

Comments by Akihiko Yamada

History of Computing in Japan



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Edited by Radomir S. Stanković

2015



Preface

Prof. Akihiko Yamada helped me in the work towards the *Reprints from Early Days of Information Sciences – On the Contributions of Akira Nakashima to Switching Theory*, in all possible ways, to find the related publications, understand the subject and comprehend the circumstance under which the work have been done, until providing the necessary copyright permissions for reprinting.

While working together, Prof. Yamada has sent me many comments and explanations about different topics. These comments were very useful and his explanations quite interesting for me. Therefore, I thought they can be interesting also for others, in particular for readers of this volume of Reprints. Thus, I decided to offer them to public notice in the form of this booklet.





7.5.2008

Design and Test in Japan, Guest Editor Akihiko Yamada,
IEEE Design & Test, October 1985, 15-16.



Akihiko Yamada is chief engineer at the EDP Systems Engineering Division of NEC Corporation, and is in charge of the planning and development of CAE/CAD systems. Previously, he was the manager of the CAD Engineering Department in NEC's Computer Engineering Division.

Yamada is currently the International Editor/Far East for *D&T*. He arranged the first translation of an original Japanese article for the magazine's November 1984 issue. He was an invited speaker on DA in Japan at the 19th IEEE/ACM Design Automation Conference, and at the 1984 IEEE International Test Conference plenary session on gate array testing. Yamada was an IEEE/IFIP CHDL '85 program committee member, and was the chairman of the DA Working Group of the Information Processing Society of Japan (IPSI) for three years, until March 1984.

He received his BS degree in 1959 and his PhD in engineering in 1980, both from Osaka University, Osaka, Japan. He is a member of IEEE, IEEE-CS, the Institute of Electronics and Communication Engineers of Japan, and IPSJ.

IEEE DESIGN & TEST



9.5.2008

I got the information about the residence where Akira Nakashima lived in from the daughter of late Yasujiro Shimazu. Yesterday I visited there but I couldn't get any information about his family.

Shimazu had been the boss of Nakashima when he worked with NEC. He wrote his condolence message to late Nakashima in the IEICE journal.

Today I went to the IEICE office and explained the current situation. They recognized the search for Nakashima's family is very difficult. They decided the IEICE copyright committee will meet next week and will discuss if they could give you the permission to reprint without Nakashima's family's consent. They will reach the conclusion within next week. Would you please wait to fill the form of author's consent until they tell us their conclusion.

The first paper in your list "The theory of equivalent transformation of simple partial paths in the relay circuit", *Nippon Electrical Communication Engineering*, No. 9, February 1938, 32-39, is shown as authored by Akira Nakashima only but this is coauthored by Akira Nakasima and Masao Hanzawa.

([31] in your "Publications in the First Twenty Years of Switching Theory and Logic Design" August 2001 is correct.) I told it to the IEICE people today. They will correct it.

I'll attach a copy of the page of "Contributors to this Issue" in No.9, February 1938 (Paper 1 in your list), for your reference. You will find pictures of Nakashima and Hanzawa.

I'm wondering if it would be possible for you to include the following three papers also in your plan to reprint Nakashima-Hanzaw's papers:

a) Nakashima, A., "The Theory of Relay Circuit Composition", *Nippon Electrical Communication Engineering*, No. 3, May 1936, 197-226.

b) Nakashima, A., "Some Properties of the Group of Simple Partial Paths in the Relay Circuit", *Nippon Electrical Communication Engineering*, No. 5, March 1937, 70-71.

c) Nakajima, A., Hanzawa, M., "Expansion theorem and design of two terminal relay networks (Part II)", *Nippon Electrical Communication Engineering*, No. 24, October 1941, 53-57.

a) is Nakashima's first paper on switching theory in the *Nippon Electrical Communication Engineering*. I think this paper is a very important one as this is the first one of his series of papers and the ideas of De Morgan's theorem and dual function are included.

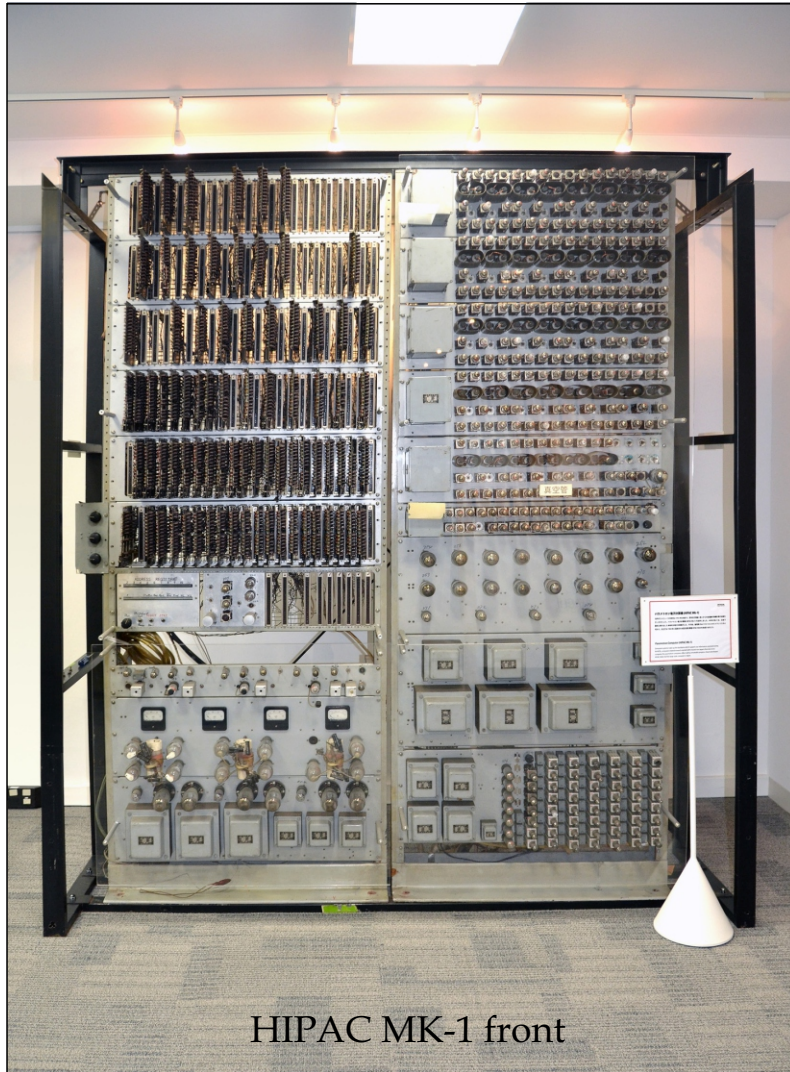
This is included as [30] in your "Publications in the First Twenty Years of Switching Theory and Logic Design" August 2001. This paper is based on his invited speech for three hours at the lecture meeting sponsored by the *Institute of Telegraph and Telephone Society of Japan* on September 19, 1935.

b) is the summary of the detail discussion or the extension of the dual function in the paper a).

c) is the second part of "Expansion theorem and design of two terminal relay networks." The first part is already included in your reprint list as the paper 6.

It would be very nice if all nine Nakashima-Hanzawa papers in *Nippon Electrical Communication Engineering* will be reprinted. I would appreciate it very much if you kindly consider adding these three papers to your plan to reprint.

By the way Akira Nakashima was born in 1908. Therefore this is the 100th anniversary of his birth! Your reprint project will be the best celebration of it.



HIPAC MK-1 front

Photo courtesy of the Information Processing Society of Japan (IPSJ)



NEAC-1101 front

Photo courtesy of the Information Processing Society of Japan

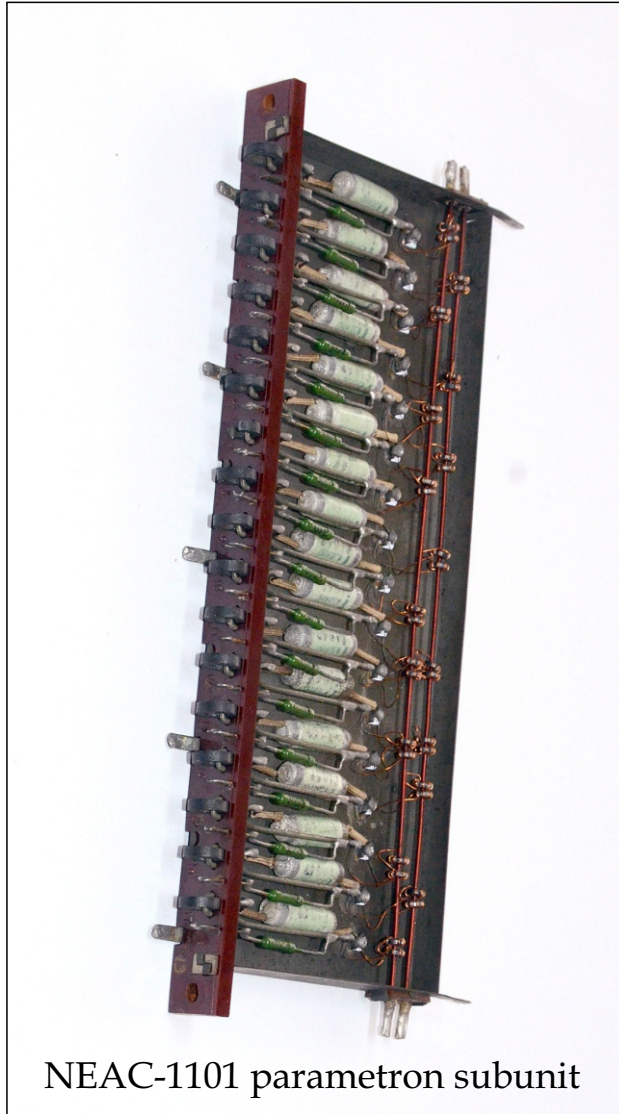


Photo courtesy of the Information Processing Society of Japan



NEAC-1101 rear and paper- tape-reader printer
Photo courtesy of the Information Processing Society of Japan

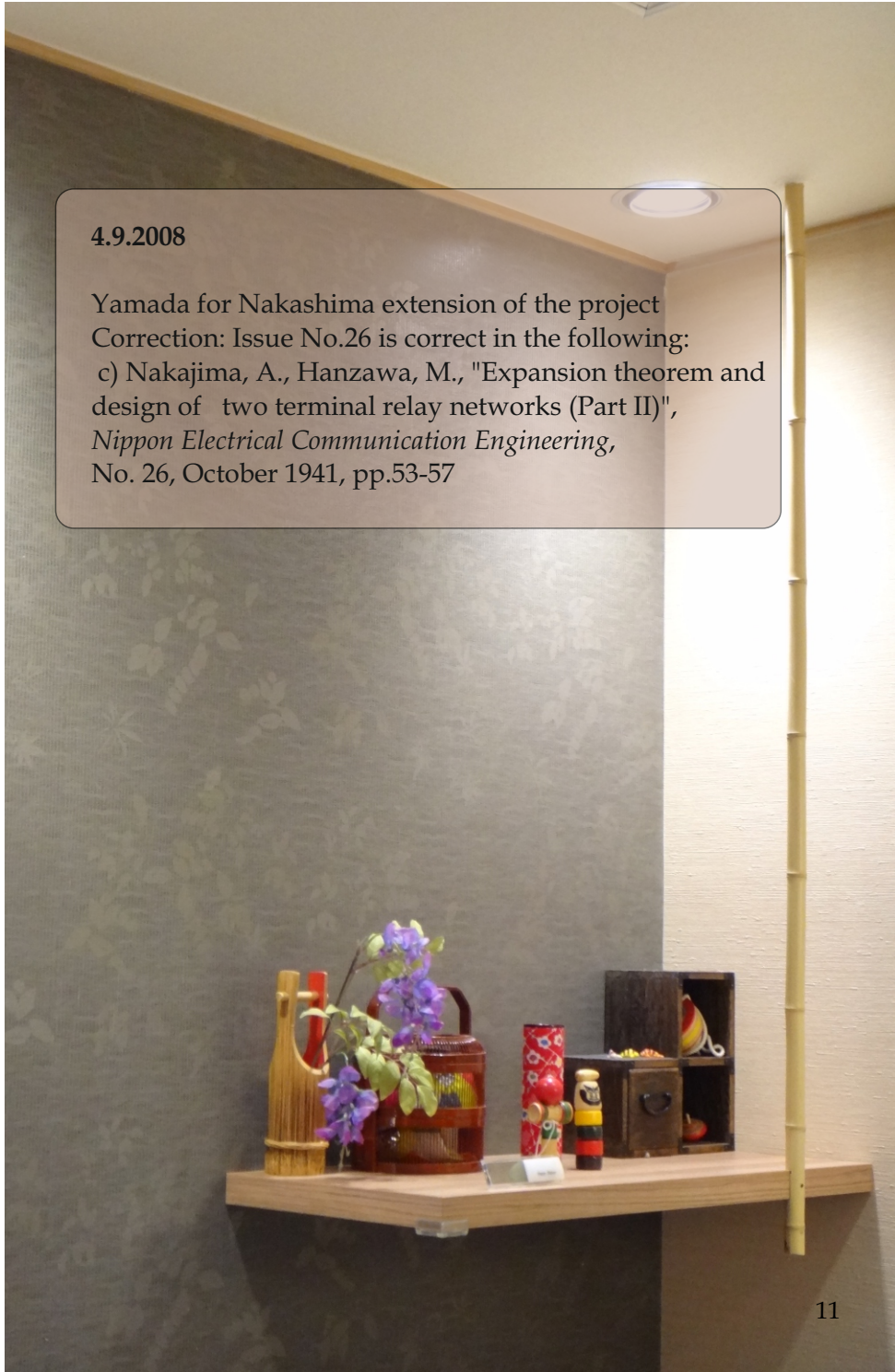


4.9.2008

Yamada for Nakashima extension of the project

Correction: Issue No.26 is correct in the following:

c) Nakajima, A., Hanzawa, M., "Expansion theorem and design of two terminal relay networks (Part II)", *Nippon Electrical Communication Engineering*, No. 26, October 1941, pp.53-57





23.9.2008

The last paper of Akira Nakashima is Paper No. 14 in your list:
14. Nakajima, A., "Theory of relay circuit", *Journal of the Institute of Electrical Communication Engineers of Japan*, No. 220, July 1941, 397-406.
No English translation of this paper.
I added the month and page numbers.

This is the speech delivered by Akira Nakashima at the general assembly of the IECEJ on 26th April 1941. It covers his major research results.

Nakashima's following article was published in March 1941. This is a kind of short tutorial.

Nakajima, A., "Theory of relay circuit", *Journal of the Institute of Electrical Communication Engineers of Japan*, No. 220, March 1941, 9-12
No English translation of this paper.

Maybe the last publication of Nakashima is the following:
Nakashima, A., "Reminiscences of the Switching Network Theory", *Journal of the Institute of Electronic Communication Engineers of Japan*, December 1970, 1658-1661.

This is a history of Nakashima's research on switching theory. It includes the brief description about his visit to Bell Labs and the meeting with Claude Shannon at AIEE Winter Convention.

He passed away on the 29th October 1970. Therefore this article was published after his death.

The condolence on Nakashima's death was written by Zen-iti Kiyasu, Kan-ichi Oohashi and Yasujiro Shimazu and was published in the *IECE* March 1971 issue.





26.9.2008

I received the attached copy of the cover of Nippon Electric (NEC Technical Journal) from a friend of mine in NEC.

The formal name of the journal in English is "Nichiden Geppo" as shown in it. The original Japanese name is "日電月報".

Please excuse me if these Chinese characters are not shown correctly.

"Nichiden Geppo" is the Romanized (alphabetic) expression of "日電月報". "日電" is the abbreviation of "日本電気 (Nippon Denki)". "Denki" means "electric" in English. "月報" means "a monthly journal". Therefore "Nichiden Geppo (Nippon Electric)" or "Nichiden Geppo (Nippon Electric monthly journal)" would be an appropriate expression in English.

Just "Nippon Electric" might also be all right as "Nippon Electric" is shown in the heading of each page but it might be a bit confusing as Institute of Telegraph and Telephone Engineers of Japan uses the name "Nippon Electrical Communication Engineering" for their journal.

The attached copy is the first three pages of *Nichiden Geppo*, Vol. 12, No. 11. You will find the first page of Akira Nakchima's paper "継電器回路工学の理論と実際" (其の五) in them. If we translate this title into English, it will be "Theory and practice of relay circuit engineering (Number five)". (The English title is not shown in the original Japanese paper.) You may already know but this series consists of the following seven papers:

- Number 1: Vol. 11, No.11, 1-7 (Nov. 1934)
- Number 2: Vol. 12, No.1, 9-23 (Jan. 1935)
- Number 3: Vol. 12, No.2, 8-22 (Feb. 1935)
- Number 4: Vol. 12, No.3, 18-26 (Mar. 1935)
- Number 5: Vol. 12, No.4, 1-13 (Apr. 1935)
- Number 6: Vol. 12, No.5, 1-12 (May 1935)
- Number 7: Vol. 12, No.9, 1-10 (Sep. 1935)

There is another paper by Nakashima in *Nichiden Geppo*: "Transient phenomena during releasing operation of a relay with two parallel coils" , "*Nichiden Geppo (Nippon Electric)*, Vol. 12, No. 4, pp.14-18 (Apr. 1935)

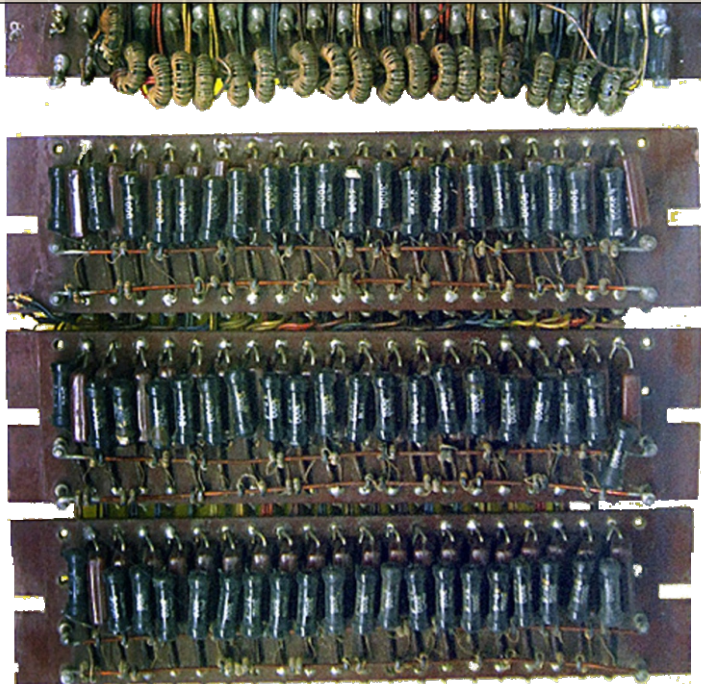
This is the addendum to the above Number 3 published in February 1935. I hadn't included this paper in my list of Nakashima's papers.

The above information might be bit confusing but I hope it will help your understanding a little bit.

15.11.2008

1. Shigetoshi Okada, "Question and Comments about 'The Law of Development of Impedance Functions and Theory of Designing Two-Terminal Networks in the Relay Circuit by Akira Nakashima and Masao Hanzawa' ", *Journal of the Institute of Electrical Communication Engineers of Japan*, Nov. 1941, pp.662-665 (in Japanese)

2. Akira Nakashima and Masao Hanzawa, "The Answer to the above Question and Comments", *Journal of the Institute of Electrical Communication Engineers of Japan*, Nov. 1941, 665-666 (in Japanese).





17.11.2008

Last week I was visiting Sendai in Tohoku region to attend the ceremony of the 50th anniversary of SENAC-1 (NEAC-1102) parametron computer at Tohoku University and to do my research on history of computing. SENAC-1 was jointly developed by Tohoku University and NEC. This is the first NEC's computer product and is kept at NEC plant in Fuchu, Tokyo.
Dr. Hitoshi Watanabe designed the logic circuits of this system.

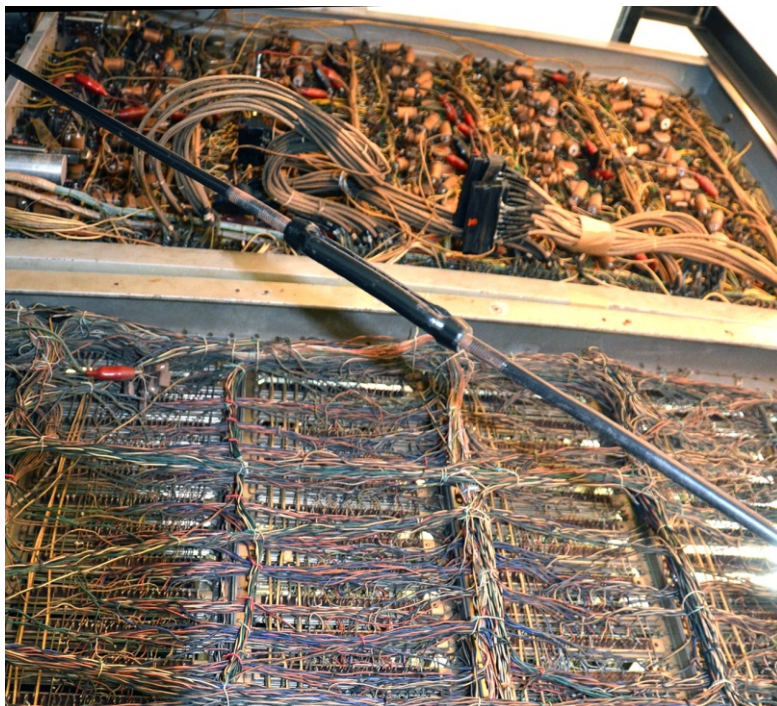
In 1958 PC-1 parametron computer of University of Tokyo, NEC's NEAC-1101 parametron computer, SENAC-1 (NEAC-1102), NEC's NEAC-2201 transistor computer and Hitachi's HIPAC-101 parametron computer were developed in Japan.

It was a very exciting year. NEAC-2201 and HIPAC-101 were demonstrated at Automath in Paris in 1959.

I did read your mail in Sendai but couldn't answer as I didn't have materials with me.

The discussion between S. Okada and A. Nakashima/M.Hanzawa is very interesting. S. Okada is suggesting to adopt impedance zero (close contact) as the basic element (corresponding to logical one) rather than impedance ∞ (open contact). Okada thinks this will be easier to understand for most people in general.

This means a serial circuit uses AND expression and a parallel circuit uses OR expression. Okada also mentions H. Piesch uses this system. (You will see the name of Piesch in the first page of his paper.) The answer of Nakashima and Hanzawa is that to adopt impedance ∞ (open contact) is natural way and the expressions of impedance of transmission lines are similar to this though either system will do as they are dual from mathematical point of view. As you know C. Shannon adopted the same system as Nakashima and Hanzawa did.



The back of HIPAC MK-1

Photo courtesy of the Information Processing Society of Japan (IPSJ)

24.11.2008

Page 2:

was: a Member of IPSJ Computer Museum Subcommittee

is: a Member of IPSJ History Committee

Page 10, the second paragraph:

was: the paper by Prof. Yamada (reference [?])

is: the paper by Prof. Yamada (reference [22])

Page 18, Reference [3]:

was: Electric Soc. of Japan

is: Journal of the Institute of Electrical Engineers of Japan

The reference [21] seems to be incomplete. May be it is the English abstract of my Japanese paper. As I'm in Sapporo, Hokkaido to attend the IEEE Asian Test Symposium, I'll check it as soon as I return home this Thursday.

It might be kind for readers to add a short explanation about the spelling of Nakashima's name. Three kinds of spelling, Nakashima, Nakasima and Nakajima appear in his English papers. Two kind of Chinese characters, 中嶋 and 中島 appear in his Japanese. Readers may confuse to see these.



3.12.2008

I have two more materials I happened to find. One is a very brief report of Nakashima's lecture meeting in the Institute Column of the JITTEJ October 1935 issue, page 33(341).

The translated version is as follows:

Academic Lecture Meeting

September 19 at Big Hall of Denki-Kurabu in Yuraku-cho, Kojimachi-ku.

The lecture meeting (the seventh in 1935) was held.

289 people including 93 members and 113 associate members attended it.

Title: The Theory of Relay Circuit Composition

Speaker: Akira Nakashima, Nippon Electric Company

In the same issue a sheet of an announcement of the sale of English journal Nippon Electrical Communication Number 1 is inserted. It says the price of a copy is one-yen (fifty-sent for members).



7.12.2008

Yesterday I got the permission to use page 74 of the book "50 years of Ando Electric" and the photo of Akira Nakashima in it for your Reprint from Hajime Nakajima of Yokogawa Electric Corporation. I also sent a mail to Nomizu of NEC asking to obtain the permission for you to use the photo of Akira Nakajima in a chair from the publicity department of NEC.

"昭和40年" in the upper left corner of page 74 of the Ando book shows the year of 40 in Showa era. It corresponds to the year of 1965.

The title is "Resolution to become a world's leading instrument manufacturer".

The subtitle is "Depression in the year of Showa 40 (1965)"

The economic depression started in October 1964 in Japan. In November, in the midst of depression, Akira Nakajima was appointed president of Ando Electric. In the New Year message in January 1965 he told all employees as follows and encouraged them:

"We private companies have to earn by ourselves to survive. We shouldn't rely on others. If we are not cautious, we will fall and have to disappear.

Be ambitious to become a world's leading instruments manufacturer!"

Nakajima promoted education for managers and sped up the development of digital instrument systems. In 1966 they started to develop IC testers.

(Comments written by Prof. Akihiko Yamada, who provided the reprinted page by courtesy of Mr. Hajime Nakajima, General Affairs Department Manager, Yokogawa Electric Corporation which includes former Ando Electric.)

Yesterday I met Hajime Nakajima, General Affairs Department Manager, Yokogawa Electric Corporation. He lent me a book "Fifty years of Ando Electric Co.,Ltd" published in September 1983. I scanned the page 74 which includes Nakashima's photo and his New Year message in 1965.
He was appointed president in November 1964.

I scanned the picture part in higher density.
I attach the scanned data, a retouched data and a page with the retouched data.

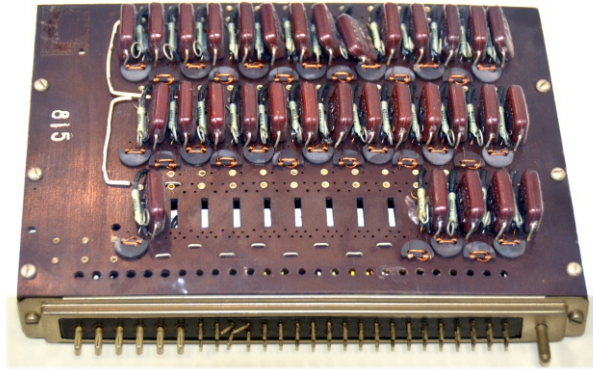
I also received another photo of Nakashima yesterday from Nobuyoshi Nomizu of NEC who worked with me when I was with NEC. He has been helping me to get the permission of

NEC related material from NEC.
I hear NEC got this photo from Ando Electric before.

This page shows the New Year message in January 1965 he told all employees as follows and encouraged them:
"We private companies have to earn by ourselves to survive. We shouldn't rely on others. If we are not cautious, we will fall and have to disappear. Be ambitious to become a world's leading instruments manufacturer!"

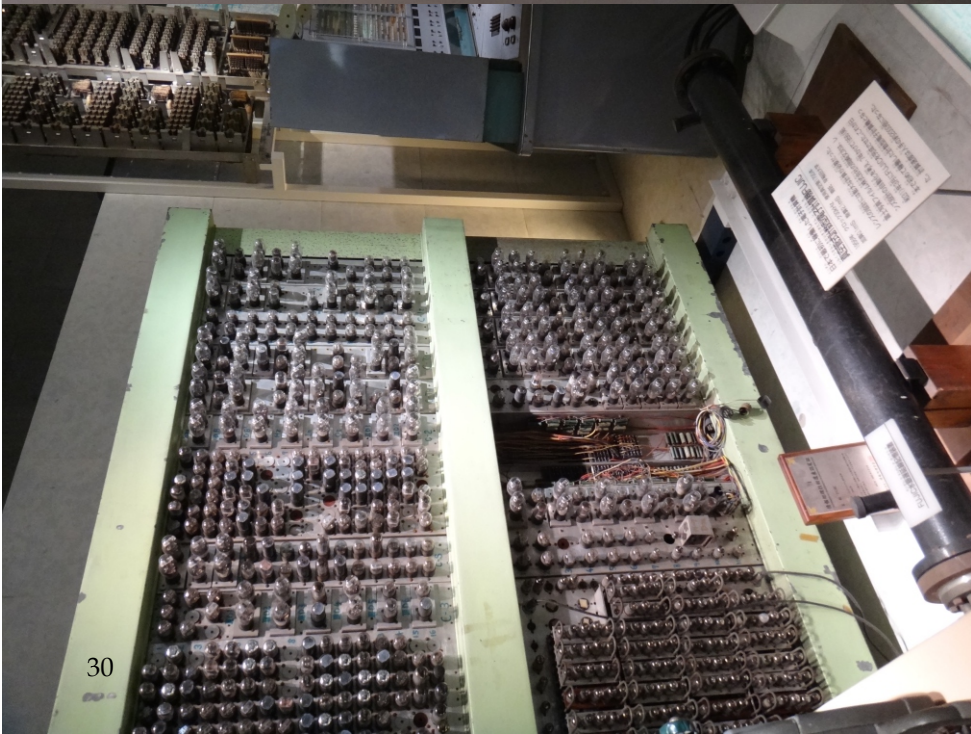
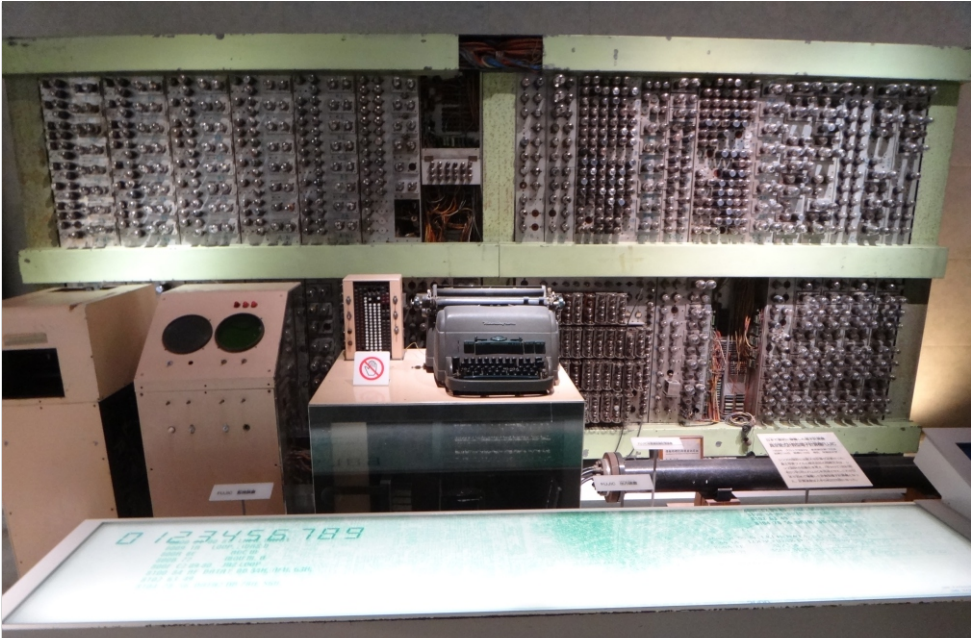
Nakajima promoted education for managers and sped up the development of digital instrument systems. In 1966 they started to develop IC testers.

(Comments written by Prof. Akihiko Yamada, who provided the reprinted page by courtesy of Mr. Hajime Nakajima, General Affairs Department Manager, Yokogawa Electric Corporation which includes former Ando Electric.)



A board of arithmetic unit for HIPAC MK-1

Photo courtesy of the Information Processing Society of Japan (IPSJ)



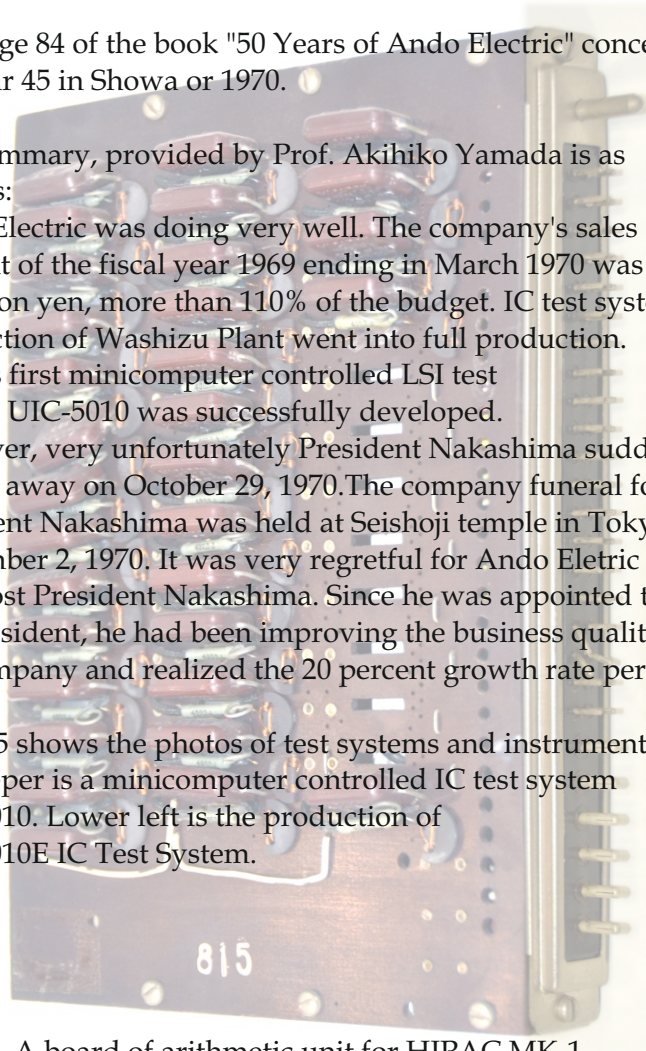
19.1.2009

The page 84 of the book "50 Years of Ando Electric" concerning the year 45 in Showa or 1970.

The summary, provided by Prof. Akihiko Yamada is as follows:

Ando Electric was doing very well. The company's sales amount of the fiscal year 1969 ending in March 1970 was 34 billion yen, more than 110% of the budget. IC test system production of Washizu Plant went into full production. Ando's first minicomputer controlled LSI test system UIC-5010 was successfully developed. However, very unfortunately President Nakashima suddenly passed away on October 29, 1970. The company funeral for President Nakashima was held at Seishoji temple in Tokyo on November 2, 1970. It was very regretful for Ando Electric to have lost President Nakashima. Since he was appointed to the president, he had been improving the business quality of the company and realized the 20 percent growth rate per year.

Page 85 shows the photos of test systems and instruments. The upper is a minicomputer controlled IC test system UIC-5010. Lower left is the production of UIC-4010E IC Test System.



A board of arithmetic unit for HIPAC MK-1
Photo courtesy of the Information Processing Society of Japan (IPSJ)



4.2.2009

For your information I write the name of paper in both English and Japanese. You don't need to write the Japanese title but you can add it if you like. This paper is included in the IEICE DVD database. (The English version is not included.)

Akira Nakashima, "The Theory of Relay Circuit Composition"
J.I.T.T.E. No. 150, Sept. 1935 pp. 731-752

中島 章：継電器回路の構成理論，電子電話学会雑誌，
第150号昭和10年9月1935年)，731-752.

For this paper 島, not 嶋, is used. This is really confusing.

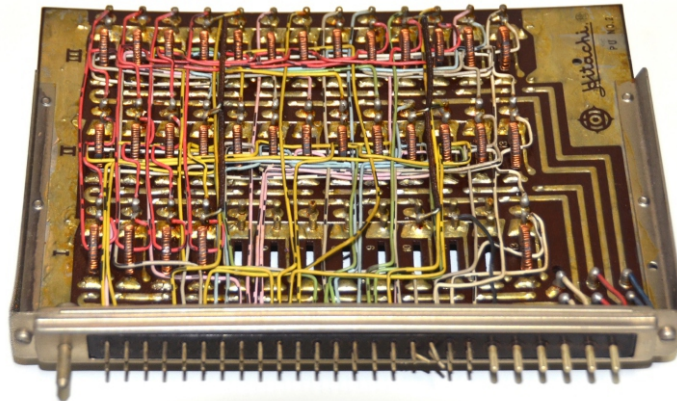
Thank you for remembering the word Kenkyukai. This time I made a brief report on the NPL Pilot Ace.

I just started to study it. As you know, it was originally designed by Alan Turing. Harry Huskey, who had joined the ENIAC project, joined the NPL Pilot Ace group during his sabbatical. After returning to the US, he designed SWAC and Bendix G-15. He adopted delay line registers for Bendix G-15 similar to Pilot Ace and realized a very high performance small computer.

When Dr. Mamoru Hosaka of Japan National Railway developed the first seat reservation system MARS-1, he introduced Bendix G-15 to his laboratory to study. He adopted delay line registers successfully and succeeded in minimizing the number of transistors to use.

MARS-1 is the first train seat reservation system in the world. Dr. Hosaka was awarded the Computer Pioneer Award of the IEEE Computer Society for the first time from Japan in 2006. This is why I started to study about Pilot Ace.

Notice that MARS-1 uses transistors, diodes, vacuum tubes and a magnetic drum but no Parametron.



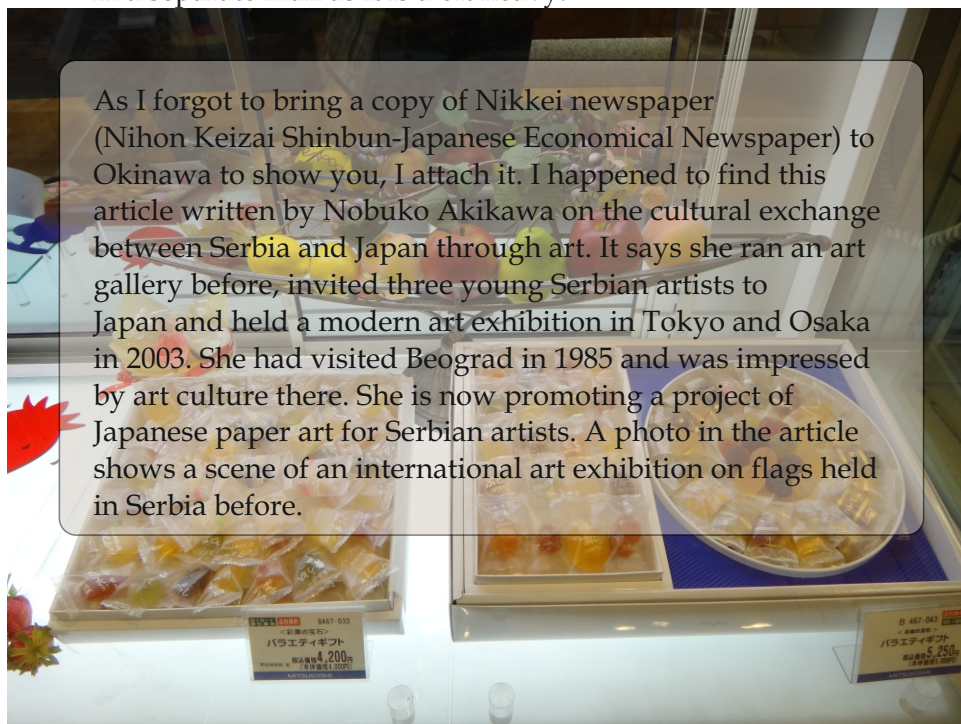
The back of a board of arithmetic unit for HIPAC MK-1

Photo courtesy of the Information Processing Society of Japan (IPSJ)

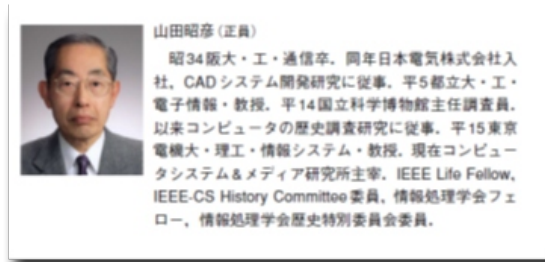
31.5.2009

Yes, Dr. Eiiti Goto, Dr. Soma whom we met in Okinawa, Dr. Eiiti Wada (Professor Emeritus of university of Tokyo) et al. worked together to build PC-1 parametron computer at Prof. Hidetosi Takahasi's Laboratory.

For your reference, I attach my report on the 50th anniversary of PC-1 and the obituary for Eiiti Goto written by Prof. Kanada. (In my report I made a mistake to spell Prof. Takahasi's name.) I'll send Prof. Takahasi's paper on early Japanese computers in a separate mail as it is a bit heavy.



The First Japanese Mechanical Calculating Machine
“Jido Soroban” (Automatic Abacus) Developed in Meiji Era
- Supported by Mori Ogai, Yazu Ryoichi Developed
a Unique Calculating Machine -
山田昭彦 Akihiko YAMADA



24.6.2009

以紀
Mochinori Goto kako mi je objasnio Akihiko Yamada





26.6.2009

You also kindly mentioned the name of Yasujiro Niwa in your lecture on switching theory. Maybe you have already known but Niwa joined Electrotechnical Laboratory in 1916 after graduating from the University of Tokyo. He moved to NEC in 1924 and served as chief engineer. He invented the first FAX machine in Japan. The machine was successfully used at the coronation ceremony of Emperor Showa, Hirohito, in Kyoto in 1928 by Osaka Mainichi Newspapers to transmit photos from Kyoto to Tokyo. The machine is preserved at National Science Museum, Tokyo.

In 1949 Dr Niwa became the president of Tokyo Denki University where I teach now.

Dr. Niwa's motto "In the technology breathes its creator" is also that of Tokyo Denki University now.

(http://atom.dendai.ac.jp/info_e/060421_971.html)



17.10.2010

The boss of Prof. Muroga at NTT laboratory was Dr.Kiyasu, who decided to develop a parametron computer at NTT laboratory.

Dr.Muroga researched at University of Illinois and brought back the drawings and related design materials of the Illiac I to the NTT Laboratory. He proposed to develop an Illiac I based computer. Dr. Kiyasu had decided to use parametrons as logic elements and organized a special project team to develop a computer. He himself preferred to his own architecture but finally approved to adopt Illiac I architecture for their computer.

Dr. Muroga was in charge of logic design. The machine was completed on March 1957 and was named MUSASINO-1 by Dr. Kiyasu. Musasino is the place name where the laboratory was located. MUSASINO-1 is the first parametron computer in Japan and also in the world. This is only one Illiac-based computer developed in Japan. The University of Tokyo's PC-1 parametron computer was developed by Prof. Hidetoshi Takahashi and Dr. Eiichi Goto and was completed in March 1958. By the way, I wrote an article on Jido Soroban (Automatic abacus) for October issue of IEICE Fundamental Review. I'll attach it for your reference though it's completely in Japanese.



22.10.1010

Thank you for reminding me of Dr. Soma. There were three major parametron research groups in Japan.

1. The University of Tokyo: Hidetoshi Takahashi, Eiichi Goto, Eiiti Wada, Takeshi Soma
2. NTT (Musashino ETL) : Zen-iti Kiyasu, Saburo Muroga, Kensuke Takashima
3. KDD: Shintaro Oshima

They jointly established Parametron Research Laboratory and promoted the research of parametron and published books.

By the way, Professor Muroga and Dr. Takashima co-authored a paper "The Parametron Digital Computer MUSASINO-1 ", in the IRE Transactions on Electronic Computers, Sept. 1959, Volume EC-8 Issue 3, 308 - 316. I'm afraid I don't have a copy of this with me now.

I also thank you for your great efforts to understand my Japanese article. I'm glad you are interested in it. I attach my English abstract on Jido Soroban in the Japanese report of National Science Museum published in March 2005 for your reference.

There is a web site written by Kadokura in English about the history of Japanese mechanical machines.

http://www.xnumber.com/xnumber/japanese_calculators.htm

Sorry, I should have sent you these information in my last mail.

Many thanks for sending the photos of a mechanical calculator you took in Tampere. I think this is an Odhner calculator, the same type of machines as the figure 4 in my article but it seems to be an older one. Odhner calculator was invented by Willgodt Theophil Odhner and was the most successful mechanical calculator. You will find a page for Odhner in the following:

http://en.wikipedia.org/wiki/Willgodt_Theophil_Odhner

There are many web sites about Odhner machine.

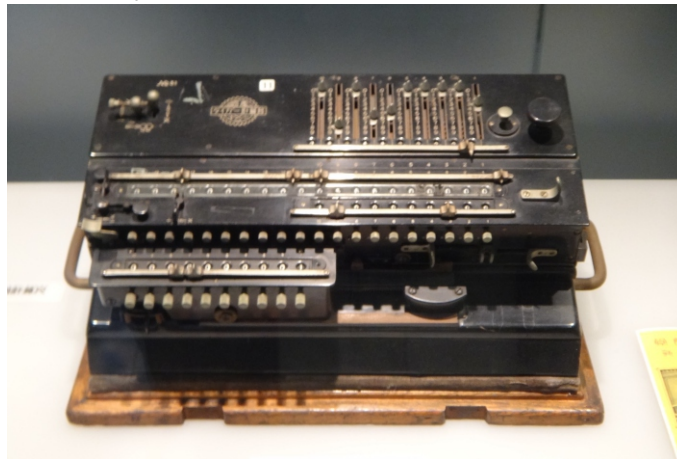


Photo by courtesy of Akihiko Yamada

29.10.2010

I'm afraid I've never seen the Prof. Goto's 1959 IRE paper on Parametron. I joined the IRE as a student member in 1958 when I was an undergraduate student at Osaka University. In April 1959 I joined NEC Corporation and became a IRE regular member. So I should have seen the both papers!? They are very nice as circuits, operations and applications of parametrons are described precisely and concretely, maybe better than those in Japanese.

There are many interesting topics about Parametron. In page 1305 of the Prof. Goto's paper, he mentions that the idea of two stable phases can be applied to digital operations can be found only in US patent of Prof. von Neumann except Prof. Goto's papers and patents. Von Neumann's proposal is very similar to Prof. Goto's Parametron invented in 1954 but was never implemented. It is said that Prof. Goto found the Prof. von Neumann's patent when he tried to get the US patent of Parametron. Both patents were applied in 1954 and published in 1957, though their inventions are completely independent.

I attach a photo of Parametron units used for PC-1 Parametron computer developed by Prof. Eiichi Goto et al. at the University of Tokyo in 1958. These are exhibited in a

glass display case at the lobby of the Koshiba Memorial Hall of the University of Tokyo. So the photo is not taken well. There are two wired units. Each unit consists of three subunits. These three subunits correspond to what they call group I, II, and III respectively.



18.2.2011

I'm sending you a illustrated catalogue "Annual Exhibition of Shoso-in Treasures". The Shosoin is the treasure house of Todaiji Temple in Nara which keeps treasures mainly made during Nara Period of between 710 and 784.

Nara National Museum exhibits selected treasures in the Shosoin every year. Last November I went to Nara to see the exhibition and was very impressed by the exhibits this time as they looked more vivid and modern than I expected.

Last December and January, My wife and I drove to Yamanashi and Shizuoka and took photos of Mt. Fuji in winter.

You will find some in the following:

<https://picasaweb.google.com/Yamada.CSAMY/MtFujiInWinter?authkey=Gv1sRgCPiWoMLWh4uWVA#>

Please click the upper left Slideshow button and hit F11 key for full screen slideshow.

Photos of the first half were taken from Suruga Bay (Pacific Ocean) in Shizuoka last month. Those of the second half were taken from lakes in Yamanashi; Lake Motosu, Lake Tanuki and Lake Yamanaka in last December.



21.3.2012

Photo of Yasujiro Niwa

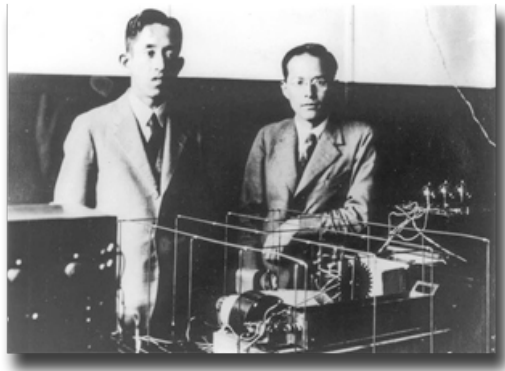


Figure 1. Yasujiro Niwa and Masatsugu Kobayashi in front of the NE-type phototelegraphic system (facsimile machine) used for picture transmission at Emperor Hirohito enthronement ceremony in 1928. (Courtesy of NEC Corporation.)

Yasujiro Niwa was the chief engineer of NEC who encouraged Akira Nakashima to continue his work in Switching theory.











