

# TANTALUM PRODUCERS INTERNATIONAL STUDY CENTER

QUARTERLY BULLETIN

ISSUE No. 13

MARCH 1978

FIRST QUARTER

## T.I.C. Activities

*The Ninth General Assembly of the T.I.C. will be held in Rothenburg ob der Tauber and will be followed by the First International Symposium on Tantalum. 120 participants have registered for the Symposium and of these about 50 will be accompanied by their wives, who will take part in the ladies' programme.*

### FIRST INTERNATIONAL SYMPOSIUM ON TANTALUM

#### PROGRAMME

##### WEDNESDAY 10th MAY

- 9.00 Ninth General Assembly of the T.I.C. at the Hotel Eisenhut (for members).  
10.30 Opening of the Symposium by the President of the T.I.C. in the Reichsstadthalle.  
11.00-13.15 Presentation and discussion of the following papers :  
Metallurgy, production and applications of tantalum.  
Prof. Dr. R. Kieffer, Technical University, Vienna. (Please note change of title and speaker.)  
Tantalum supply and demand outlook - is the balance favourable ?  
T.C. Barron, Emory Ayers Associates, USA.  
The interplay of industry and trade press with special reference to the problems of representative price and market information.  
T.J. Tarring, Metal Bulletin, London.  
13.15-14.30 Luncheon at the Reichsstadthalle.  
14.45-17.30 Presentation and discussion of the following papers :  
The relationship between cost of tantalum and tantalum capacitor demand.  
R.W. Franklin, ITT Components Group Europe, Tantalum Capacitor Division, Paignton, England.  
Capacitor trends - an impact study, and the alternative to the use of solid electrolyte tantalum capacitors due to current trends in the price of  $Ta_2O_5$ .  
W.E. McLean, Sprague Electric Company, USA.  
Future of tantalum powder for capacitor use.  
John A. Cenerazzo, Kawecky Beryloco Industries Inc., USA.  
19.30 Address of welcome by the Lord Mayor of Rothenburg ob der Tauber, at the Rathaus.  
20.15 Festive Dinner at the Reichsstadthalle.  
The guest speaker will be the Secretary of State at the Ministry of Economics and Transport, Mr. Franz Sackmann.

##### THURSDAY 11th MAY

- 9.00-11.45 Presentation and discussion of the following papers :  
Use of tantalum carbide in cemented carbides.  
Sven Ekemar, Sandviken, Sweden.  
Tantalum developments in Europe - products and processes.  
G.J. Korinek, Hermann C. Starck, Germany.  
Specific problems related to tantalum products.  
H.J. Heinrich, GFE Gesellschaft für Elektrometallurgie mbH, Düsseldorf, Germany.  
12.00-13.15 Luncheon at the Reichsstadthalle.  
13.30-15.00 Presentation and discussion of the following papers :  
Engineering aspects of tantalum chemical equipment.  
Gerald D. Corey, Fansteel Inc, USA.  
Tantalum in chemical plants.  
F. Sperner and C.H. Liesner, W.C. Heraeus, Germany.  
15.00-16.00 General discussion and final report.  
17.00 Departure by coach for Nuremberg.  
18.30 Arrival at hotels.  
19.45 Departure by coach for Reception at Nuremberg Castle, with buffet.

##### FRIDAY 12th MAY

- 9.00 Departure by coach for GFE works.  
9.30-10.30 Film on GFE's metallurgical operations.  
10.30-13.00 Visit to the works and Central Research Department.  
13.00-14.00 Luncheon at the canteen of GFE. Official closing of the Symposium.  
14.00-16.00 Visit to the Grundig works.  
19.30 Bratwurstessen.

##### SATURDAY 13th MAY

- 10.00 Sightseeing in Nuremberg and Fränkische Schweiz, visit to the Germanisches Museum.

## T.I.C. NINTH GENERAL ASSEMBLY

The Ninth General Assembly of the T.I.C. will be convened at 9.00 a.m. on Wednesday 10th May 1978 at the Hotel Eisenhut, Rothenburg ob der Tauber, West Germany, preceding the First International Symposium on Tantalum. All members will be represented. The Agenda for the meeting will be :

1. Approval of Minutes.
2. Report of Executive Committee.
3. Financial Report for 1977.
4. T.I.C. Programme :
  - Bulletin and Publications;
  - Statistics.
5. Statutory Elections :
  - New members;
  - Executive Committee;
  - Resignation of a member.
6. Tenth General Assembly : location and date.
7. Other Matters.

Prospective members wishing to be elected during the Ninth General Assembly should send their applications before the Assembly to Mr. P. Leynen, President of the T.I.C., care of Compagnie Geomines, Chaussee de la Hulpe 150, 1170 Brussels, Belgium.  
Telephone 673 98 50.  
Telex Socmin 26.361.

#### ARRIVAL

Participants arriving at Nuremberg airport on 9th May should note that coaches will be available throughout the day for the transfer to Rothenburg.

#### LADIES' PROGRAMME

##### WEDNESDAY 10th MAY

Visit to the romantic Tauber valley, Creglingen, Weikersheim and Dinkelsbühl.

##### THURSDAY 11th MAY

Tour of Rothenburg ob der Tauber.

##### FRIDAY 12th MAY

Sightseeing in Nuremberg - Germanisches Museum and Spielzeugmuseum; shopping.



## The role of primary materials in the relations between E.E.C. and the developing countries

*This article is a condensation of a presentation made at the T.I.C. Eighth General Assembly on 11 October 1977 by Mr. José Nicolai, Adviser to the General Manager of Industrial Affairs of the E.E.C. Commission.*

I shall start by reviewing the various problems that, in the Community, we face in the field of raw materials. First, for the very long term, we have come to the conclusion that the risk of absolute shortage is relatively small. We see problems, amazingly enough for a certain number of renewable resources, such as timber, paper, hides and skins, but possibly for silver. Recently, the N.T.F. has concluded that by the year 2,000 we might have some difficulties for lead and zinc. Therefore, we are not very concerned because if we adopt intelligent policies for the renewable resources we should be able to stabilize the balance between supply and demand. For most others, in particular silver, there exist substitutes.

But our real problem is a long-term problem. As you may know, we depend on third countries for something like 70 to 100 percent of our raw materials and of course this degree of dependency is somewhat of a worry to us. And, simultaneously, we see the development of local processing in countries like Canada and Australia and also in a large number of developing countries. And we have some worries about how industry can survive in the long run in view of this great dependency on outside sources and the development of industrialization in the Third World.

In the medium term, we have a problem which has been caused mainly by a wave of expropriation of our investments in a number of countries. We are faced, at present, with a lack of risk capital for mining investment particularly in developing countries. To keep an adequate balance of supply and demand for raw materials, an important amount of money will have to be invested. In the medium-long term, the policy of mining houses to invest mainly in Canada and Australia, in disregard of most of the developing world, is not a very safe policy since Canada and Australia are the countries which want and are able to process their raw materials themselves. For a number of years, we have had extremely tough discussions as to possible guarantees on safety of supply from the Canadian side. With uranium, we have had some serious problems both with Australia and Canada and, therefore, we would like a better spread of our dependency throughout the world. We also believe it would be contrary to our development policy not to foster investment in the developing world.

I have already, more or less, mentioned our trading partners in this field. On the one hand we have Canada and Australia. The second group is Rhodesia and South Africa where it cannot be excluded that, at some stage, political difficulties might disrupt supplies. Then there are the state trading countries and Red China, which are not the ideal partners as far as safety of supply is concerned.

This is why we are more or less led to concentrate on the developing countries, largely because the rest goes more or less by itself. We do not have to do much to encourage our people to invest in Canada or in Australia. They do so anyhow. So, our worries are much more as to how we can develop our relations with the developing world.

The key problem which we are facing there is much wider than the raw materials themselves. It is what is now called the setting up of a new world economic order. The developing countries have come to the conclusion that our economic system leaves them very little chance to arrive at an adequate economic development. Therefore, they want to change the rules of the game. In fact, it is clear that the degree of indebtedness of the developing countries is enormous and growing very rapidly and our official development aid, about \$13.5 billion a year for the whole of the industrialized world, represents less than the interest that the developing countries have to pay each year on their debts to us. One has pledged to gear up to a level of development aid to the order of 0.7 % of our GNP. We are very far from that. We are, let's say, around 0.3 for Germany, and at 0.28 for the United States. With the present recession it is extremely difficult to obtain from our finance ministers commitments that they will do better rapidly.

The developing countries also consider that they do not have an adequate access to processing of their raw materials, to technology, to maritime transport, and to marketing and distribution. They also consider that they have no control whatsoever over our commodity exchanges which puts them sometimes in an extremely awkward position. If you take the case of Kameroun, what can Kameroun do for cocoa versus the commodity market on which one buys and sells each year twenty times the annual

cocoa consumption of the world. And, of course, they want to get a better access to markets so that they can sell here processed raw materials and not simply raw materials as such. They also claim a right to exploitation of deep sea nodules. For five years we have been engaged in a very lengthy and difficult negotiation for a law of the sea and we are not yet there. There are still pretty strong differences of views between industrialized and developing countries.

One basic remedy that the developing countries envisage to improve their situation, to reverse what they call the "continuous deterioration of their terms of trade", is to adopt a generalized indexation of the price of manufactures which they buy. Of course, this sort of idea is highly unpopular in industrialized countries. In many cases, we feel that it would be impossible to implement it. In many cases, it might even be detrimental to the developing countries because, for a certain number of commodities for which substitutes exist or which compete with synthetics, it would simply mean that consumption of these commodities would collapse if the price was not competitive.

Of course, this brings the developing countries to demand that we establish control of production and investment in synthetic fibers and synthetic rubber so that they have a chance to develop their production and exports of natural products. There, again, we are faced with the fact that most industrialized countries have systems which would not permit them to engage in firm control, either of production or investment.

These problems have been the core of the discussions we had in the North-South Dialogue. We made some progress on a number of issues. Others remained unresolved. We shall have to proceed with this dialogue in some other forum in the future. One has not been picked yet. It is generally agreed to negotiate within the U.N. framework. But, in parallel with this, most of what the group of 77 want to implement in the field of commodities has been embodied in what is called the UNCTAD Integrated Program which was adopted at the end of the Nairobi Conference in May of last year. Basically, this integrated program, which includes a list of 18 commodities, foresees two things for these 18 commodities: rounds of discussions, going on continuously now in Geneva, aiming at the signing of commodity agreements for as many of these commodities as is feasible, and, secondly, setting up what they call The Common Fund. To them, the Common Fund would be an institution within the UNCTAD framework which originally should be granted, by the member states, capital of the order of \$1 billion with the possibility of borrowing an extra \$2 billion on the capital market, and, if this did not do the trick, have a second slice a few years later to double these amounts. The basic purpose of this Common Fund, originally, was to be able to manipulate commodity markets so as to improve price levels of the commodities that the developing countries export. It would have served as an incentive for the conclusion of commodity agreements because in the past signing of commodity agreements has failed for lack of finance. If the finance was ready there on the table from the start, the negotiations on individual commodity agreements would be easier. Of course, underlying this is the problem of who would finance commodity agreements and, again, there is no totally common ground. A certain number of industrialized countries still believe that they can be part of a commodity agreement without financing it. The recent tendency, however, has been improvement as now most industrialized countries, Japan and the U.S. the latest ones, have joined in financing the hypothetical tin buffer stock. Since there is no stock at present as there is a shortage of tin, the Republic of Germany has indicated its willingness to envisage it by the time that this stock will have to be built up. There is a certain readiness also on the side of the consumer countries to finance a natural rubber buffer stock. There is also consideration of financing copper buffer stock although this might be a very expensive affair.

But, of course, not all commodities lend themselves to buffer stocking. From the start the industrial countries were extremely reluctant about this program and the Common Fund. They disagreed with the developing countries as to the objectives of the operation. To the industrialized countries, the objective was essentially to stabilize commodity markets around the long term price trend and they denied that the objective might be systematically to manipulate prices to modify the relationship between commodity prices and the prices of manufactures. This led some of them to make declarations in Nairobi that they had some reservations as to parts of the program. They were also very reluctant about the Common Fund, saying that this was putting the cart before the horse. Finally, under the political pressure of the 77 in the North-South Dialogue, they accepted that there should be a Common Fund and that in November we would go



into a resumed session of the negotiating conference on the setting up of a Common Fund which will be a key instrument in the Integrated Program.

In the meantime, the 77 had realized that very few commodities would qualify for buffer stocks, that those which were most likely to qualify concern only about 20 developing countries and that the other 110 would get nothing out of the Common Fund. Therefore, they added the words, after buffer stock, "for the financing of other measures as well", but without defining which ones. And this sets another problem which is that most of the measures which can be foreseen in commodity agreements are very close to aid for development because it is R & D, or it is diversification, it is local processing, it is transfer of technology, etc. Most industrialized countries believe that we have enough institutions already which deal with aid for development. We have the World Bank, we have the International Finance Corporation, we have U.N.D.P., and they do not quite see why one should add another one. They would rather see the other measures being financed by the existing bodies rather than by the Common Fund. It would, of course, considerably alter the nature of this Common Fund if it had to finance measures where the money simply disappeared. It does not mean that it would not be well used but it is a form of aid and it is not self-revolving as would be the money that would be used for buffer stocking.

So there were considerable misunderstandings on both sides for a long while and one of the virtues of the North-South Dialogue has been to dispel some of these misunderstandings. But still one finds it difficult to talk adequately about the real problems. In other words, and I am speaking on a personal basis and not presenting the official views of the Commission or the Community here, we try to oppose one system, the old liberal system where the only thing that counts is free competition and all the best should come out of it, with an artificial system proposed by the 77 which would be highly dirigistic in nature and would require considerable amounts of money to modify existing economic relations. Everybody avoids talking about what I would call the reality. To me the reality is that for most commodities there is some form of dominant position of consuming countries, either because they are the largest consumer, or because it is their companies that enjoy an oligopoly, or there is some form of cartel, or because they hold the marketing channels, etc. So the price determination today for most commodities does not reflect the natural play of a totally free liberal economy.

The second point which is important is that it is obvious that there is a considerable lack of purchasing power in the developing countries. The consequence is that when multi-national companies, and other industrialists, set up plants in developing countries, it is with a view to sell here because the purchasing power is here, not in developing countries. This, in turn, automatically implies that each time we build a plant in Singapore, we have to close one in the Community. Since we are faced now with the recession and a considerable unemployment problem,

this drives member states into a wave of protectionism which, in turn, creates a new wave of wrath in the developing countries. We see it now with the re-negotiation of the multi-fiber agreement. We see the difficulties we have for the sugar agreement, etc.

We have quite a few problems of this kind and we are stuck in a static position. In my view, there is only one way to get out of this static position. In the short term, we have to plod along to arrive at sensible commodity agreements. We have to develop links with the developing countries in the field of bilateral agreements on the protection and promotion of our investments in these countries in order to restore the investment flows that are no longer there.

But in the medium term, the solution is a different one. It is the one of convincing gradually our industrial circles that the only chance they have to come back to full employment in Europe is by going along in a movement that will gradually develop purchasing power in the developing world. After all, they are there, two billion people who lack just about everything. If they had purchasing power, there would never be any question of closing any plant here in the Community. Plants would run at 100 percent of capacity.

And, of course, the question is "How do we do it?" I am not in favor of artificial setups. If we are sincere enough to admit that we exert considerable pressure on the price level of commodities, if we would realize that we cannot, when we talk as European industry, deal with the developing countries as a single head of a company deals with a supplier of raw material and simply try to get the lowest possible price, and that the developing world is the best potential customer our industry has, then we should realize that accepting a gradual readjustment of the price ratio between commodities and manufactures would be the best possible, smoothest, and easiest way to economically expand the purchasing power of these would-be customers. I feel there is no other way out. When one looks at the system that has been tried in the field of official development aid, it leads nowhere. For access to this market, we know that we are practically with our backs to the wall. Of course, we shall go into the Tokyo round, but each time a concession is made, we can readily tell the number of plants that we shall have to close. And for official development aid, we will never reach financial flows of such a magnitude that will really modify considerably the purchasing power of the developing countries. Of course, together with this, we will try to develop adjustment policies mainly through bilateral cooperation agreements with individual countries so that we can organize where the gradual phasing out of certain activities can be done within the Community.

This is just about how I see things and, of course, I would not say that all of this concerns directly tantalum but I thought you might be interested in having the sort of broad outline of what is going on in the field of raw materials and commodities overall.

## Hermann C. Starck Berlin - A major tantalum processor

Hermann C. Starck Berlin — HCST — was established about fifty years ago and has grown to be one of the world's leading special metal producers. Extensive production facilities in West Germany are located in Goslar, southeast of Hannover in the foothills of the Harz mountains, and at Laufenberg/Baden, near the German-Swiss border. The HCST plants comprise a very versatile combination of mineral dressing, chemical processing, and pyrometallurgical operations. This variety of available installations, coupled with an extensive technical capability developed over the years, gives HCST an unusual degree of flexibility in treating almost all types of raw materials in the special metals area. Both the Goslar and Laufenberg plants have modern laboratories equipped with every type of testing and evaluating instruments to ensure that HCST products satisfy the most exacting specifications.

Starck has been particularly known for its continuing extensive research and development effort. This activity, housed in a modern laboratory at Goslar, consists of laboratories and pilot plant facilities used exclusively for R and D. The great variety of products produced by HCST have been developed over the years "in-house" and many proprietary processes are used.

Although HCST is Europe's leading producer of tungsten and molybdenum products, its product line covers almost all forms of metals and chemicals derived from cobalt, nickel, tantalum and niobium. Perhaps HCST is best known for the broad line of carbides produced for the cemented-carbide industry. But in addition it manufactures carbides, nitrides, silicides and borides of the special metals for a great variety of applications as well

as a full line of master alloys produced both by pyrometallurgy and powder metallurgy.

Compared to tungsten, which has been produced at Goslar since 1899, tantalum is a relatively new product for HCST. It has been produced for just over twenty-five years. There are few tantalum processors who offer as wide a range of tantalum and niobium products as HCST. The most important of these products are synthetic concentrates, refined oxides, carbides and metal powders.

### Synthetic Concentrates

More than half of the world's tantalum demand is provided by the tantalum oxide contained in tin slags. A large portion of the tin slags contains so little tantalum oxide (less than 3 %) that they cannot be processed by direct acid digestion. The cost is prohibitive. A proprietary process developed by HCST for the electric furnace conversion of lean slags to synthetic concentrates provides the only means of utilizing the tantalum from this source. HCST produces these concentrates at its Laufenberg plant.

Slag upgrading is really an art. Years of experience have been necessary to make the process meet the three most important requirements of a tantalum source material which can be used for extraction:

1st: Applicability to slags of varying origin and varying tantalum content,



2nd: 80 % to 90 % recovery of the slag-contained tantalum and niobium oxides, depending on the type of slag being processed, and

3rd: High solubility in acid of the tantalum in the synthetic concentrates to assure good yield in digestion and extraction.

Furthermore, the concentrates have to be reasonably low in the content of carbides and uncombined carbon. The insoluble residues, when the concentrates are digested in acid, must settle well to permit maximum separation. The resulting product, a synthetic tantalite, contains combined tantalum and niobium oxides at the 50 % level.

Being the only processor in the free world of low-grade slags to make synthetic concentrates, HCST provides toll service to other tantalum processors to process their low-grade slags to concentrates. This demonstrates the widespread acceptance of the process and the product.

## Refined Oxides

The wet chemical dissolution of tantalum and niobium ores and concentrates (both natural and synthetic) is carried out at Goslar. The source materials are dissolved in hydrofluoric and sulphuric acid in special corrosion-resistant digesters. The process is controlled so that the leach liquor is laden with tantalum and columbium with just enough free acid to ensure that the tantalum and niobium values can be extracted and the insoluble residue is so lean in tantalum content that it can be dumped.

Liquid-liquid extraction was introduced in 1955 and has been steadily improved since that time. MIBK is used as the extractant. After separation from all impurities and from each other, the tantalum and niobium are stripped from the extractant and precipitated as pure oxides. They are subsequently calcined to provide the market product known as « technical-grade oxide ».

Another way in which refined oxides are produced is the chlorination process practised at Laufenberg. The technology was originally developed by the CIBA Rare Metals Division and was acquired by HCST in 1968. Concentrates, ores, or ferro-alloy of tantalum and niobium are treated with gaseous chlorine and the tantalum and niobium are volatilized as chlorides. Because of the difference in boiling points of these two chlorides, they can be separated from each other and from all impurities; the resultant pure chlorides are hydrolyzed and calcined to oxides. The products are very pure, containing not more than a few parts per million of impurities. They are well suited for all applications in which extreme purity is prerequisite, such as use in electronic and optical materials.

## Carbides and Carbide Solid-Solutions

The refined tantalum and niobium oxides are used for conversion to carbides. The process is straightforward and can be controlled so that either pure carbide powders or mixed carbide solid-solutions of different compositions result. They can be tailored specifically to the varying requirements of the cemented-carbide industry. The average particle size of the carbide and carbide solid-solution powders can be varied and controlled in the range of one to five microns. But also, by means of plasma technology, tantalum and niobium carbides with particle size of only a few hundredths of a micron can be produced. These are the so-called « ultra-micron carbides ».

Other products in this area include triple-carbides, mixed crystals of tungsten, titanium, tantalum, and niobium carbides for direct use in the manufacture of various cemented-carbide products. Additional hard-materials produced are tantalum and niobium nitrides, borides and silicides.

## Potassium-Tantalum Fluoride

Part of the tantalum-laden organic phase, obtained in the standard processing at Goslar, is used to produce potassium-tantalum fluoride. Reaction of the MIBK organic containing the tantalum with a potassium salt yields a crude double salt which is then crystallized in dilute hydrofluoric acid of extreme purity, the latter produced by a HCST proprietary process. The resultant K-salt then becomes the source material for further processing into metallic tantalum by direct reduction.

Higher quality special potassium-tantalum fluoride, used to produce capacitor powder, uses special tantalum niobium concentrates processed in a new potassium-tantalum fluoride facility. After conventional acid digestion, separation is effected by contacting the leach liquor with a TBP-containing organic. This extractant is not inflammable and is considerably less water soluble than MIBK. In a proprietary process, so-called hot extraction and direct crystallization, the special grade of potassium-tantalum fluoride is produced.

## Capacitor Grade Powder

A new process, proprietary to HCST, has been developed to produce capacitor grade tantalum powder with extremely high capacitance values. The special grade K-salt and an alkali halide are mixed with an alkali metal or alloy. The reactive mass is cooled down under carefully controlled conditions before the reduction reaction is initiated. Since the reaction is run at a defined temperature, the process yields only capacitor grade tantalum powder. The reduction process is continuous.

Typically, this tantalum powder yields a specific capacitance of more than 10,000 cv/gram. The product is marketed under the trade names of PL-8000, PL-10000 and PL-12000. The numbers refer to the specific capacitance which will be exhibited in anodes pressed from the powders if they are formed with a press-density of 5 grams per cubic centimeter and are sintered for thirty minutes at 1,600 degrees Celsius. PL-12000 has the highest specific capacitance of any tantalum capacitor powder currently available in the market.

HCST also produces tantalum powders by electrolytic and carbon reduction. The ever-rising demand for high-performance high-voltage capacitors is met by powder produced from electron-beam melted tantalum.

As a part of the capacitor grade product line, HCST also produces capacitor anodes. A facility with a capacity of 300 kilograms of anodes per month is operated to provide anodes to customers when their needs exceed their own capacity. Since an essential element of anode production is the ability to test completely, the HCST facility provides the means of testing capacitor powders in all stages of production. By this means, the pace required continually to develop new powder types can be met.

## Research and Development

As is commonly known, all activities in the tantalum field require the backing of strong research and development and well equipped analytical laboratories. HCST has excellent facilities at both Goslar and Laufenberg to provide such. Some long-term projects include the investigation of means of up-grading very low grade tin slags (with even less tantalum content than those now being processed), recovery of tantalum from minerals not now considered commercial sources, and continuing programs to improve further the quality of all products. One very important project is the study of the influence of variations in the source material upon the quality of the final products.

Since tantalum production is a very competitive industry, a successful producer must exercise continual full-scale effort even to maintain his position. The HCST stated philosophy is to research actively all aspects of the tantalum and niobium businesses and to concentrate on the production of the most important products without neglecting the side-lines. This philosophy has gained and will keep HCST's leading position in tantalum.

## HCST and NRC

Early in 1976 HCST and Samincorp jointly bought most of the business of the Metals Division of the Norton Company. This acquisition has been organized as NRC, recalling the name of National Research Corporation, the original tantalum pioneering company acquired by Norton. NRC is best known for its high quality capacitor grade powder, but also produces flat-rolled sheet, strip and plate; a variety of wire and rod; welded tubing; and lines of bayonet heaters and repair kits for the chemical, petro-chemical and pharmaceutical industries. NRC is headquartered in Newton, Massachusetts, U.S.A.