application No; Title; Applicant; Date of publication; Priority date. Abstract. Dates are in mm/dd/yy format.]

1. JP 90,271,288; "Nuclear fusion employing heavy fermion effect in solid"; T. Mizugai; 11/6/90; 4/13/89. Deuterium (^{2}D, or ^{2}D and ^{3}T) is made to be absorbed by a heavy fermion compound or a composite of the heavy fermion compound and an H-storing material, to cause nuclear fusion. The method uses electrons with extraordinary heavy mass due to the heavy fermion effect in solid state to shield electric charge of the deuteron to cause nuclear fusion with a small unit.

2. JP 90,276,989; "Apparatus for nuclear fusion at room temperature"; Hitachi; 11/13/90; 4/5/89. The apparatus comprises a container for heavy H_2O, electrodes placed in the heavy H_2O, an electric power source, a means to circulate the heavy H_2O between the container and a heat exchanger, and a system of a heating medium, which comments the heat exchanger and a power-extraction compartment.

3. JP 90,276,990, "Nuclear fusion at room temperature"; Hitachi; 11/13/90; 4/10/89. In the nuclear fusion based on the electrolysis of heavy H_2O, a D-absorbing cathode has a porous structure. To increase the absorption rate of O, a small amount of As, CN-, S_2, and/or Cl- is added to the heavy H_2O.

4. JP 90,276,991; "Apparatus for nuclear fusion at room temperature"; Hitachi; 11/13/90; 4/5/89. The apparatus which comprises a heavy-H_2O container, electrodes placed in the container, and an electrical power source, is characterized in that: (1) a coolant fills the cathode interior; and (2) the coolant-circulation system includes means to condense the coolant vapor, and to extract power. The boiling point of the coolant may be set lower than that of heavy-H_2O.

5. JP 90,276,992; "Deuterium absorption in nuclear fusion"; Hitachi; 11/13/90; 4/14/89. In nuclear fusion, D is absorbed, in vapor phase, by a neg.-biased material (e.g., Pd). The material may be a film formed by chemical vapor or sputter deposition in a D atmosphere.

6. JP 90,278,189; Power generator and heater based on cold nuclear fusion"; M. Tanaka; 11/14/90; 4/19/89. A power generator based on cold nuclear fusion comprises: (1) a device for electrolysis of D_2O; (2) a steam generator utilizing hot D_2O; (3) a steam turbine; (4) a steam condenser; (5) a pump to send H_2O from the condenser to the steam generator; (6) a means to burn D with O; (7) a steam heater; and (8) a pump to send D_2O from the steam generator and the steam heater to the electrolysis device. A heater based on cold nuclear fusion comprises (1) a device for electrolysis of D_2O; (2) a first means to heat a fluid with hot D_2O or D_2O steam from the electrolysis device; (3) a means to burn D with O; (4) a second means to heat the fluid or a second fluid requiring higher temperature, with the D_2O steam from the combustion means; and (5) a pump to send D_2O from the first and second heating means to the electrolysis device.

7. JP 90,280,088; "System for cold nuclear fusion, heat transport and thermoelectric cells"; Sanyo; 11/16/90; 4/20/89. In a cold nuclear fusion system, in which an anode from an O-generating metal (e.g., $LaNi_5$) and a H-absorbing cathode are placed in electrolyte-containing D_2O: (1) the cathode is formed of a H-occluded alloy; and (2) an electrical field is applied between the electrodes. A D-compound (e.g., D_2S) may be added to the electrolyte. A heat-transport system uses heat generated by the cold fusion system, and the H gas adsorbed and released by the H-occluded alloy is employed as a heat-transferring medium. A thermoelectric-cell system comprises the cold fusion system and a thermoelectric-cell.

8. JP 02,287,289; "Power generator based on cold nuclear fusion"; Sumitomo Electric Ind., Ltd.; 27 Nov 1990, 28 Apr 1989, 4 pp. A power generator based on cold nuclear fusion which involves electrolysis of D_2O is characterized in that D and O generated by the electrolysis are burned back to D_2O, which is returned to the electrolysis tank.

9. JP 90, 293,692; "Cold nuclear fusion"; A.I.S.T.; 12/4/90; 5/9/89. Cold nuclear fusion includes: (a) introducing a D gas ($\sim 10^{-3}$ torr) into a vacuum chamber containing a planar or curved cathode plate from an electrical conductor (e.g., P2) which is likely to form a hydride, and a needlelike anode from a refractory electrical conductor; (b) applying d.c. to form an electrical field of $\sim$30 V/A between the electrode tips for the ionization of D; and (c) accelerating D ions toward the cathode plate; so that the plate adsorbs and enriches D ions.

10. NL 89 02,962 "Process and apparatus, and the use of the apparatus in electrolysis-nuclear fusion," Peter Jan Van Noorden; 1 Jul 1991, 01 Dec 1989; 13 pp. The process comprises the application of a magnetic field. The apparatus, comprising and electrolytic cell equipped with two electrodes, additionally comprises means for generating a magnetic field in the electrolytic cell. The use of the apparatus comprises filling the cell with an electrolyte comprising LiD dissolved in heavy water. The use of the magnetic field increases the rate at which the alleged cold fusion occurs in the D-loaded Pd electrodes. The electrodes (Pt anodes and Pd and Ti cathodes) are connected to one electrical source, and the means for generating the magnetic field, i.e., a cooled, hollow coil, is connected to another electrical source, i.e., a battery.

11. JP 90,302,693; "Apparatus for cold nuclear fusion using solid bodies"; Sanyo; 12/14/90; 5/12/89. The apparatus comprises a solid body containing a large amount of D, and a means to supply excitation energy to the body. The solid body may be of C, Si, Ge, Sn or Pb. The energy may be supplied by heating, electrical-field application, electromagnetic-wave application, and/or supersound application.

12. JP 90,304,393; "Cold nuclear fusion based on heavy water electrolysis"; Seiko-Epson; 12/18/90; 5/18/89. Cold nuclear fusion is based on the electrolysis of D_2O and uses cathodes from Ni or a Ni-Pd alloy.

13. JP 90,306,194; "Apparatus for cold nuclear fusion and heat transport system"; Sanyo; 12/19/90; 5/19/89. The apparatus consists of a cathode-comprising tank from a H-absorbing metal, D_2O containing an electrolyte, and a cathode immersed in the D_2O, while electrically insulated from the tank. Nuclear fusion of D is conducted in the cathode with the application of a electrical field between the electrodes. A heat-transport system is based on the absorption and releasing of H (heat-transferring medium) by the H-absorbing metal.

14. JP 90,307,093; "Cold nuclear fusion based on heavy-water electrolysis"; Seiko-Epson; 12/20/90; 5/22/89. In cold nuclear fusion, pressured O or its plasma is introduced into a container made of Pt, Ti or a Pd-Ti alloy. Nuclear fusion is caused on the inner wall of the container. Alternately, the container is filled with a powder of Pt, Ti or the Pd-Ti alloy before the introduction of D or its D plasma. Voltage may be applied to the D plasma, forming D ions.

15. JP 90,311,792; "Method of cold fusion"; Seiko-Epson; 12/27/90; 5/29/89. D_2 gas or plasma state D or ionized D gas is absorbed into a H_2-absorbing alloy. Pd may be loaded inside and/or on the surface of the alloy. The method does not necessarily require electrolysis. Thus, a H_2-absorbing alloy is exposed to D_2 gas to absorb as much a 1000 times the volume of the alloy, to cause cold nuclear fusion. The heat evolved by the cold fusion can be extracted via heat exchangers.

16. JP 90,311,793; "Electrolysis apparatus used in cold nuclear fusion"; Seiko-Epson; 12/27/90; 5/29/89. The apparatus which conducts electrolysis of H_2O or D_2O has a cathode with protrusions. The protrusions may have a triangular cross-section. The apparatus has increased efficiency.

17. JP 91,002,690; "Deuterium-absorbing materials in cold nuclear fusion"; N. Hirokasu; 1/9/91; 5/31/89. A D-absorbing material (e.g., Pd) used in cold nuclear fusion has an amorphous structure. Nuclear fusion of D atoms has increased efficiency.

18. JP 91,006,490; "Controlling cold nuclear fusion based on electrochemistry"; Nippon Light Metal; 1/11/91; 6/5/89. In controlling cold nuclear fusion based on electrochemistry, a cathode containing a temperature-controlling device is used to adjust the temperature of the anode.

19. JP 91,033,687; "Laminated electrode structure for cold fusion"; Taiyo Yuden; 2/13/91; 6/30/89. The electrode consists of ≥ 1 Pt layer via a continuous pore, having porous electrical insulating layer. The electrode had wide Pd area for high-efficiency cold fusion.

20. JP 91,035,192; "Uranium cathode for electrolytic exothermic tritium formation"; Nuclear Fuel Ind.; 2/15/91; 7/3/89. The cathode consists of Pd-coated U used in ^3H-formation by electrolyzing an electrolytic solution containing D_2O and small amount base with a Pt anode and a cathode to produce larger energy than required for the electrolysis. The cathode may be built in a porous Al_2O_3 container instead of Pd-coating. The cathode has high H absorption.

21. JP 91,035,193; "Lanthanum nickel cathode for electrolytic exothermic tritium formation"; Nuclear Fuel Ind; 2/15/91; 7/3/89. The cathode consists of Pd-coated $LaNi_5$ used in ^3H-formation by electrolyzing an electrolytic solution containing D_2O and small amount base with a Pt anode and a cathode to produce larger energy than required for the electrolysis. The cathode may be built in a porous Al_2O_3 container instead of Pd-coating. The cathode has high H absorption.

22. WO 90/10935; "Method and apparatus for power generation"; S. Pons et al; 9/21/90; 7 dates 3/13/89-5/16/89. The present invention involves an apparatus and method for generating energy, neutrons, tritium or heat as a specific form of energy. The apparatus comprises a material such as a metal having a lattice structure capable accumulating isotopic hydrogen atoms and means for accumulating isotopic hydrogen atoms in the metal to a chemical potential sufficient to induce the generation of the specified items. The sufficient chemical potential is, for example, enough to induce generation of an amount of heat greater than a joule-heat equivalent used in accumulating the isotopic hydrogen atoms in the lattice structure to the desired chemical potential.

23. JP 91 07,113; "Cooker based on cold nuclear fusion," Sanyo Electric Co.; 14 Jan 1991, 5 Jun 1989; 4 pp. The title cooker comprises an outer container and an inner container for cooking materials, where the space between the two containers is filled with D_2O. An anode (e.g. Pt) to generate O and a cathode from a H-absorbing material (e.g. Pd) are placed in the D_2O, close to the inner container, and an electrical field is applied between the two electrodes to cause the electrolysis of D_2O.

24. WO 90/13126; "Energy/matter conversion methods and structures"; R.L. Mills; 4/13/90; 4/21/89. A method and apparatus for releasing energy comprise: selecting a first and second atom; detecting the resonance orbital shrinkage energy levels of the *e* orbitals of the two atoms; providing two energy holes substantially equal to each of the shrinkage energy levels of the atoms; and juxtaposing the atoms and energy holes to product nuclear fusion of the atoms. The cold fusion takes place when the energy is removed from the electron orbitals of atoms by the energy holes permitting reduction of the atomic orbitals and attractive nuclear forces to act. The energy holes can be provided by using a catalytic ion-pair, each ion having ionization energy close to the resonance orbital shrinkage energy of one of the ions. A table of numerous such ion-pairs is also presented.

25. WO 90/13127; "Electrolytic apparatus for disassociation of compounds containing hydrogen isotopes"; Ceramatec; 11/1/90; 4/18/89. An improved apparatus is described for high temperature electrolytic decomposition of compounds containing H isotopes, e.g., D. The apparatus includes a solid state electrolyte capable of conducting O, H+, Li or Na ions, an anode porous to O adherent to one surface of the solid state electrolyte, and a H-absorbing cathode such as Fe, Ti, Mg, Ni, Pd or their alloy, adherent to another surface of the solid state electrolyte. The apparatus is placed in a H isotope medium and 1-2 V of d.c. passed through the electrodes. Upon application of this voltage D_2 is absorbed in the cathode. Once the saturation of D_2 in cathode occurs fusion begins to take place, thus releasing heat energy. A cold fusion process using a molten electrolyte is also claimed.

26. WO 90/13128; "Enhancing nuclear fusion rate in a solid"; EPRI; 4/20/90; 4/23/89. A method of producing power by nuclear fusion comprises: introducing fusible nuclei into a solid carrier material, optionally in presence of an electrical field or time varying magnetic field; and restricting the motion of the fusible nuclei to <3 dimensions. The carrier material may be a superconductor lattice, heavy fermion metal, or light metal hydride.

27. WO 90/13129; "Coherent fusion apparatus"; P. Hagelstein; 12/6/90; 4/6/89. A nuclear cold fusion apparatus and a coherent fusion theory are described. The energy from nuclear fusion reaction is coupled to a macroscopic system coherently through electromagnetic interaction of low energy photons. A theory is formulated for a 2-step reaction in which

virtual fusion is followed by exothermic incoherent decay. Incoherent *e* capture is followed by coherent fusion in the theory.

28. WO 90/13897; "Deuterium-lithium energy conversion cell"; Drexler Tech; 11/15/90; 5/12/89. Method and apparatus are described for production of energy through electrolyte ionization of heavy water, acceleration of the resulting ionized particles by an electrical field, and collection of the ions in Pd to facilitate ion-ion combination. A first electric field source drives D ions toward a D accumulator that includes a surface layer of Pd or an alloy thereof and is spaced from 2 electrodes that produce the electrical field. A time-dependent second electrical field source (optional) periodically drives negative charged particles away from the D accumulator and assists in triggering the cold fusion.

29. WO 90/14668; "Cold fusion propulsion apparatus and energy generating apparatus"; D.J. Cravens; 11/29/90; 5/1/89. A propulsion apparatus employs nuclear cold fusion of D absorbed in a metal host lattice to generate a heated momentum exchange effluent stream from the D itself and/or to heat a momentum exchange fluid to provide a propulsive impulse upon exhausting through a nozzle. Thermal efficiency of a propulsion apparatus and an energy generating apparatus is improved by using a D absorbing metal lattice alloyed or compounded with one or more of W, Re, Mo, Tu, Ti, Ir and C to raise the lattice m.p. and permit higher cold fusion temperatures.

30. WO 90/14670; "Isotope deposition, stimulation and direct energy conversion for nuclear fusion in a solid"; EPRI; 4/20/90; 5/2/89. A method of fabricating a composite structure for cold fusion comprises providing a substrate and depositing alternating layers of a fusible isotope and an absorbing material. The method of loading fusible isotope into the absorbing material comprises depositing the isotope on the substrate and creating temperature gradient at the surface or surrounding the substrate with the isotope and applying ultrasound. The method of exciting the isotopes comprises pressure pulse or ultrasound. The method of converting the fusion energy to electricity comprises electrostatically or inductively coupling the charged reaction products to electrodes. The energy can be stored by circulating the high-energy reaction products.

31. WO 90/15415; "Cold fusion support"; Johnson-Matthey; 12/13/90; 6/2/89. Materials are described which are effective to support cold fusion when loaded with D, e.g., Pd modified to change the local environment for D under cold fusion conditions. Particular modifications are alloys or dispersions of Pd with Ce, Ag, $LaNi_5$, and Ti. Other modifications concern the grain size. Excess heat and T and *n* have been detected.

32. WO 90/16070; "Catalyzed nuclear fusion of heavy isotopes of H_2"; Condensed Matter Technology, Inc.; 12/27/90; 6/14/89. A nuclear fusion device and method for D or T are described having a solid/liquid phase of noble metals in contact with another phase containing D or T where the nuclei of D or T are moved into the lattice of the liquid or solid noble metal by means of diffusion, mechanical forces, or by electric or magnetic means to undergo temperature and lattice-assisted nuclear fusion.

33. WO 91/01037; "Chemo-nuclear fusion methods"; G.E. Shaffer; 1/24/91; 7/13/89. A method of causing D molecules to combine to become He atoms in the presence of a Pd catalyst comprises providing a reactor chamber containing D_2O and a Pd catalyst, introducing controlled amounts of D into the chamber so that the D molecules are adsorbed by the Pd catalyst where the Pd catalyst executes a simultaneous shift of 2 electrons, leaving 2 stripped D nuclei trapped in single Pd clathrate cages. The juxtaposed D nuclei in a single cage and having the effect of the adsorption energy exerting tremendous compressive forces collapse to form an α-particle and release relativistic energy as γ-ray or kinetically as heat. Finally, the evolved heat is transferred to perform useful work.

34. WO 91/01493; "Method and device for the determination of the obtained energy during electrolytic processes"; V. Noninski; 2/7/91; 7/20/89. A method and apparatus for use in determining the quantity of energy obtained during electrolytic processes is disclosed. The apparatus includes a Dewar vessel containing a measured quantity of H_2O. An electrolyte cell is hermetically sealed in the vessel. A plurality of thermocouples is positioned within the vessel for purposes of measuring temperatures within the vessel. A magnetic stirrer is mounted in the bottom of the vessel. The apparatus can be used in cold fusion experiments.

35. WO 91/02359; "Distributed accumulation for energy conversion"; Drexler Tech; 2/21/91; 8/4/89. A cell is described for producing thermal energy by absorption or adsorption of D and lithons into D ion-permeable and Li ion-permeable particulates supported on a surface of an accumulator in the form of a mesh, rods, sheets, or membranes, or within a gelatin-like matrix. Deuterons and lithons are produced by electrolyte ionization in a liquid containing high purity D_2O, and net electrical charge on a D-permeable and lithon-permeable particulate is controlled by allowing negatively charged OD- radicals to accumulate on the surface of the particulates that balance out the positive charged deuterons and lithons.

36. WO 91/02360; "Electrochemical nuclear process and apparatus for producing tritium, heat and radiation"; G.J. Schoessow; 2/21/91; 6/30/89. A process for the production and recovery of T, heat energy and radiation energy by electrolysis of a liquid medium containing D_2O in an electrolytic cell having a cathode of Pd, or certain other elements by operating the process at ~10-300° and an apparatus for this process are described, the cathode comprises a central solid geometrical mass and the anode is an open top cup-shaped vessel positioned adjacently below and encircling the cathode.

37. DE 3,910,806; "Method and apparatus for nuclear fusion reaction at low temperature"; H. Hora; 10/11/90; 4/4/89. Group VIII elements (esp. Fe, Pd, or Pt) are placed in the atmosphere of H and/or D and/or T and held at temperatures between 0° and their m.ps.

38. DE 3,913,002; "Fusion energy production by using Fe group metals as electrodes"; K.F. Dies; 10/25/90; 4/20/89. Fe, Ni, and Co rods are used as electrodes (cathodes) in electrolysis of D_2O for energy production by cold fusion, or these rods are pickled in DCl, DF, DBr, D_2SO_4, or DNO_3 for energy production by cold fusion.

39. DE 3,915,153; "Method and apparatus for sorbing hydrogen in solids especially in electrodes for cold fusion and support containers"; Siemens; 11/15/90; 5/9/89. The method comprises continuously depositing or forming a H sorption-promoting coating having high surface area and/or many lattice imperfections and/or an amorphous structure on the solids during H sorption. The apparatus comprises a container containing the solids, and means for introducing the H sorption-promoting material and/or means for forming the coating. This method significantly increases the sorption of H by the solids. An apparatus for cold fusion consisted of a container containing a Pd electrode and a Pt counter electrode and the H sorption-promoting material was provided by a $PdCl_2$ and/or $Pd(NH_3)Cl_2$ solution.

40. DE 3,916,397; "Method and apparatus for fusion of light nuclei"; Siemens A.-G.; 11/22/90; 5/19/89. The title method and apparatus, using electrolysis for nuclear fusion of D or T from an electrolyte containing D, T and/or Li in D_2O or T_2O, the anode is made of a H-activating material, e.g., Pt, Au, and/or Pd, and it is kept at >100°, preferably 1000°. The process is known as cold fusion.

41. DE 3,920,312; "Method and apparatus for fusion of light particles in solid getter"; Siemens A.-G.; 1/3/91; 6/21/89. The title method of fusion of H and/or its isotopes in a solid getter comprises an electrode, t.g. Pd, a center electrode, and an electrolyte where the getter and the light particles are irradiated and/or bombarded with radiation and/or particles, e.g., *n*, α-particles, or ^3H ions. One of the ways to implement the above

process is incorporating an α-emitting nuclei in the cathode material. The above process increases cold fusion probability.

42. EP 392,324; "Electrochemical nuclear fusion method"; SEL(Japan); 10/12/90; 4/13/89. A method of producing an electro-chemical nuclear fusion reaction comprises the steps of introducing into a reaction vessel a solution containing D_2O, so that a pair of electrodes disposed in the reaction vessel are immersed in the solution, and applying electric energy across the electrodes to produce an electrochemical reaction for a nuclear fusion reaction at a high pressure of 1.3-200 atmospheres which is caused by confining in the reaction vessel D and O, which are the products of the electrochemical reaction.

43. EP 392,325; "Electrochemical nuclear fusion method"; SEL(Japan); 10/12/90; 4/13/89. A method of producing an electrochemical nuclear fusion reaction comprises introducing into a reaction vessel a solution containing heavy water, so that a pair of electrodes disposed in the reaction vessel are immersed in the solution, and applying pulsed electric energy across the electrodes to produce an electrochemical reaction for a nuclear fusion reaction.

44. EP 394,204; "A system for producing neutrons and heat by nuclear fusion in a gas absorbed on a metal." ENEA, Italy; 24 Oct 1990, 18 Apr 1989, 9 pp. A system is described for producing neutrons and heat by nuclear fusion of D absorbed or adsorbed in the crystal lattice of Ti or of other metals with analogous characteristics. The equipment comprises a reaction vessel immersed in a temperature controlled environment. The vessel contains Ti or other metals in such a physical form as to expose a high surface of the metal to the gas and is connected to a gaseous D supply, through a pressure reducer, a vacuum pump and a pressure gauge, with a set of valves downstream of the D supply and upstream of the reaction vessel, as well as a thermocouple for the measurement of the temperature in the latter.

45. EP 393,463; "Electrode for nuclear fusion and a method for using the same," SEL, Japan; 24 Oct 1990, 20 Apr 1989, 10 pp. An electrode structure is comprised of a pair of electrodes provided in a reaction vessel for causing a nuclear fusion reaction with D or a D compound in a gaseous or liquid state, ≥1 of the electrodes having a surface portion which is made of a reactive material for nuclear fusion reaction and a base which is tightly connected with the surface portion, wherein a heat exchange medium is introduced from a heat exchange device into the base and out from the base to the heat exchange device after heated by nuclear fusion reaction.

46. EP 394,980; "Cold nuclear fusion apparatus"; Matsushita; 10/31/90; 4/27/89. A cold nuclear fusion apparatus comprises a metal or alloy which can occlude D at a high concentration, means for making the concentration of D occluded in the metal or alloy high, and means for enhancing harmonic oscillation energy of nuclei of D of the metal or alloy by adding external energy, such as discharge energy of D gas, optical irradiation or supersonic energy.

47. EP 395,066; "Apparatus for cold nuclear fusion"; Matsushita Electric Industrial Co, Ltd.; 10/31/90; 4/27/89. 19 pages. The apparatus comprises a container for containing H isotopes in liquid or gas state and ≥1 element made of a H isotope occluding alloy such as Laves C14 type or C15 type alloy wherein H isotopes are occluded in the element in a high d and occluded H isotopes collide with each other.

48. EP 402,988; "A process with relevant plants and devices, for the production of energy through the indicated apparatus"; Ecoline; 12/19/90; 6/14/89. The process, relevant plants, and devices are described for the industrial production of energy, based on plausible dynamics explanatory of nuclear fusion in metals, exp. Pd and Ti, which readily absorb H and its isotopes. The process is based on the absorption by these metals, through electrolysis of gas-pressurizing, of D or its mixtures with T or He, followed by their consequent liberation within cracks, created in the metal mass either by mechanical or metallurgical means.

49. EP 414,399; "Process for storing hydrogen, and apparatus for cold nuclear fusion and method for generating heat energy using the process"; Canon K.K.; 2/17/91; 8/4/89. A process for storing H comprises placing a H storing member in a H gas atmosphere and generating a discharge in the H gas atmosphere, thereby occluding the H in the H storing member. An apparatus for cold fusion by using the above process is also claimed.

50. US 4,986,887; "Process and apparatus for generating high density H_2 in a matrix"; S. Das Gupta; 1/22/91; 3/31/89. A process is described wherein H and its isotopes are dissolved in Pd metal in high d by utilizing electrochemical methods in an electrolytic cell. The cell has an inert anode and a Pd containing cathode, both being immersed in an electrolyte which contains a Li salt dissolved in an aprotic solvent, and a small amount of H_2O. The dissolved H to Pd ratio in the Pd bearing cathode, which may be achieved by this process, is >0.95.

51. CAN 2,023,216; "Method of preparing electrode for use in heat generating apparatus"; U/Utah; 2/16/91; 8/15/89. An improved method of treating material for use in a heat-generating method involving the absorption of H isotope into the material comprises treating the material to substantially remove impurities in the surface region and then depositing a thin film of a substance capable of absorbing on the surface of the material. An optional additional treatment is to substantially remove H already absorbed in the material, then heat the material in an atmosphere of H isotope to precharge the material with the H isotope. A method of producing electrode and method of enhancing absorption are also claimed.

52. FR. 2,647,943; "Reactor for electrolytic nuclear fusion in solid electrolyte"; F. Forrat; 12/7/90; 6/6/89. The title reactor comprises a solid electrolyte, e.g., glass, crystal, ceramic, electrolytically or chemically vapor-deposited film. An a.c. current is applied to generate fusion and heat energy is recovered by a fluid. The reactor can be used for isotope production.

53. JP 91 025,392; "Nuclear Fusion and Plants"; Hitachi; 4 Feb 1991; 23 June 89; Nuclear fusion is caused by immersing a D-adsorbed material in liquid D. A nuclear fusion plant may include a means to repeat the introduction of the D-adsorbed material into a low-temperature or boiling heat-transferring medium, causing nuclear fusion, and reimmersing the material in liquid D.

54. JP 91 025,393; "Nuclear Fusion Fuel Elements"; Hitachi; 4 Feb 1991; 23 June 1989; A fuel element for nuclear fusion consists of a solid material (e.g., Palladium) with a body-centered cubic structure, and a H isotope(s) adsorbed by the material. A nuclear fusion plant contains the fuel element, a coolant to remove heat generated by nuclear fusion inside and/or on the fuel element, and a means to generate steam from the coolant.

55. JP 91 51,794; "Cold Nuclear Fusion Apparatus"; NEC Corp; 6 Mar 1991; 19 Jul 1989; The apparatus, equipped with a device for heavy-water electrolysis, is characterized in that the cathode of the device is formed at a graphite-alkali-metal interlayer compound (e.g. C_8K.)

56. JP 91 53,194; "Power generators based on cold nuclear fusion"; Matsushita Electric Industrial Co., Ltd.; 7 Mar 1991; 21 Jul 1989; A power generator based on cold nuclear fusion utilizes heavy water, a Pt anode, a Pd cathode and an electric power source, is characterized in that the Pd cathode is porous.

57. JP 91 53,195; "Power generators based on cold nuclear fusion"; Matsushita Electric Industrial Co., Ltd.; 7 Mar 1991; 21 Jul 1989; A power generator based on cold nuclear fusion, which utilizes heavy water,

a Pt anode, a Pd cathode, and an electrical power source, is characterized that the Pd cathode is porous, and it is under vibration.

58. JP 91 160,397; "Preliminary treatment of hydrogen holder"; Canon K.K.; 25 Mar 1991; 4 Aug 1989; Before adsorbing D (for cold nuclear fusion), a H holder (for example, Pd) is either heated or placed in vacuum. The process can expel H from the H holder and adsorb highly pure D.

59. JP 91 160,395; "Cold nuclear fusion in solids, and apparatus therefor"; Nagoya Univ; 10 Jul 1991; 18 Nov 1989; The process includes: (a) evaluating a reaction chamber; (b) activating a solid body (e.g., Pd) which adsorbs a nuclear-fusion-causing gaseous material (e.g. D); (c) supplying a predetermined amount of the gaseous material; and (d) allowing the body to adsorb the gaseous material close to saturation. The surface of the solid body may be cleaned in short time by glow discharge. An application for the process includes means to take out heat caused by the nuclear fusion.

60. JP 91 160,396; "Cold nuclear fusion in solids: Nagoya Univ; 10 Jul 1991; 18 Nov 1989; The process includes: (1) allowing a solid to adsorb a nuclear-fusion-causing material (as an eutectic element) to almost saturation; and (2) exciting the solid (by, for example, electric discharge) to cause sudden supersaturation, which creates high local concentration of the material.

61. JP 91 160,397; "Forming elements by cold nuclear fusion in solids."; Nagoya University; 10 Jul 1991; 18 Nov 1989; The process includes: (a) evacuating a reaction chamber; (b) activating a gas-adsorbing body (for example, Pd) in the vacuum chamber; (c) supplying a nuclear-fusion-causing gaseous material into the chamber; (d) allowing the body to adsorb the gaseous material to saturation; (e) causing nuclear fusion by the material adsorbed in the body; and (f) recovering the fusion product.

62. WO 91 06,959; "Media for solid state fusion," Mass. Inst. of Technology; 16 May 1991; 25 Oct 1989; Apparatus for electrochemical as well as thermochemical fusion are provided. Material systems consisting of D storage intermetallic compound, transition metal/rare earth metal intermetallic compound, and elemental material cathodes are combined with compatible electrolytes including solid deuteride electrolytes, cryogenic electrolytes, and supercritical deuterium in electrochemical fusion apparatus wherein a magnetic field may be provided to enhance fusion initiation in the cathodes. The invention enables the operation of these electrochemical and thermochemical fusion apparatus over a wide range of temperatures and pressures which may be adjusted to optimize the efficiency of the solid state fusion reaction.

63. JP 91 82,991; "Energy Converters Based on Electrochemical Nuclear Fusion"; Matsushita Elect Industrial Co.; 8 Apr 1991; 25 Aug 89; The apparatus contains an electrolytic cell comprising a cathode from an alkali-metal-doped e^{pi}-type compound, a noble-metal anode, heavy H_2O, and an electrolyte containing support material, where the cathode and anode are immersed in the electrolyte.

64. JP 91 105,284; "Apparatus for Cold Nuclear Fusion"; Fujitsu; 2 May 1991; 20 Sept 1989; An application for cold nuclear fusion includes: (a) a chamber with a means to guide a D-containing gas into it, and an exhaust means; (b) a plasma-generating means; and (c) a reactive substrate on which is a H-absorbing metal (e.g., Pd). Nuclear fusion is caused by contacting a plane of the gas with the reactive substrate.

65. JP 91 107,791; "Apparatus for Cold Nuclear Fusion"; Matsushita; 8 May 1991; 21 Sep 1989; The apparatus includes a cathode to adsorb (in crystal lattices or on the surface) a H isotope(s), an anode from a metal, its oxide, or its hydroxide, and an electrolyte containing at least a H isotope. The electrodes are film-shaped. Nuclear fusion is caused based on the electrolysis of the electrolyte.

66. JP 91 150,494; "Apparatus for Cold Nuclear Fusion"; Toyoaki Omori; 26 Jun 1991; 7 Nov 1989; The apparatus, which includes a reaction tank containing D_2O, a pair of discharge electrodes in the tank, and a power source to apply pulsed voltage on the electrodes, and which causes nuclear fusion based on D ion generation by pulsed voltage, and a pressure wave produced by underwater plasma discharge, is equipped with a partition structure around the plasma-discharge area, which controls the pressure of the wave.

67. JP 91 183,987; "Cold Nuclear Fusion Process"; Nippon Telegraph & Telephone Co.; 9 Aug 1991; 14 Dec 1989; In the process, pressure gradient is applied across a Pd or Ti plate which is covered, on 1 side, with a think film (e.g., Au) having a small D-atom diffusion coefficient, so that D pressure on films [sic] becomes greater than the other, accumulating D atoms at the interface of the plate and the film.

68. JP 91 183,988; "Cold Nuclear Fusion Process"; Nippon Telegram & Telephone Co.; 9 Aug 1991; 14 Dec 1989; The process includes: (1) placing in a container a D-absorbed Pd or Ti plate, which is covered on 1 side, with a 1st film (e.g. Si oxide) having a small D-atom diffusion coefficient, and on the other side, with a 2nd film (e.g. Au), having a large D-atom diffusion coefficient and (2) decreasing the pressure inside the container to increase D concentration at the interface of the plate and the 1st film.

69. JP 91 194,493; "Cold Nuclear Fusion Apparatus"; Fuji Electric Co.; 26 Aug 1991; 22 Dec 1989; The apparatus comprises an anode, a cathode, and an electrolyte bath containing heavy H_2O, where the cathode is formed of V, Sr, Y, Nb, Hf, or Ta, and adsorbs D produced by the electrolysis of heavy H_2O.

70. JP 91 194,494; "Cold Nuclear Fusion Apparatus"; Fuji Electric Co.; 26 Aug 1991; 22 Dec 1989; The apparatus comprises an anode, a cathode, and electrolytic bath, and a means to expose cathode metal, where the electrolytic bath contains heavy H_2O, the cathode is formed of a D-absorbing metal, and the means keeps active the surface of the cathode metal.

71. NETH APPL NL 89 02,962; "Process and Apparatus, and the Use of the Apparatus in Electrolysis-Nuclear Fusion;" Peter Jan Van Noorden; 1 Jul 1991; 1 Dec 1989; The process comprises the application of a magnetic field. The apparatus, comprising an electrolytic cell equipped with 2 electrodes, additional comprises means for generating a magnetic field in the electrolytic cell. The use of the apparatus comprises filling the cell with an electrolyte comprising LiD dissolved in heavy water. The use of the magnetic field increases the rate at which the alleged cold fusion occurs in the D-loaded Pd electrodes. The electrodes (Pt anodes and Pd and Ti cathodes) are connected to one electric source, and the means for generating the magnetic field, i.e., a cooled hollow coil, is connected to another electric source, i.e., a battery.

72. S. AFRICA 115: 242,246; "Energy Source System," Shell Research, Ltd.; 29 May 1991; 11 Jul 1989; Energy is produced by: loading a body with equal or greater than ^1H isotope where, at least, a part of the body comprises a metal capable of forming a metal hydride-type lattice system; arranging the body as an electrode of a capacitor means in an electric circuit along with another electrode connected with an externally controllable voltage supply means; operating the voltage supply means; and recovering energy produced in the body by operating the voltage supply means. The system produces energy by a process commonly known as cold fusion.

73. JP 90 285,283; "Method for Nuclear Fusion;" Bridgestone Corp; 22 Nov 1990, 26 Apr 1989, 3 pp. To bring about a nuclear fusion reaction by electrolysis of heavy water, a H_2-storing alloy comprising ≥ 2 elements is used as the cathode. Typical alloys include La alloys ($LaNi_5$, $LaCo_5$, etc.), Fe alloys (FeTi, $Fe_{1-x}Be_xTi$, etc.), Cr alloys ($Cr_{1.8}Ti$), Mg alloys (Mg_2Ca, etc.). An alloy with a higher H-storing capacity is preferably

used. Solvent heavy water purity ≥90% is desirable. An electrolyte to be added to the solvent includes DCl, DNO_3, D_2SO_4, $DClO_4$, LiCl, $LiNO_3$, NaCl, $NaNO_3$, etc. Preferred electrode potential is 2-20 V, and desirable electrical current is 10 mA/cm²-1 A/cm².

74. JP 91 78,691; "Power generation by cold nuclear fusion"; Hitachi; 03 Apr 1991, 23 Aug 1989. Thermal energy is generated by implanting D in a substance (e.g., Pd) to cause cold nuclear fusion, and the thermal energy is converted into electrical power by thermoelectrical means.

75. JP 91 215,785; "Thermal energy generators based on cold nuclear fusion"; Canon; 20 Sept 1991, 19 Jan 1990, 10 pp. A thermal-energy generator based on cold nuclear fusion, contains: (1) a container of D gas; (2) a pair of electrodes, at least one of which is formed of a H-storing material; (3) a means to apply voltage on the electrodes to cause electrical discharge in the presence of D gas between them; (4) a thermal conductor to transfer heat generated at the electrodes to a coolant; and (5) a converter, to heat, of the kinetic energy of neutrons generated by cold nuclear fusion on the H-storing metal.

76. JP 91 215,786; "Apparatus for cold nuclear fusion using solar energy"; Canon; 20 Sept 1991, 19 Jan 1990, 8 pp. The apparatus contains: (1) a solar-energy-based electrical generator; (2) a means to generate D by electrolysis of heavy water using electricity from the generator; (3) a means to absorb D using a metal; (4) a means to contain D generated by (2); (5) a cold-nuclear-fusion device in (4), which comprises a pair of discharge electrodes, at least one of which is made of the H-absorbing metal; and (b) a device to apply voltage to the electrodes to cause electrical discharge.

77. JP 91 226,694; "Cold nuclear fusion based on electrochemistry in ultrasound field"; Semiconductor Energy Laboratory Co. (SEL); 07 Oct 1991, 1 Feb 1990. In cold nuclear fusion, in which electrical energy is applied between a pair of electrodes immersed in a heavy-H_2O filled tank, to cause reaction between the electrode surface and D, the whole reaction system is placed in an ultrasound field. The method can improve the efficiency of cold nuclear fusion.

78. JP 91 237,397; "Neutron radiographic apparatus based on cold nuclear fusion; Nissin High Voltage Co.; 23 Oct 1991, 14 Feb 1990, 2 pp. A neutron radiographic apparatus, which contains a neutron source, and a film on which neutrons from the source are projected across a sample target, uses a cold-nuclear fusion device as the neutron source.

79. JP 91 237,398; "Radioactivation analyzer using cold nuclear fusion"; Nissin High Voltage Co.; 23 Oct 1991, 14 Feb 1990, 2 pp. A radioactivation analyzer which is equipped with a neutron source and a radiation detector, is characterized in that the neutron source is a cold nuclear fusion apparatus.

80. WO 91 14,267; "Method and apparatus for nuclear fusion"; Khudenko, Boris; 19 Sept 1991, 13 Mar 1 1990, 57 pp. The present invention relates to a method and apparatus for cold nuclear fusion in which fusionable particles located within an electrolyte are accelerated by local electromagnetic fields in a migrational transport layer. This migrational transport layer can be induced either by creating a cementation system, applying an outside source of current to an electrode system, or a combination of both.

81. WO 91 15,071; "Deuterium energy accumulation"; Drexler, Jerome; 03 Oct 1991, 23 Mar 1990, 21 pp. Method and apparatus are described for promoting electrolyte ionization of heavy water to thereby produce D ions that are accelerated by an electrical field and collected in the interior of an accumulator. Negative and positive electrodes, spaced apart, are immersed in the liquid with an approximately constant voltage impressed between them. An ion accumulator substantially surrounds the negative electrode, is formed of an accumulator material through which the ions may flow, and has a metal that readily absorbs D at its surface. The accumulator material can absorb a fraction of the D ions that otherwise flow to the negative electrode. D ions, absorbed into the accumulator material, may produce heat energy by cold fusion therein.

82. WO 91 18,396; "Deuterium accumulator for energy conversion; Drexler, Jerome; 28 Nov 1991, 17 May 1990, 37 pp. Method and apparatus are described promoting electrolyte ionization of high purity heavy water (containing Li^6OD), thereby producing *d* and Li ions that are accelerated by an alternating voltage. These are swept through a matrix of suspended D absorbing and Li-absorbing particulates and collected in the interior of said particulates. The electrodes are spaced apart and immersed in the liquid with an alternating voltage between them. The matrix of suspended particulates is located between the two electrodes. When the D and Li ions which are absorbed in the particulates may fuse or otherwise combine to produce heat energy.

83. WO 91 18,397; "Deuterium accumulation energy conversion apparatus"; Drexler, Jerome; 28 Nov 1991, 17 May 1990, 27 pp. Method and apparatus are described for promoting ^6LiOD electrolyte ionization of heavy water to produce *d* and lithons that are accelerated by an a.c. voltage and swept back and forth through a *d* and lithon permeable and absorptive accumulator and collected in the interior of the accumulator. Two electrically insulated electrodes are spaced apart and immersed in the liquid with an a.c. voltage impressed between them. The accumulator is positioned between the 2 electrodes and forms a structure through which the ions may flow, and which consists of a material that readily absorbs the D and the ^6Li ion. The accumulator material can absorb a fraction of the *d* and lithons that would otherwise flow toward the instantaneous negative voltage electrode. The instantaneous negative electrode is electrically insulated from the *d* and lithons, which cannot pick up a free *e*. Thus, the *d* and lithons are not converted to unwanted D atoms and gas. Deuterons and lithons, absorbed into the accumulator may fuse or otherwise combine to produce heat energy.

84. WO 91 19,294; "Distributed deuterium lithium energy apparatus"; Drexler, Jerome; 12 Dec 1991, 25 May 1990, 18 pp. A method and apparatus are described for production of thermal energy through electrolyte ionization of D_2O using a ^6LiOD electrolyte, with dissolved D gas in the heavy water, and pumping the ionized heavy water over a bed of Pd metal particulates, foils or porous baffles to collect both D and ^6Li ions to facilitate ion-ion combination. No electrodes are used to achieve the fusion process. The container is a closed loop or helix to permit continuous cycling of the ionized heavy water over the Pd ion collector again and again to absorb the maximum number of ions and to reuse the kinetic energy of the pumped water flow and the thermal energy added to the heavy water. Porous or perforated baffles are used to contain the Pd accumulator structure when it is in the form of particulates or loose components. Perforated baffles made of Pd may also be used as the accumulator structure.

85. DD (former East Germany) 293,147; "Arrangement for cold fusion in electrochemical fusion cell"; Technische Universitat Dresden; 22 Aug 1991, 12 May 1989. The title arrangement comprises a D-containing electrochemical fusion cell with a D-oxidizing anode. The evolved gases from the cathode are fed into the anode where D and O recombine to form D_2O. This arrangement reduces the loss of heavy water during electrolytic fusion of D.

86. DD 293,148; "Arrangement for cold fusion in electrochemical cell"; Technische Universitat Dresden; 22 Aug 1991, 12 May 1989. The title arrangement comprises a D-containing electrochemical fusion cell and a D-O-fuel cell. The evolved gases from the fusion cell are fed into the fuel cell where D and O recombines to form D_2O. The thus produced D_2O is fed back to the fusion cell so that there is no loss of D_2O during electrolytic fusion of D.

87. DD 295,939; "Material combination for electrochemically or chemically induced nuclear fusion and method of its preparation";

Humboldt Universitat zu Berlin; 14 Nov 1991, 10 May 1989, 3 pp. The title material comprises use of a metal, alloy or intermetallic compound in contact with a Li isotope for absorption of H or its isotopes. The combination provides improved efficiency.

88. EP 461,690; "Cold nuclear fusion thermal generator"; Boeing Co; 18 Dec 1991, 13 Jun 1990, 5 pp. An apparatus for conducting cold fusion comprises an electrically conductive anode, an electrically conductive cathode comprised of a constituent for selectively adsorbing H and releasing larger nuclei, and B or Li; a vessel for containing the electrodes; and electrolyte; means to vent gaseous reaction products; and means to carry away the heat generated by the fusion. A method of producing heat energy comprises the steps of immersing an anode and a cathode in an ionic aqueous solution in an electrolytic cell; applying an electrical current across the electrodes such that H^+ ions are produced and H nuclei are adsorbed by the cathode; fusing the adsorbed H with B in the cathode, and withdrawing heat from the cell.

89. FR 2,655,465; ZA 90/05389; "Energy Source;" Shell Internationale Research Maatrachap, B.V.; 07 Jun 1991; 11 Jul 1989; Energy is produced by: loading a body with ≥ 1 H isotope where at least a part of the body comprises ≥ 1 metal capable of forming a metal hydride-type lattice system; arranging the body as an electrode of a capacitor means in an electrical circuit along with another electrode connected with an externally controllable voltage supply means; operating the voltage supply means; and recovering energy produced in the body by operating the voltage supply means. The system produces energy by a process commonly known as cold fusion.

90. BE 1,002,781; "Energy production by nuclear fusion;" Van Den Bogaert, Joannes; 04 Jun 1991, 5 Jun 1989, 11 pp. In this process, in which a fusible material is absorbed in the crystal lattice of a H-absorbing material that has a negative electrical polarity, the fusible material is, or is being, absorbed by a H-absorbing material in the form of individual particles having a negative electrostatic charge, after which the polarity of the particles is changed from negative to positive. This process is especially aimed at the controlled fusion of D, optionally mixed with T, in the crystal lattice of the H-absorbing material, at high efficiency. The H-absorbing material is a metal or alloy consisting of, or containing ≥ 1 element selected from Pd, Ti, Zr, V, Th, Nb, Ta, Ni, and Fe. A turbulent aerosol or suspension of colloidal or crystalline Pd particles (average particle size 0.1-0.001 μm) in D is supplied in an upflow through a vertical quartz tube internally coated with an electrically conductive coating or metal foil, e.g. Al or Cu, connected to the negative electrode of a d.c. source. A cooled, positively charges plate (anode) is located above the tube, the polarity of the particles containing the absorbed D is changed upon contact with the anode, and the positive ions, e/g. triton, formed by nuclear fusion are then expelled from the Pd particles. The ions then flow downwards, are neutralized at the cathode in the conical bottom of the reactor, and the Pd particles are then separated from the aerosol in, e.g., a hydrocyclone. The Pd particles may be electrically charged in an insulating oil, e.g. a silicone oil. The heat generated by the fusion is removed by the heat transfer medium with which the anode is cooled.

91. FR 2,661,033 "Method and apparatus for producing fusion energy from heavy water," Jean Pierre Vigier (Ampère S.A.); 18 Oct 1991, 17 Apr 1990; 31 pp. The title process and apparatus comprises a combustion chamber, a tube ending in the chamber, means for introducing heavy water in the tube by, e.g., a water-arc gun, ejecting simultaneously two clusters in opposite directions, means for applying a pulsed electrical discharge on water to product an electrodynamic pressure and to accelerate the clusters to a hypervelocity and eject them outside the tube into the combustion chamber, means for placing fusible material on the trajectory of the accelerated clusters, and means of recovering fusion energy.

92. JP 91,276,095 "Nuclear fusion using atmospheric-pressure glow discharge," SEL, Japan; 06 Dec 1991, 27 Mar 1990, 5 pp. In a gas-phase plasma reaction using an electrode coated with a material for nuclear fusion in a reactor, nuclear fusion is done by discharging in a He-D mixture using a pair of D-absorbing metal electrodes to generate overvoltage at the electrode surface, and supplying D to the electrode or its vicinity.

93. JP 90,267,495 "Electric guns utilizing nuclear fusion," Japan Steel Works; 01 Nov 1990, 06 Apr 1989; 3 pp. The title guns comprise a gun barrel, a reaction chamber at the root of the barrel, in front of which a projectile is placed, a heavy water filled in the chamber, cathode and cathode in the chamber, which are formed at a D-absorbing material, and a power source to supply enough electrical energy between the anode and cathode to cause nuclear fusion. The parts of the anode and of the cathode in contact with the heavy water are formed of, respectively Pt (or C) and Pd (or its alloy).

94. JP 91 82,991 "Energy converters based on electrochemical nuclear fusion," Matsushita Electric Industrial; 08 Apr 1991, 25 Aug 1989, 5pp. The apparatus contains an electrolytic cell comprising a cathode from an alkali-metal-doped e^--type compound, a noble metal anode, heavy water and an electrolyte containing a support material, where the cathode and anode are immersed in the electrolyte.

95. JP 91 105,284 "Apparatus for cold nuclear fusion." Fujitsu Ltd.; 02 May 1991, 20 Sep 1989, 8 pp. An apparatus for cold nuclear fusion includes: (a) a chamber with a means to guide a D-containing gas into it, and an exhaust means; (b) a plasma-generating means; and (c) a reactive substrate on which is a H-adsorbing metal (e.g., Pd). Nuclear fusion is caused by contacting a plane of the gas with the reactive substrate.

96. JP 91 150,494 "Apparatus for cold nuclear fusion," Toyoaki Omori; 26 Jun 1991, 07 Nov 1989, 6 pp. The apparatus which includes a reaction tank containing D_2O, a pair of discharge electrodes in the tank, and a power source to apply pulsed voltage on the electrodes, and which causes nuclear fusion based on D ion generation by pulsed voltage, and a pressure wave produced by underwater plasma discharge, is equipped with a partition structure around the plasma-discharge area, which controls the pressure of the wave.

[Note: Normally a patent application filed in the U.S. is not available to the public until it is issued as a patent. When an inventor files a supporting patent application in a foreign country, the policy has been to assume that the information can be made public within about eighteen months after the filing date. The patent applications are then treated as public information. Therefore, the newest entry in the above patent-application list is at least eighteen months old. Ed.]

E. SHORT ARTICLES FROM READERS

INFORMATION ON TUNGSTEN BRONZES

By Samuel Faile and Hal Fox

The following information about tungsten bronzes has been obtained from Structural Inorganic Chemistry, by A.F. Well, 3rd Edition, Oxford, c 1962.

The recent paper by Kaliev [1] has engendered considerable interest in the so-called tungsten bronzes. The name bronze is given to these types of material due to their color and not due to their bronze-metal content. The tungsten bronzes belong to a class of crystalline materials having a perovskite type of structure.

Because tungsten can form both W^{5+} and W^{6+} ions, one might expect to find compounds such as $NaWO_3$ with the perovskite structure. The tungsten bronzes are intermediate between hypothetical compounds such as $NaWO_3$ and the oxide WO_3. The sodium compounds can be formed by heating a mixture of Na_2WO_4, WO_3, and WO_2 in a vacuum or by reducing Na_2WO_4 by hydrogen or molten zinc. These materials may be represented by the formula Na_xWO_3, where x has a value between 0 and 1. These tungsten bronzes have a color ranging from golden yellow (x about 1) through red (x about 0.6) to deep violet (x about 0.3), and are quite good conductors of electricity.

The phases from about $Na_{0.4}WO_3$ to $Na_{0.93}WO_3$ are all cubic with the perovskite structure. The size of the cubic cells vary with the Na content [2]. When the Na falls below about 0.4 the cubic structure collapses to less symmetrical forms. Copper analogues of the alkali-metal bronzes have also been prepared [3].

These compounds have been described as ionic crystals but they may be better described as solid solutions of alkali metals in WO_3. Sodium bronzes have metallic conductivity. Lithium bronzes apparently conduct by some ionic mechanism.

We do not, as yet, know the precise nature of the tungsten bronze used by Dr. Kaliev in his most interesting experiments with hydrogen and deuterium loading. He has reported that with the introduction of hydrogen and deuterium and the use of electrical current, excess heat results. The larger results are obtained with the use of deuterium. As discussed in the article about capillary fusion in this issue, it is suggested by Vigier, Rambaut, and the Graneaus that this experiment is an excellent example of capillary fusion.

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"COLD FUSION UPDATE:
Why Japan Forges Ahead While Washington Sleeps"
Extracted from Article by Dana Rotegard

In an article for *Futurics*, the Journal of the Minnesota Future Society, Dana Rotegard recaps the politics and prejudices of the denouncement of cold fusion by both the American Physical Society (APS) and the news media, and the effect it has had on both government and public acceptance of this new science.

Since American hot fusion programs are staffed predominantly by members of the APS, who have considerable political clout in Washington because of their importance in classified cold war weapons research, the discovery of 'cold fusion' by private chemists was a major coup against the APS members' presitge, credibility and career prospects.

When the first theories about what actually happened in cold fusion didn't pan out, the critics denounced the research as pathological and tried to run its proponents out of American science. Rather than search for a new theory to explain the data that by then were not isolated anomalies, but reproducible at many facilities around the world, the APS chose to ignore facts and retain prejudice. The results were more of a commentary on the sociology and politics of science, than on the actual research being done.

To represent the current theories, Rotegard quotes a major paper published by *Fusion Technology*, September 1992, by Dr. Robert Bush, "A Light Water Excess Heat Reaction Suggests That 'Cold Fusion' May Be 'Hydrogen-Alkali Fusion'." The theory explains a transmutation reaction that takes place in solid material during electrolysis, and produces excess heat equal to 3-4 times input.

Rotegard shows that by the end of 1992 over 90 international patent filings (mostly Japanese), several hundred positive peer-reviewed published papers from 25 countries and at least 4 working prototypes were a fact. The American science press continued to ignore advances that were front page stories in Japan, where the government's MITI has backed research with over a billion yen in basic science funding, in addition to vast private commercial backing and research. The third annual International Conference on Cold Fusion in Nagoya, Japan was sponsored by nearly every major scientific society in Japan. "The simplicity of the technology and its human scale suggests that massive market penetration could take place once commercial prototypes are developed for selective market niches such as space heating, water heating, powering electric cars or generating non-grid electricity." Because of their positve approach to this new science, the Japanese are far closer to this goal.

The disinformation being spread to the government by the science advisors who have their hands in hot fusion pockets needs to be carefully reviewed in light of newer information. "Refuting an theory does not refute the data that the theory sought to explain." Since the data has been reproduced world wide enough times that there is no chance of all instances being 'poor science' remains, maybe the science 'Establishment' had better be forming some theories too. Otherwise

American scientific commercialization will still be plowing with mules while the Japanese are running new cold fusion 'tractors.'

TAPPING ZERO-POINT ENERGY

By Mrs. Win Lambertson

[In a discussion with Dr. Win Lambertson concerning some of his enhanced-energy experiments, he mentioned that his wife had written a short article about his work. The article follows:]

On January 22nd of this year and just two days after our President was inaugurated, the story was revealed on *Washington Week in Review* about President Clinton's compassion with a woman standing in line at the White House. She said, "Mr. President, I want to tell you that I have found a new energy source and it will cure two-thirds of the world deficit besides having military and industrial uses." Clinton's response was, "Let me have some material on that. Thank you very much."

Perhaps a new broom sweeps clean, but to my husband, Win, and me, these words were like a shot in the arm. Win has been working in the energy field for the past eighteen years. He concluded that the woman was talking about zero-point energy conversion. This is rarely mentioned in physics textbooks and most people have never heard of it even though this energy source is freely available everywhere in the universe. Win had been the Director of the Science and Technology Commission for the state of Kentucky before we retired to Florida.

He was exposed to the concept about twenty-five years ago and he made fun of it just as did the reporter on *Washington Week*. This skepticism came from the fact that no research programs were being supported by the U.S. Government. Skeptics ask, "If this is such a wonderful thing, why isn't everyone working on it?" It took Win a long time to come around to believing this concept himself.

Only after working on it [zero-point energy conversion] as a hobby in our basement with our older son, Larry, over twenty years ago, did it become a possibility. Then it became an obsession for Win.

Today, Win is still an independent inventor and spends every day possible working on this project and paying for it out of our retirement income. He has never been able to obtain government or corporate assistance. His first patent application was rejected and a new one is now pending in the patent office.

Win wrote to President Clinton after the *Washington Week* program. He also sent a copy of his most recent progress report to him. He mentioned that he had heard that President Clinton was the "Technology President" and asked him the following questions:

1. Do we presently have any programs in the conversion of zero-point energy to electricity?"

2. If not, WHY not?"

3. If "yes,' then why has this been withheld from the public?"

We are in hopes that the President is sincere about creating more jobs in the U.S.A. and that he will force a change in the Department of Energy. The major stumbling block seems to be that this energy force is not easily explained and sounds impossible. The scientific language has to be put into layman terms so that the public can understand it along with the patent office employees! It is a slow and arduous task, but Win remains optimistic and tireless in his endeavor.

He plans to replace fossil fuels [with enhanced-energy systems] and eliminate global warming. This energy source is free and will result in lower energy costs for everyone. As the standard of living is proportional to energy costs, this invention will lead to a richer life for future generations and our children and grandchildren should have high hopes for their futures.

EDITOR'S COMMENTS

The only patent with a zero-point energy explanation, that I am aware of, is the U.S. patent 5,018,180. Kenneth Shoulders is the inventor. When over 100 laboratories in over 25 countries have successfully produced cold fusion, **and the fact is ignored by the Department of Energy (at least during the Bush administration), it is predicted that zero-point energy conversion will have to be funded by concerned citizens.** *Fusion Facts* wishes the best of good luck to Dr. Win Lambertson (216-83rd Street, Holmes Beach, Florida, 34217) and to his wife.)

F. LETTERS TO THE EDITOR

MATSUMOTO FROM JAPAN

From Dr. Takaaki Matsumoto, Hokkaido Univ.

February 4, 1993

Last night at 9:00 - 9:45, NHK broadcast at "time 21", a special TV document, "Following the fever: a dreamful technology Cold Fusion". The presentation contained:

Beginning of cold fusion,
Congress hearing of USA,
Activities of Japanese companies,
Activities of Japanese universities,

Nagoya conference,
MITI activities,
Critics, and so on.

The total tone was very severe to the activities of the cold fusion R&D. It sounds as if they want to say that although the science of cold fusion is not understood yet, only the activities of the applications, especially obtaining funds, are proceeding.

Yours sincerely, /s/ T. Matsumoto.

SHORT NOTE FROM CINCINNATI

From Dr. Samuel P. Faile

Dr. Faile reports the following:

January 13, 1993
Mr. Brightsen of Clustron Sciences Corporation said that Westinghouse Corporation has eight people who are monitoring cold fusion. This information was provided in a discussion with Mr. Brightsen.

LETTER FROM ENGLAND

From Chris Tinsley, Nottingham

February 1, 1993 [Excerpts]

...Cold fusion is utterly cold stone dead here. Apart from one small piece in a Sunday broadcast after Yamaguchi's announcement [press conference in Tokyo given at beginning of Nagoya conference], I don't think there's been even a negative report in the press ... No, that's not quite true, obviously the SRI accident got reported, and there were a couple of pieces about Nagoya, but all but one of them had the usual Close/Williams [Dr. Frank Close and Dr. David Williams] rubbishing treatment tacked on the end. ... BUT there was a TV report showing F&P's boiling cells, I sent a tape to Eugene Mallove. As to success, the *Sunday Times* science correspondent has undertaken to do some kind of world tour and report it, I know he has scheduled an interview with F&P in Nice [France]. Since a few words by this paper can knock the value of our currency into a cocked hate, a big CF splash in it [the *Sunday Times*] will be taken seriously. ...

The idea is that while there is controversy (what I might call 'Wright brothers/Edison'-type work) going on in the rebel colonies [meaning the U.States], back here [in England] the intellectual heirs to Newton, Faraday and the rest do not even **KNOW** about what is happening; so there is chance that when presented with the full works [information] they will listen.

Personally, I am very interested in the science of it all, I do at least have enough background to follow the science. At least enough to go into shock when I hear of the potassium-carbonate electrolyte and the nickel cathode electrochemical cells. I think that we may well have to wait for an explanation - after all, there is still no explanation for warm semiconductors or even conducting polymers. ... Reading between the lines of recent Close/Huizenga drivel, I note that excess heat seems to be accepted by them. We know that nuclear processes are going on, but with the exception of Bush/Notoya, we don't seem to have really solid evidence that it accounts for all the energy. ... But what I want is loads of cheap, clean, low-tech energy and would forgo the theory to have it. Yes, I do know why theory is needed, but we may just have to get by. It is false logic to say that it [cold fusion] is not chemistry, it is not nuclear, it is not tapping the zero-point energy, or even it's nothing to do with the peculiar feeling you get when you stand inside a stone circle in Wiltshire.

/s/ Chris Tinsley

Editor's note: The intellectual heirs to Newton and Faraday may remember that Faraday was, at first, not allowed to present his experimental results to the distinguished Royal Society because he was not degree qualified - not a member of the club. Shortly before his death Newton said, "I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me." It seems that Newton's humility is not a prerequisite for today's pedagogues who not only studiously avoid new truth but vociferously deny it.

LETTER FROM ITALIA

Roma, December 10, 1992

Dear Hal Fox,

I forward to you a copy of my article, issued in *Nova Astronautica*, Vol.12, N. 54, Sept-Oct-Dec 1992. *Nova A. (ISSN: 0393-1005)* is the official organ of ASPS. As I show in the article my principal interest is to show **if the "mysterious" Homopolar Induction satisfies the classical conservation laws of energy and momentum.**

In my opinion, it may be a lack of time to debate if homopolar induction is, or not, relativistically coherent. It may be as to debate, who, between Tolomeo or Platone, have reason in the distribution of epicycles. What is my interest is to know **if Homopolar Induction Satisfies the Classical Laws?**

It is my opinion, that it seems a scientific outrage that, since over 150 years nobody has been able to demonstrate that homopolar induction satisfies the principles of classical electrodynamics! I hope you may clear such question in your

issue to other scientists, to show if my doubts are serious. I don't exclude to be in error, I simply ask you if there are **experiments** and not, **only words** and/or **"established churches"**, that may clear this question. In my opinion, to clear **definitively** the mystery of homopolar induction, may open new horizons in solid state and nuclear physics.

Awaiting your reply,

Dr. Emidio Laureti, President
Associazione Sviluppo Propulsione Spaziale
Dipartimento RA-1
Via N. Martoglio, 22
00137, Roma, Italia

EDITOR'S PLEA

Here is an earnest request for help from the President of the Association for the Development of Space Propulsion. *Fusion Facts* urges all of its readers to seriously consider this question and provide an answer to Dr. Laureti. His paper is reprinted below:

Hypothesis of Homopolar Atomic Model for Cold Fusion Energy
By Emidio Laureti

ABSTRACT: By the means of a macroscopic structure, which reproduces homopolar induction, it is defined a form of interaction which might offer an hypothesis of atomic models, for a possible explanation of cold fusion energy.

Homopolar induction is known since many years [1,2,3]. Many authors think that it defines a new form of interaction with an unknown substratum, so that, to save energy conservation law for energy production [4,5,6,7] it is said that, by homopolar induction, we can extract energy from vacuum.

The conclusion of Dr. Kincheloe [6,7] corresponds to my experience [8]. Using his words [4,7] "...Known for over 150 years, the Faraday homopolar generator has been claimed to provide a basis so-called "free energy" generation, in that under certain conditions the extraction of electrical output energy is not reflected as a corresponding mechanical load to the driving source... DePalma may have been right in that there is indeed a situation here whereby energy is being obtained from a previously unknown and unexplained source. This is a conclusion that most scientists and engineers would reject out of and as being a violation of accepted laws of physics, and if true has incredible implications."

Since over 150 years nobody has been able to verify "clearly" if, when the current flows in the conductors by homopolar structures, THERE EXISTS A DAMPING FORCE [4,5,8]. Besides, **the structures of homopolar induction are constructed so that IF THE CLASSICAL CONSERVATION OF ENERGY IS SAVED, IT IS CONTRADICTED THE PRINCIPLE OF CONSERVATION OF ANGULAR MOMENTUM AND OF MOMENTUM [8,9,10].**

In the studies of homopolar devices, I have considered many disputes if homopolar induction is, or not, relativistically coherent [11,12]. It must be said that, what Einstein affirms, in his relativistic paper of 1905, contradicts homopolar experiences (as refers Francisco J. Muller in his letter [12]: "(Einstein words).... THE PHENOMENON HERE [electromagnetic induction] DEPENDS ONLY UPON THE RELATIVE MOTION BETWEEN MAGNET AND CONDUCTOR".

I have called such unknown and unexplained substratum, with which, it might interact an homopolar machine in the production of energy, KETER [8] (The first Sefirot of Khabbalah: i.e., the Cosmic Nothing) to distinguish it from the inconsistent properties so-called Aether. I have realized an homopolar machine which has the characteristic to use "rotational brushes" to avoid frictional losses.

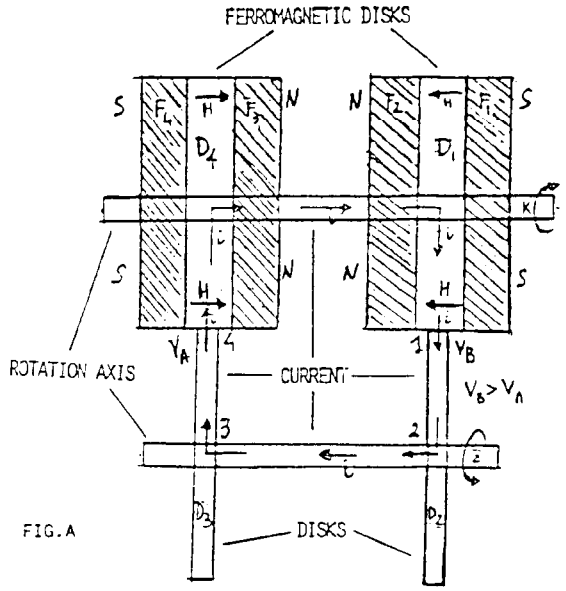

FIG.A

I describe here, a simple homopolar mechanical structure, that is suitable of several variations. In the Fig. A is shown a macroscopic model, suitable, in generalization, to atomic or molecular structures. The homopolar machine in the upper part of Fig. A is composed of four ferrite toroidal magnets: F1, F2 which enclose the iron disk D1 (F1 and F2 are attached to D1); and so, F3, F4, which enclose the iron disk D4 (F3 and F4 are attached to D4). The magnetic field is directed from right to left in D1 in Fig. A, opposite in D4. The opposite magnetic fields in the disks D1 and D4 are parallel to K axis.

Disks (fixed on K axis) and permanent magnets, rotate together around the axis K (clockwise in Fig. A, if seen from K zone (right in Fig A.)). The K axis is made in steel. Rotational brushes, disks D2 and D3 and Z axis are conductors; it is not necessary that they are ferromagnetic.

When all system rotate, D1, D4, and also D2, D3 have obviously in modulus the same angular velocity, i, (as in Fig. A) all four disks have the same diameter.

The two systems: disks D4, D1 and ferrites around K axis and on Z axis rotate in contact. When disk D1 is in contact with disk D2, and disk D4 is in contact with disk D3, as indicated in Fig A, there exists an electric circuit between the four disks and the two axis. In contacts 4 and 1, the four disk contact zones, have the same velocity, so the friction is zero. The contact force is only normal to circumferences and so it has no component along the radius. The work done by contact force is zero.

For the homopolar induction, I have experienced a current in the verse 1,2,3,4, if the direction of magnetic fields and the rotation of the axis is that indicated in Fig. A. In the Fig. A, the potential Vb, in contact zone 1 of disks D1 D2, is major of potential Va in contact zone 4 of D3 and D4 disks. The sense of such macroscopical model is that it is possible to generate a current with no frictional forces by rotational brushes and overall, so that there does not exist a braking of the four disks for the peculiarity of homopolar induction [8]. A better improvement is to put also magnets on the rotational brushes D2 and D3, and so to have in the iron disk D2 a magnetic field equal to disk D1, and in disk D3 a field equal to disk D4.

A variant is to substitute D2 and D3, with condensers [8]. **Express the hypothesis that for homopolar currents, the laws of electromagnetism are not valid, until (over 150 years!) someone shows clearly the opposite.**

I express the hypothesis that in the atomic domain, in COLD FUSION EVENTS, might realize structures analogous and to generate, by homopolar induction, different potentials, and overall, current, and so FREE ENERGY.

Actually, I can't exclude that such "homopolar currents", besides between ions and electrons, can implicate the structure of the nucleus. Biatomic or pluriatomic bounds in the cold fusion mixture, under the action of external fields and/or currents, might organize so that to realize the structure of Fig. A, with specific association of quantized magnetic moments an angular momenta. It might be of interest to see, during the cold fusion process, rotational atomic spectra. In such microsystems would then exists microscopic circuits and specially conduction bands (which might interest both electrons and nuclei), and so homopolar currents which develop free energy and/or change the structure of nucleus.

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G. MEETINGS AND MISCELLANEOUS

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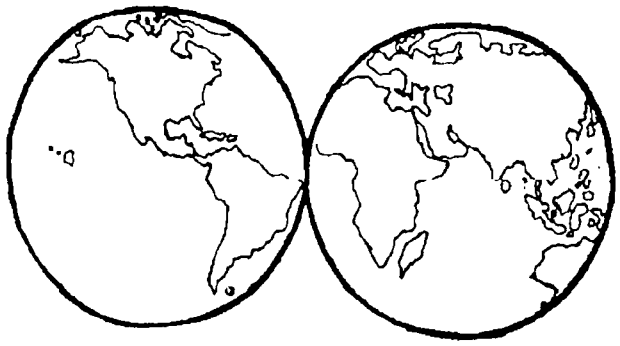

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