Report on Mr. Vang's inventions

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CONFIDENTIAL

ERB-323

NATIONAL RESEARCH COUNCIL OF CANADA

RADIO AND ELECTRICAL ENGINEERING DIVISION

REPORT ON MR. VANG'S INVENTIONS

N. L. KUSTERS

OTTAWA

C13-V-157

NATIONAL RESEARCH COUNCIL

MEMORANDUM.—

To Mr. N.L. Kusters

Enclosed please find two additional copies of Report ERB-323 "Report on Mr. Vang's inventions. One is an extra copy for your files and the other a copy for Mr. A.H. Busby, Superintendent, Engineering Research & Development, Consolidated Mining & Smelting Co., Trail, B.C.

Jean McWilliams
for
B.G. Ballard.

FORM N.R.C. 47A

CONFIDENTIAL

REPORT ON MR. VANG'S INVENTIONS

ANALYZED

On 21 February 1952, Mr. A. Vang, Mr. J. van Eynsbergen and Mr. G.A. Reid visited the National Research Council to discuss Mr. Vang's inventions. The author was present at the meeting and the main subject discussed was the electrolytic production of aluminum with the use of unidirectional electric pulses. Mr. Vang claimed some remarkable advantages for his process, and, in view of the fact that aluminum production is of national importance to Canada, it was deemed advisable that the inventions should be investigated. The author was delegated to visit Mr. Vang's plant and report.

Mr. Vang stated that one of his main purposes for visiting Ottawa was to obtain confirmation from government experts that the circuit which he claimed to have developed to start and interrupt unidirectional current employing gas discharge tubes was technically sound. In the opinion of the Research Council the circuit described will undoubtedly start and interrupt current as claimed and this opinion was communicated to Mr. Reid in the following telegram:

> "I CONFIRM THAT OUR ENGINEERS EXAMINED VANG'S PULSE GENERATING CIRCUIT AND ARE SATISFIED THAT IT WILL CONTROL ELECTRIC CURRENT AS HE STATED. REGARDING THE USE OF CURRENT PULSES IN THE INDUSTRIAL APPLICATIONS HE DISCUSSED WE HAVE NOT WITNESSED THE OPERATION NOR HAVE WE REVIEWED AN INDEPENDENT SCIENTIFIC REPORT DESCRIBING THE OPERATION. WITH OUR PRESENT KNOWLEDGE WE CAN ONLY SAY THAT THE CIRCUIT IS SOUND AND WE CANNOT OFFER SCIENTIFIC SUPPORT OF VANG'S APPLICATION CLAIMS WITHOUT EXAMINING THE PROCESS IN DETAIL..."
>
> SIGNED E.W.R. STEACIE
> NATIONAL RESEARCH COUNCIL

In October 1952 Mr. Reid issued an invitation to the National Research Council to have a representative visit Vancouver to inspect Mr. Vang's equipment. At that time Mr. Vang was completing a "magnetron panel" for the Continental Can Company of Chicago. The author was delegated to proceed to Vancouver but unfortunately before the trip could be arranged the "magnetron panel" had been shipped to the purchaser. However, it was deemed that the visit would still yield more concrete evidence of the success of the various inventions than it was possible to obtain during Mr. Vang's visit to Ottawa.

The Production of Aluminum by Unidirectional Electric Current Pulses

On arrival in Vancouver the author inquired first about Mr. Vang's aluminum production process and was informed that the B.C. Aluminum Company Limited was no longer in production. However, he visited the idle plant and examined the "pots" but the

"magnetron" control panels had been removed for use in other experimental work in the laboratory. The author was informed that enough experimental evidence had been accumulated with the pilot plant to prove beyond doubt that the process was far superior to the conventional process. It was claimed that it required less electric energy per pound of aluminum produced and that from 100 to 250% more aluminum could be produced from a given "pot" by using square unidirectional electric pulses. Mr. Vang handed a report (appearing as Appendix "A") to the author and promised to forward a more complete report. This latter report has not been received.

The report appearing in Appendix "A" was discussed with the staff of the Metallurgical Department of the University of British Columbia, including Professor Armstrong, Professor Forward and Professor Samis. Professor Samis had at one time been employed by Mr. Vang in a consulting capacity and is fully familiar with Mr. Vang's work in the production of aluminum. Professor Samis expressed the opinion that Mr. Vang has no experimental evidence to support the claims appearing in the report. Mr. Vang was operating with standard pilot plant "pots" which can operate at a current of 3,000 amperes continuously. Mr. Vang's electrical conversion equipment limited the peak current to 3,000 amperes and consequently it was impossible to maintain a constant thermal balance in the "pot" when operating on short pulses which reduce the average value of the current. To realize higher current densities he reduced the size of the anodes thereby arriving at current densities somewhat higher at the anode than is common practice and his claims are based on an extrapolation assuming that he would be able to operate the same size of "pot" with the standard larger anode at the same current densities as used previously for the smaller anodes if sufficient power were available at the anode. This extrapolation is considered to be unjustified since proper operation of the "pot" depends upon its heat balance which is affected by factors other than current density, voltage being one of these factors. Professor Samis and other workers in the field have long been interested in the characteristics of the "pot" at higher current densities. Since these high densities cannot be maintained continuously, a pulse technique, such as proposed by Mr. Vang, offers the only method of obtaining high densities and still maintaining a thermal balance. For this reason Professor Samis has followed Mr. Vang's experiments closely. He expressed disappointment that Mr. Vang's installation was incapable of producing results of value because of its limited peak capacity.

The Electric Welding of Dissimilar Metals

Mr. Vang claims to hold several fundamental patents on electric welding. The author was unable to secure a complete list of his patents from him but was able to obtain a partial

list through Mr. A.H.W. Busby, Consolidated Mining and Smelting Company (Appendix "B"). A copy of this list was handed to Mr. Nichols of the Department of Mines and Technical Surveys. Mr. Vang appears to have done some very good work in this field. It is rumoured that he has lost financial control of his patents in this field in the United States where he has done most of his work. He exhibited some very convincing weld-samples (the same as those he had brought to Ottawa). Some samples to be tested in the National Research Council laboratories were requested but these have not been received.

Mr. Vang has not done any work on welding since his arrival in Canada from the United States. Since his work on square unidirectional pulses started in Canada, it appears that the sample welds shown were produced without the benefit of square unidirectional pulses of electric current.

Induction Heating of Metals

Mr. Vang claims that the use of square unidirectional current pulses offers a substantial advantage over the conventional process using vacuum tube oscillators, mainly because the conversion equipment is smaller and cheaper. The author is inclined to agree with him, although he is not in a position to assess the character of the induction heating obtained in this manner. If the method offers satisfactory penetration control, this is a field of application in which the use of square electrical pulses is likely to be successful.

The author did not see any experimental work in this field in Vancouver and he received the impression that none has been done in Canada.

Control of the Motion of Fish

Mr. Vang has supplied a pulse type electronic control panel to the Fish and Wildlife Commission, Seattle, U.S.A. In Ottawa, he had given the impression that the control of fish by electric pulses was his own idea. The author discussed the fish control problem with Professor Don Kersey of the University of British Columbia who has made a study of this problem for the International Salmon Commission. Dr. Kersey stated that the influence of electric fields or currents on the motion of fish has been known for some time. The original work was carried out in Germany and the Scandinavian countries. The fish is attracted towards the anode and the effect was observed to be more pronounced when unidirectional pulses were used. Vang's contribution to the knowledge in the field appears to be limited to the supply of the pulse equipment. He has contributed, however, to the spreading of the knowledge by giving demonstrations, one of which was for the International Salmon Commission.

The possibility of applying this method to commercial fishing is being investigated in Germany and Russia. Mr. Vang is attempting to interest companies in the United States and Canada in applying the same method to whaling fleet operations.

Electro-Plating and Electrolytic Refining

Mr. Vang claims that the use of square unidirectional pulses of current in electro-plating and electrolytic refining of metals in aqueous solutions has several advantages. He gave a demonstration of copper-plating of a small sample of sheet steel. The author understands that other plating samples, which are now being tested, were obtained by Mr. Nichols of the Mines and Technical Surveys Department. Among the advantages claimed for the method are: higher speed, more uniform covering, better finish, better adhesion, and less electric power consumption. Inquiring about why this should be so the author was informed that by the use of square current pulses the polarization problem was reduced. The bath could depolarize during the "off" periods. Workers in the field at the University of British Columbia were not prepared to deny this. They feel that an improvement in this respect is possible. Mr. Vang, however, has never produced conclusive evidence and it is doubtful if the reduced operating costs would outweigh the increased capital investment of the control gear. The better adhesion of the plating was attributed to the larger kinetic energy of the ions when using high current pulses. This seems unlikely as any appreciable kinetic energy would appear in the electric circuit in the form of a relatively larger inductance and this does not appear to be the case.

Mr. Vang's ideas on induction plating are fallacious.

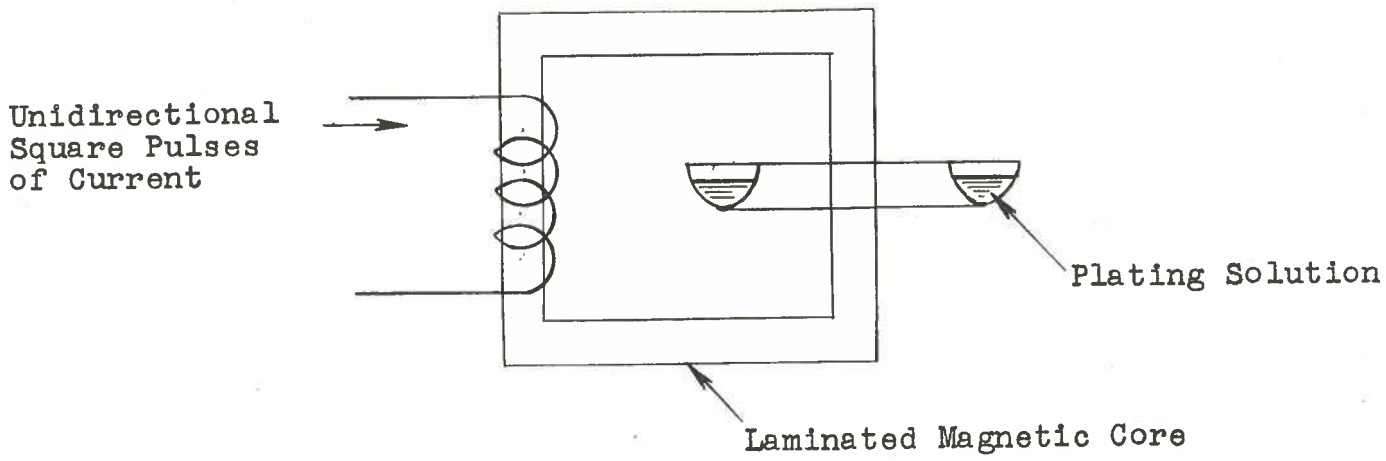

Figure 1.

The equipment employed to demonstrate this process consists of a laminated core surrounded by a primary coil and an annular electrolytic bath. The bath is separated by several radial plates which the inventor claims form cathodes on one side and anodes on the other. When unidirectional current pulses are forced through the primary coil he claims that secondary current pulses result which are also unidirectional thus producing the desired effect in the plating bath.

This is, of course, incorrect. The secondary current is alternating in character and has both positive and negative polarity. Nevertheless, Mr. Vang and Mr. Van Eynsbergen were still advocating the method, claiming that only lack of funds prevented them from exploiting the idea.

The fundamental fallacy of the principle underlying the proposed application is that a unidirectional pulse of current does not remain unidirectional in the secondary of a transformer. Mr. Van Eynsbergen was so convinced that the secondary current remained unidirectional that he undertook to support his argument by displaying the secondary wave shape on a cathode ray oscillograph when unidirectional pulses were applied to the primary. The secondary of the transformer was loaded by a resistance. It was pointed out to him that average currents are very difficult to assess on such a cathode ray display but he remained unconvinced. It was then proposed that a direct current ammeter be connected into the secondary circuit and if the secondary current were in fact unidirectional the meter should deflect. Mr. Van Eynsbergen selected the range of meter to be used based on the cathode ray display. The meter failed to deflect and he was still unwilling to accept this evidence and proposed to increase the secondary current by reducing the load resistance. A lower resistance was not conveniently available and it was proposed to employ instead a lower range ammeter. He was warned that unless the secondary output remained unidirectional the meter might be burned out without registering a deflection. This, in fact, occurred, but Mr. Van Eynsbergen remained unconvinced, arguing that possibly the pulses were not sufficiently square.

High Intensity Sound

Mr. Vang is very interested in the industrial application of high energy sonic and ultra-sonic waves. He has several patents in this field which are the result of work undertaken in the United States previous to his arrival in Canada. One of these patents concerns a transducer which consists of an aluminum alloy bar supported in the middle and excited electically into longitudinal vibration. Recently, Mr. Vang brought two of these tranducers to Canada from his laboratory in the United States and is presently engaged in making them operate. At the time of the author's visit he had not succeeded in doing so. The exciting equipment of these transducers is an electronic oscillator of conventional design, using hard vacuum valves. He intends to replace this oscillator with square wave pulses which he believes will allow him to reach higher energy levels. He also expects to obtain higher efficiencies.

The industrial applications he mentioned are varied and numerous:

1. The pulverization of suspended particles in water. He claims to have used this method to produce particles so small they would stay in suspension for years. He did not recall the nature of these particles. Possible application fields mentioned were: disintegration of wood for the pulp and paper industry, granulation of graphite and the preparation of silver salts for the photographic industry.

2. Filtration by standing waves. Particles in suspension can be collected at the nodes of the standing waves. He claims to have performed the following experiment. A bottle of black ink is poured into a tank of water. The ink spreads through the whole tank. When standing waves are produced by proper turning of his transducer in the tank all the ink collects at the nodes and the rest of the water becomes clear. A slight detuning will immediately disperse the ink evenly throughout the whole tank.

3. Improving electro-plating with the aid of standing waves. He was not very clear on this point but the author understands that he hopes to achieve better results and obtain higher rates by producing higher densities close to the cathode.

4. Vibrational rolling to close dimensions.

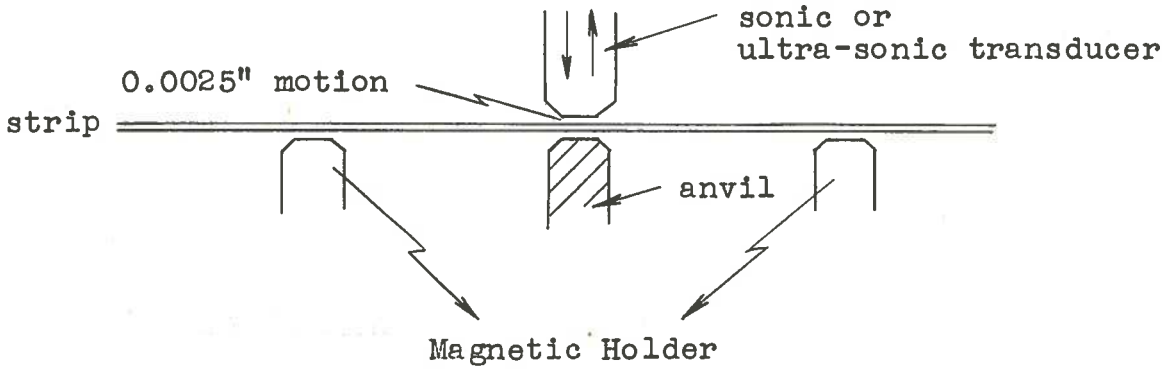

Figure 2.

The proposal, as illustrated in the sketch above, involves a kind of high frequency cold forging process. He hopes to be able to achieve extremely close tolerances which are presently impossible with conventional rolling processes.

5. Suppression of exhaust noise from internal combustion engines. Mr. Vang claims to be able to suppress the exhaust noise of internal combustion engines with the aid of standing waves. He made particular reference to the inboard engines of the "North Star" aircraft of Trans Canada Air Lines. Inquiring about the method he proposed to use, the author was given the following explanation. The normal method of suppressing exhaust noise is through the aid of a muffler. These mufflers consist of a long tube into which is connected the exhaust pipe of each cylinder. Between each exhaust outlet a baffle with a restricted opening is introduced to obtain the desired muffling effect. These baffles, however, have the disadvantage of restricting the exhaust passage thus giving rise to a back pressure which reduces the output of the engine. It is claimed that the same muffling effect, without back pressure, can be achieved by the introduction of standing waves in the exhaust manifold. The following diagram illustrates the idea.

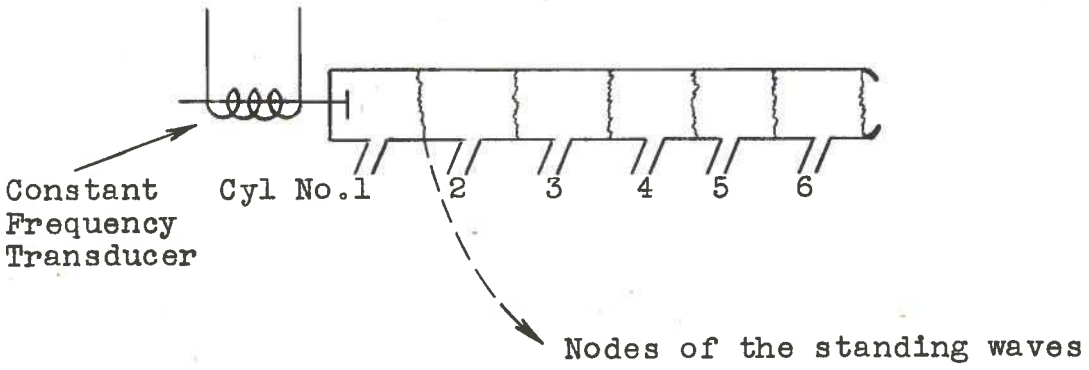

Figure 3.

This idea was discussed with Dr. George Thiessen of the Physics Division of National Research Council who expressed the opinion that it would not work.

6. Other applications of high intensity sound waves and vibrations:
--improvement of combustion by better mixing and keeping combustible particles in suspension in air.

--reduction of friction in guns by vibration of the barrel walls
--reduction of skin friction of ships by vibration of the hull
--precipitation of fog
--and so on (see attached list of patents in Appendix "B").

The Electric Hammer

The commonly used tool for drilling rock and breaking up pavement is the pneumatic hammer. Mr. Vang's first undertaking, when arriving in Canada, was the design and construction of an electrically operated hammer. Such a hammer would have many advantages and it was in the course of this development that Mr. Vang and his associates developed the circuit for starting and stopping an electric current through a gas discharge tube. The author was given a short demonstration. The hammer is powered by an engine generator set having an output rating of ten kilowatts at sixty cycles. The hammer produces 3600 blows per minute. The first working model seemed to work satisfactorily but it had not been carried through to the fully developed staged. No further development is in progress.

Notes on Visit to Consolidated Mining and Smelting

The author stopped for a short time at Trail because it was reported that Consolidated Mining and Smelting was interested in Mr. Vang's work and had followed it for some time. This was confirmed in a discussion with Mr. A.H.W. Busby who reported that Consolidated Mining and Smelting found Mr. Vang's ideas quite interesting as they covered the large field of industrial operations they are engaged in, such as electrolytic refining, electric hammer and the improvement of several processes by ultra-sonics and sonics. They felt that Mr. Vang's ideas offered a possibility of securing enough power to permit application on a commercial scale. They, however, also found that Mr. Vang's claims were mostly ideas which had not been tested thoroughly enough and that they would have to carry out extensive developmental work of their own. They felt that in order to justify such development they would have to secure control over Mr. Vang's patent rights, which are very involved and confused. Mr. R.M.B. Roome, of Consolidated Mining and Smelting, had spent considerable time investigating Mr. Vang's patents with Mr. Peter M. Boesen, 150 Maison Street, New York 7, New York, patent attorney to Mr. Vang. It was found that it would take about $250,000 to clear up Mr. Vang's commitments in Vancouver alone. This forced Consolidated Mining and Smelting

to drop the plan. Mr. Vang's comment on his dealings with them sound a little different. "They wanted to buy me out wholesale," he said, "and I refused."

CONCLUSION

Mr. Vang has been active in many fields. He has a multitude of ideas, some of which are good and some offer no promise. He appears to arrive at conclusions without presenting adequate evidence for these conclusions and he frequently fails to carry developments through to their final conclusion. He devotes more effort to the promotion of ideas than to the development of them.

The author wishes to acknowledge the co-operation of the staff of the University of British Columbia, of the B.C. Research Council, and of Consolidated Mining and Smelting Company, especially Professor F. Forward, Professor Samis, Professor Kersey and Mr. A.H.W. Busby. Gratitude should also be expressed to Mr. D.S. Smith, of the National Research Council Technical Information Service, who was kind enough to accompany the author on all visits to Mr. Vang and to supply the transportation facilities required to cover the widely spaced establishments visited.

N.L. Kusters.

COPY

Appendix "A"

Telephone Bayview 4128

B. C. A L U M I N U M C O. L T D.

1840 West First Avenue

VANCOUVER 9, B. C.

REPORT ON OPERATION OF THE B. C. ALUMINUM PILOT PLANT IN NEW WESTMINSTER.

The installation in New Westminster comprises of a large Magnaquanta Converter built in a closed central control room, an input transformer (Max. 300 KVA. -- 3000 Amps. peak load), and 2 single anode reduction cells, from which one is in steady use and the other connected up as a spare.

The converter is designed for 3 phase power input. Output: Unidirectional Magnaquanta with a repeated rate of 180 per second. This converter can control up to 5,000 KW. Peak power.

The transformer installation is the bottleneck in the momentary pilot operation. The fact that the transformer can deliver only 3000 amps peak handicaps the aim to reach large current densities per anode and therefore a larger production per cell.

To obtain an increased current density per anode we had to cut down the size of our anode to approximately 8" x 8". With these anodes densities up to 21 amp per square inch were obtained, compared with 5.5 amp per square inch in standard aluminum reduction plants. This 3 to 4 times higher current density produced with the converter showed a nicer uniform operation with a normal "pot" temperature. Any increase of the current density with D.C. current would show up in excessive heat development and finally a burning out of the cell.

The above results show a possible increase in the production of aluminum per cell of from 100 to 250%. With enough power available perhaps higher than 250% production per cell could be obtained. With the normal current efficiency this would mean from 2 to 3.5 times the normal amount of current per anode (with standard size anodes: 5,000 to 8750 amps.)

While the average transformer output is about 1500 amps, at this moment the production per pot is now about 15 lbs. per day, which could be raised to from 60 to 100 lbs. per day if a larger

transformer were installed. This would mean with a 12 anode pot 720 lbs. to 1200 lbs. per day. A potline with 40 pots could produce 14.4 to 24 tons per day. A potline of 24-anode pots would produce of course the double amount.

The production in New Westminster has also proven a very good power factor (in the potline close to 100%; with 2 transformer banks in the primary side not below 90%).

Vancouver, June 23, 1952.

(Signed) J. Van Eynsbergen
Chief Engineer.

Appendix "B"

LIST OF U.S. PATENTS HELD BY A. VANG

U.S. Patent No.	Title	Date
2,287,540	Surface Welding	June 23, 1942.
2,287,541	Discharge Tube	June 23, 1942.
2,287,542	Electric Induction Heating	June 23, 1942.
2,287,543	Welding Method and Apparatus	June 23, 1942.
2,287,544	Electric Welding of Metals and the Uniting of Dissimilar Metals	June 23, 1942.
2,344,754	Drying of Vegetables	March 21, 1944.
2,361,071	Vibration Dampening	Oct. 24, 1944.
2,366,162	Reduction of the Skin Friction of Water by Vibration	Jan. 2, 1945.
2,382,187	Apparatus for Treating Glass	Aug. 14, 1945.
2,385,043	Electric Welding	Sept. 18, 1945.
2,387,199	Gun	Oct. 16, 1945.
2,390,971	Welding Method	Dec. 11, 1945.
2,392,072	Method and Apparatus for Producing Light Bulky Soap Particles	Jan. 1, 1946.
2,393,131	Material Forming and Drawing with the aid of Vibration	Jan. 15, 1946.
2,396,216	Method for Making Air-cooled Cylinders	Mar. 5, 1946.
2,401,528	Resistance Welding	June 4, 1946.
2,420,332	Means for Constructing Air-cooled Cylinders	May 13, 1947.
2,414,494	Method and Apparatus for Carburetion	Jan. 21, 1947.
2,420,691	Evaporator	May 20, 1947.
2,414,495	Method and Means for Precipitating Fog.	Jan. 21, 1947.
2,423,858	Electric Discharge, Ultra High Frequency Generating, and Switching Tube	July 15, 1947.
2,425,767	Apparatus for Converting Electrical Condenser Discharges into Mechanical Power	Aug. 19, 1947.
2,432,051	Mercury Tube and Circuit Therefor	Dec. 2, 1947.
2,432,218	Apparatus and Method for Generating Sound	Dec. 9, 1947.
2,432,219	Self-Synchronizing Tube Discharge Control System	Dec. 9, 1947.
2,447,293	Filling of Code Slots or Notches in Embossed Printing Plates or Stencils.	Aug. 17, 1948.
2,454,900	Method and Means for Carbureting Air For Fuel Mixtures	Nov. 30, 1948.
2,473,772	Electric Stored Energy Resistance Welding System	June 21, 1949.
2,484,973	Process of Welding can Lock Seams with High-Frequency Current	Oct. 18, 1949.
2,521,955	High-Frequency Radiant Heating	Sept. 12, 1950.

Mr. Vang claims to have a patent on the starting and stopping of unidirectional currents in gas discharge tubes. He promised to forward a copy. This was never received.