The Recording Industry in Japan

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This paper provides a brief outline of the history of the recording industry in Japan, with particular emphasis on the technical aspects. Information previously presented concerning this subject is limited, and we therefore made an attempt at reporting the history as faithfully as possible, documenting it with pictures and other data where available.

INTRODUCTION: The annual record production in Japan during 1976 reached 200 million units, while music tape production exceeded the 30 million mark. The corresponding sales volume was $690 million, and related audio product sales grew to $1841 million during 1976. The Japanese recording industry is now the second largest in the world, following the United States.

THE BEGINNING OF RECORDING AND PLAYBACK IN JAPAN

The history of the recording industry in Japan began with the introduction of an Edinburgh-made tinfoil phonograph in 1878. At that time, James Alfred Ewing, then 23 years of age was invited to come to Japan from England to accept the position of professor on the Faculty of Art at the University of Tokyo. He brought the tinfoil phonograph with him and, on November 16, 1878, tested recording and playback with the machine at the university laboratory. This was the first recording test in Japan, and it followed by only one year the first conception of a phonograph by Charles Cros of France and the successful, first public presentation of the testing of a tinfoil phonograph by Thomas Alva Edison of the United States.

Professor Ewing, following his successful laboratory test, gave a public demonstration at Tsukiji in Tokyo on March 28 the following year, 1879. According to a newspaper article published at the time, the surprised and loud voice of a journalist attending the demonstration proclaimed, "Journalists will fall into much trouble if such a machine is produced!" and this was captured and played back on Ewing's machine. This journalist's comment seems to us to have represented the feeling, at that time, of concern about the new product's relationship to the newspaper industry.

Afterwards, Ewing's phonograph was lost, to be found again 80 years later by Kei Ikeda, then Governor of the Japan Audio Society (JAS), and others. They reconstructed it and restored it to its original condition for display in the National Science Museum in Tokyo. The unit shows itself to be of British origin by the imprinted lettering, "J. Milne & Son Makers, Edinb." It has a flywheel with a handle and a simple combination of needle and diaphram used for both recording and playback. It is very similar to the model demonstrated by W. H. Preece of England (Fig. 1).

It is quite amazing that the tinfoil phonograph was introduced into Japan, a far-away country in Asia, at almost the same time as it was introduced in the United States and in England.

In 1890 Edison's improved model phonograph, class M, using a wax cylinder, was presented to our Emperor by the American Ambassador to Japan. This unit (Fig. 2) has been well preserved and is kept at the National Science Museum.

In those days, wax cylinder phonographs and wax cylinders were already being commercially sold on the U.S. market. In Japan the Horne Company, managed by F. W. Horne of the United States, and Araki Shokai, a trading company, started to import the phonographs for domestic distribution in 1896. At the same time, Sanko-do and other companies were established to record Japanese classical music, etc., on the wax cylinders and attracted much public attention.

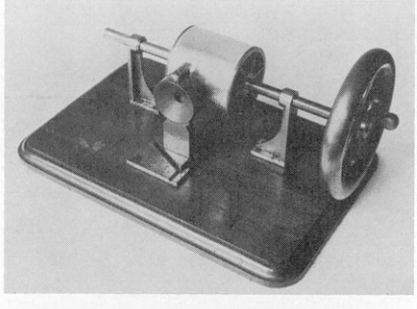
THE ADVENT OF THE DISC ERA

Emile Berliner invented the phonograph utilizing a disc record in 1887, and shortly thereafter, disc records and phonographs began to gain popularity. Fred W. Gaisberg, an engineer of The Gramophone Company of England, came to Japan in early 1903 to record Japanese music, having just completed the first recording of an Enrico Caruso in Italy the year before. In Japan Mr. Gaisberg recorded 110 10-inch discs and 166 7-inch discs which were used in Hanover, Germany, to press records of Japanese music for sale with the Angel label on the Japanese market (Fig. 3).

Following Mr. Gaisberg's example, many engineers came to Japan from both Europe and the United States, and recordings were frequently taken in Japan. The American Columbia Record Company visited Japan to record 900 discs in 1903 (Fig. 4), the German Beka Company came and made 130 disc recordings in 1906 (Fig. 5), and this was followed by 892 disc recordings taken by the Victor Talking Machine Company of the United States in 1907 (Fig. 6). All those recordings were sent back to the respective countries for the records to be pressed and the finished products were exported to Japan.

The phonographs and records of that period were appreciated by only a limited number of music lovers in Japan, as both the machines and the discs were imported and sold at high prices. The general public, nevertheless, apparently appreciated the phonographs and records as is evident from the new word that originated during this period, "hayari-uta" or "popular song." Incidentally, those old records are now regarded as extremely precious items among Japanese record collectors.

At last, in 1907 the first record manufacturing company was established in Japan. This was Nihon Chikuonki Shokai Kabushiki Kaisha (Japan Gramophone Trading Company) using the label of "Nipponophone." This company later developed into the present Nippon Colum-



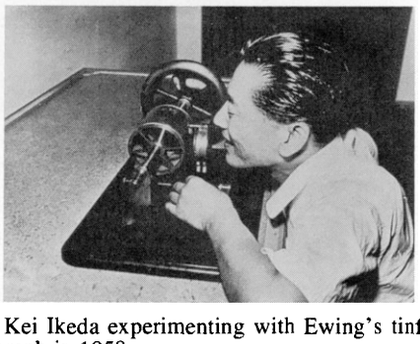


Fig. 1. Kei Ikeda experimenting with Ewing's tinfoil cylinder phonograph in 1958.

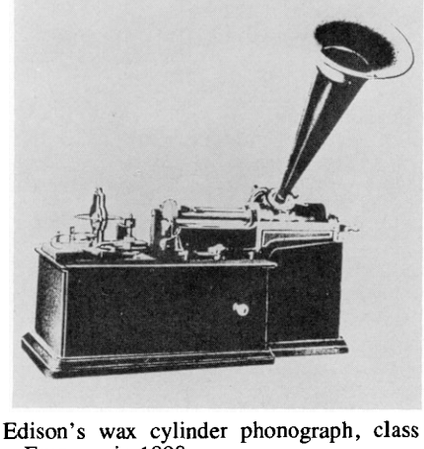


Fig. 2. Edison's wax cylinder phonograph, class M, presented to the Emperor in 1890.

Fig. 3. 7- and 10-inch discs with the Angel label imported from the Gramophone Company.

Fig. 4. Columbia (U.S.) record marketed in Japan.

Fig. 5. Beka-Grand (Germany) record marketed in Japan.

bia Company, Limited. Nihon Chikuonki marketed the first Japan-made phonographs and records, marking the very first step of the Japanese recording industry (Figs. 7–10).

Electrical recording began in 1925, marking a new era and the formation of many new record companies, one after another, in Japan. Japan Polydor was established in May of 1927, Victor Company of Japan in September of 1927, Teichiku Records in February of 1934, and King Record in March of 1936. With the development of these Japanese record companies, domestic production of both phonographs and records skyrocketed as the completely Japan-made products became popular. Satoru Ibaragi was the first to develop and manufacture audio components, such as transformers, phonograph pick ups, and loudspeakers, in Japan. His work extended to designing and building high-quality radio-phonograph consoles. One of his designs, an "all-wave" electric phonograph called the Delica (Fig. 11) was awarded a gold medal at the Exposition of Paris held in 1937 as a result of its highly regarded technology. Mr. Ibaragi is probably the only living Japanese inventor and developer who actually visited and met Thomas Edison at his laboratory.

Fig. 6. Victrola (U.S.) record marketed in Japan.

Fig. 7. Nipponophone produced by Nihon Chikuonki Shokai, the first Japanese record and phonograph manufacturer, established in 1907.

Fig. 8. Nipponophone no. 35 Japan-made phonograph.

Fig. 9. Nihon Chikuonki Shokai's advertisement.

Fig. 10. Home entertainment by phonograph in 1910, painted by Tsuruzo Ishii.

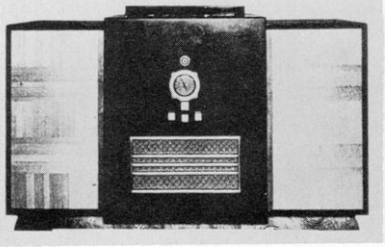


Fig. 11. The Japan-made Delica phonograph was awarded a gold medal at the Exposition of Paris in 1937.

THE INTRODUCTION OF LONG-PLAYING RECORDS IN JAPAN

The public's desire for long-playing time existed from the early days of the industry. World Records of England marketed records providing from 10 to 100 minutes of playing time, and these were designed to be played back at a constant linear tracking speed. The World Records' LPs were first marketed in 1921, followed by Nitto Records' LPs, using the same principle, in 1925 (Fig. 12). These records provided 15 minutes of recording and playback on each side, and 18 different records were sold under the Tsubame (Swallow) label (Fig. 13). Also, Edison experimented with the microgroove record, utilizing the hill and dale recording method, in 1927. This record provided 40 minutes of recording and playback time using both sides.

In 1934 an LP recording and playback system, called Filmon, was invented by Shozo Konishi, and was developed into a practical model through the efforts of Koichi Tsubota and Ginjiro Sato. An endless acetate film, 35 mm wide by 0.23 mm thick by 13.1 m long, is used in this device with the needle running along a groove at a constant linear speed of 610 mm/s. One hundred grooves are cut into the endless belt, and this provides 36 minutes of continuous recording and playback time (Fig. 14).

The Filmon machine gained a high reputation throughout Japan in those days, and the voice of Prime Minister Hiranuma of that time was said to be recorded using this machine. The Filmon recording belt production was difficult and required much labor. The process involved wrapping eight wax belts around a 4.18-m diameter vertical drum, finishing the wax surface, then laterally cutting the surface of the drum with a slowly traversing magnetic cutter head while rotating the drum at a speed of one turn in 21 seconds, corresponding to a circumferential speed of 610 mm/s. After cutting of the wax master was completed, graphite was applied followed by copper plating. This belt-making procedure is similar to disc record production, but great pains and much effort were needed due to the extremely large size of the belts (Fig. 15).

Those early trials and efforts simply could not lead to the remarkable success that the LP record industry has achieved today. The failure is readily attributable to the high noise levels and the limited dynamic range as a result of the poor-quality plating and raw material of those days

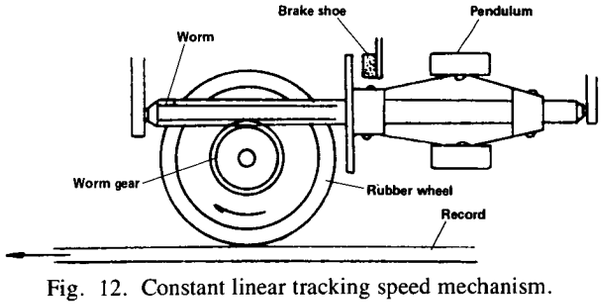
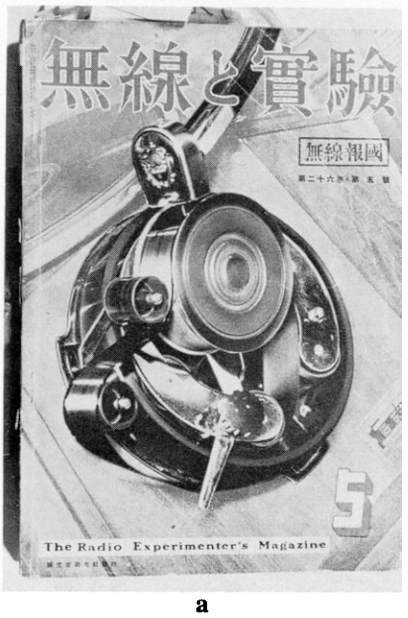
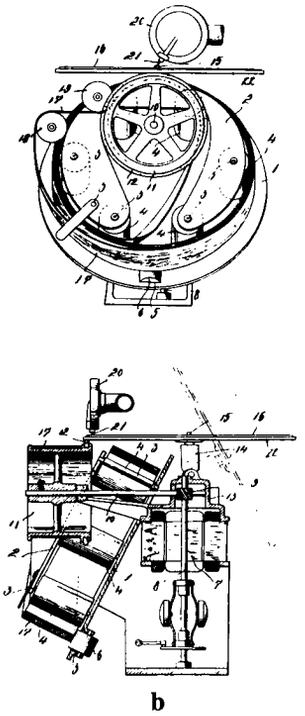


Fig. 12. Constant linear tracking speed mechanism.

Fig. 13. Nitto Records' LP with Tsubame (Swallow) label in 1925.



a



b

Fig. 14. **a**. Filmon's 1934 machine. **b**. Details of recording and playback system by S. Konishi.

used for record production. Long-playing time was the only merit of the machines and processes of that era.

The Japanese recording industry, which had been severely damaged during World War II, was tremendously inspired by the LP record development by Columbia and the 7-inch, 45 r/min disc release by RCA, both of the United States. The first marketing of LP records in Japan was initiated by Nippon Columbia in 1951 which imported disc masters to press LP records in Japan for domestic distribution. Later, in 1953, Denon went ahead with the manufacture of a large-size cutting lathe for 33⅓-r/min records which represented a first in the history of records in Japan (Fig. 16).

The Victor Company of Japan, Limited, made its first LP record by cutting with the above-mentioned lathe and marketed the records in the same year, 1953. Then in 1954, Japan-made EP (extended play) records started to sell, and the traditional 78-r/min records were gradually replaced by the LP and EP records. This new period was called the "hi-fi" age during which new and different audio techniques were developed in rapid succession, one after the other, and in this way the record industry grew remarkably with the support of music lovers.

THE AGE OF STEREO RECORDS

In 1958 the Victor Company of Japan began to market the 45/45 stereo records, being the first in Japan to follow the established trend in the United States. Other Japanese record companies also soon entered the stereo record market to generate, along with the Victor Company of Japan, a so-called stereo record boom. The new word "stereo boom" was popularized due to the explosive stereo record sales increases every year at that time in Japan. In order to improve the sound quality of stereo records, new cutting and plating techniques were developed along with vast improvements in pressing machines and in the chemical compounds used for the raw material of the disc itself.

The first Japanese industrial standard (JIS) for stereo records was issued in 1967, with the agreement of the Japan Phonograph Record Association, to clarify and to provide minimum standards for stereo record quality and characteristics. However, there was severe competition among the various companies to provide better quality recording. In 1963 the Victor Company of Japan adopted RCA's Dynagroove technology in order to reduce tracking distortion. Toshiba-EMI Ltd. developed and employed the pinchless tracking simulator (PTS) system in 1968, and Nippon Columbia Company, Ltd., adopted a nondistortion cutting system designed by D. Cooper in 1970 to improve sound quality.

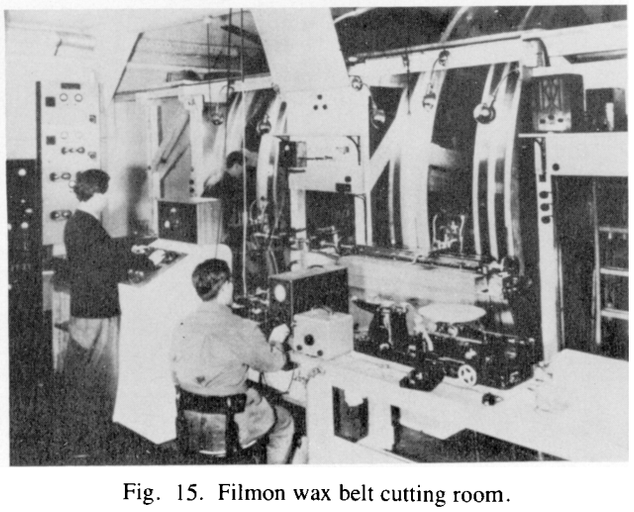


Fig. 15. Filmon wax belt cutting room.

THE LATEST RECORDING TECHNOLOGY IN JAPAN

With prevailing multitrack tape recorders, multichannel recording technology advanced greatly in the 1960s, and, as a result of the trend, audio engineers began to develop an interest in increasing the number of recording channels of records.

The Victor Company of Japan developed a three-channel record using a frequency multiplexing system between 1961 and 1965 (Fig. 17). The third channel was recorded and played back with a carrier of 24 kHz (18 kHz in the beginning) having a frequency deviation of ±4 kHz and yielding a signal having a bandwidth of 50–5000 Hz with a signal-to-noise ratio of 47 dB. At that time there were only a few pickup cartridges that enabled tracking of the three-channel records, and, consequently, this record system was not further developed to the level of practical use. However, this system contributed to the later development of the four-channel record and its practical utilization thereafter.

Since 1969, development and merchandising of quad-

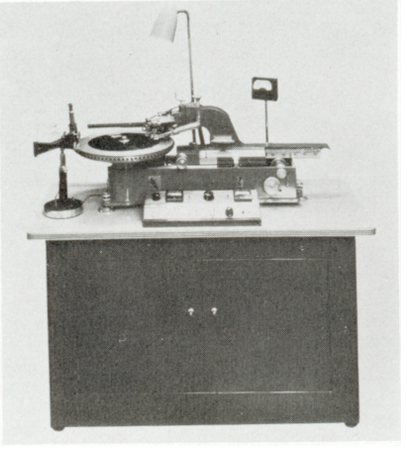


Fig. 16. Japan's first cutting lathe for LP records manufactured by Denon in 1953.

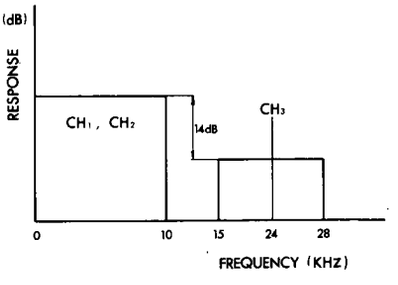


Fig. 17. Three-channel disc record developed in 1961 by the Victor Company of Japan.

raphonic recording were undertaken in both the United States and Japan, while the three-channel record was further developed into the CD-4 record system which is in practical use today.

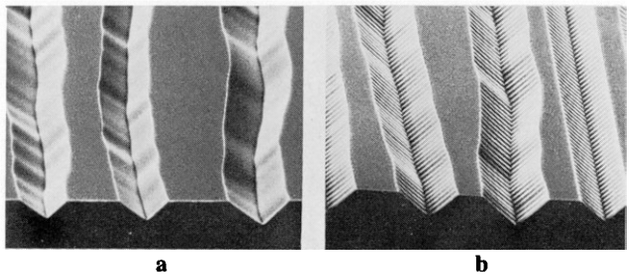
The CD-4 record was announced by the Victor Company of Japan on September 2, 1970. Its name derives from the words compatible, discrete, and four-channel. In October 1970, the CD-4 record system was demonstrated at the 39th Convention of the Audio Engineering Society, held in the United States [1]–[3].

The CD-4 is a disc into which a subcarrier signal is multiplexed during recording in the range of 20 to 45 kHz using a 30-kHz carrier (Figs. 18–20). Later, CD-4 records were adopted and improved by RCA and other companies in addition to the Victor Company of Japan. Those CD-4 technological developments contributed not only to the improvement of recorded sound but also to the overall audio technological level, including pickup cartridge characteristics [4].

The Japan Phonograph Record Association settled on a standard for CD-4 records in 1971, followed by the regular matrix and SQ matrix record standardizations made in 1972. Recently in 1976, the UD-4 record was standardized. In this way, the Association helped in promoting the quadraphonic disc record development.

With the advent of quadraphonic technology developments, high-fidelity sound field generation techniques began to be further considered in more detail, and the binaural system with ambience suddenly attracted keen interest from audio engineers.

In 1975 Matsushita Electric Industrial Company, Ltd. announced an ambience control system based on the binaural technique [5]. The Victor Company of Japan introduced a new biphonic technology which enabled generation of a sound field with ambience by reproducing the binaural signals through the loudspeakers.



a **b**

Fig. 18. Record grooves by S. E. M. **a.**stereo. **b.** CD-4 (x130).

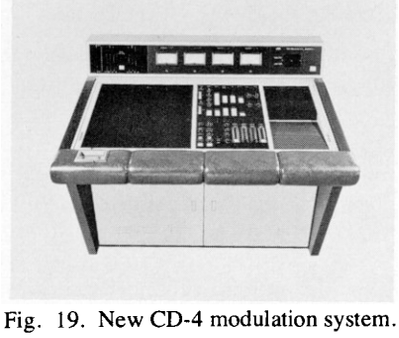


Fig. 19. New CD-4 modulation system.

The company also introduced the Quad-Biphonic system which was a combination of the binaural and quadraphonic technologies to assure stable, 360° localization and depth feeling of the sound image using the CD-4 record as a medium. A further development of the Quad-Biphonic system is expected by both engineers and music lovers.

In the latter half of the 1960s noise reduction systems were more widely used, and dynamic range extension techniques began to attract the interest of engineers. In 1972 Nippon Columbia Company, Ltd. developed a master tape recorder utilizing a pulse code modulation (PCM) technique, and the records transferred from masters using this system were marketed (Fig. 21).

In the PCM master tape recorder the audio signal is converted into pulse coding for recording by a video tape recorder, and then the recording is decoded into the original audio signal in playback. Using this new master recorder, characteristics have been greatly improved as compared with those obtained using conventional tape recorders, such as dynamic range of 87 dB, frequency response of direct current to 20 kHz $^{+0.2}_{-1.0}$ dB, and total harmonic distortion of 0.1% or less.

In the future digital technologies will also be applied to disc recording. Video disc technologies are now being developed by many organizations throughout the world. These will combine to realize a revolutionary disc

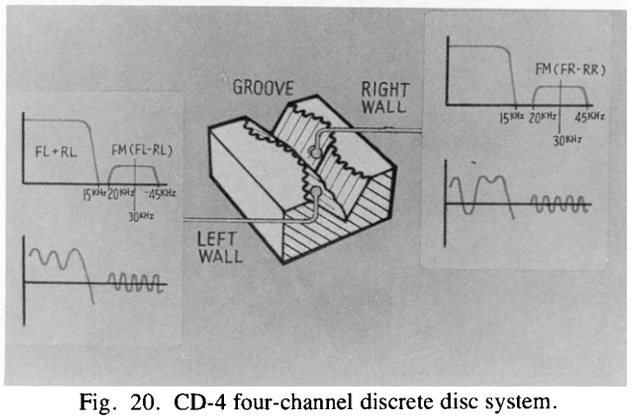


Fig. 20. CD-4 four-channel discrete disc system.

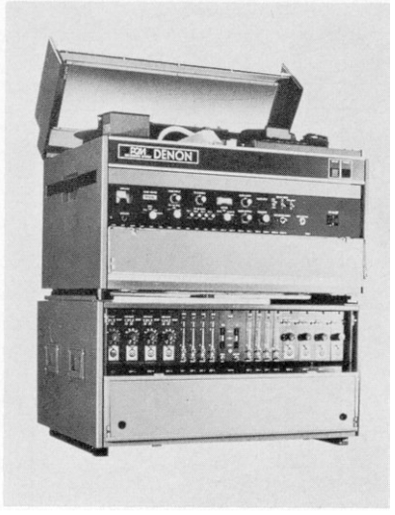


Fig. 21. Nippon Columbia's portable PCM recorder model DN-034R.

that can accommodate not only video signals but also audio signals. The dream of the ultrahigh-fidelity or ultralong-playing-time audio disc will come true, making an epoch in the recording industry.

THE PRESENT STATE OF THE JAPANESE RECORDING INDUSTRY

As indicated in the Introduction, the record and music tape production figures are showing yearly increases of from 10 to 20% in Japan. As seen in Fig. 22, 12-inch (30-cm) record production increased sharply to become comparable to the production of 7-inch records in units. Fig. 23 shows that cassette type music tapes have far outpaced cartridge types in terms of production.

The high annual sales growth of audio products is clear from Fig. 24, and the household audio product diffusion rate is now approaching the 60% level.

At present, sixteen record companies and three music tape specialist companies are the members of the Japan Phonograph Record Association. The association provides

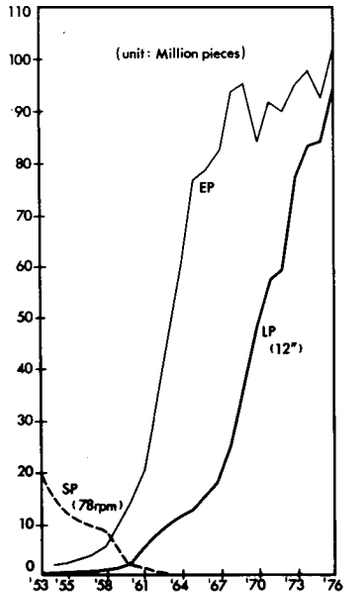


Fig. 22. Japan's disc record production.

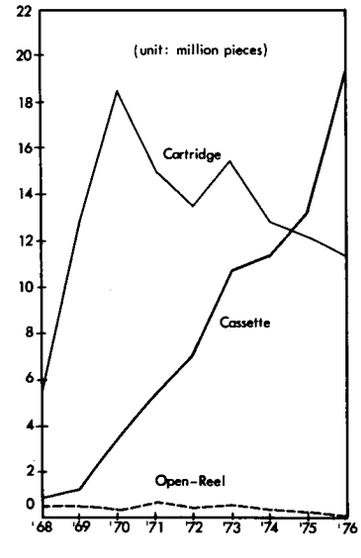


Fig. 23. Japan's music tape production.

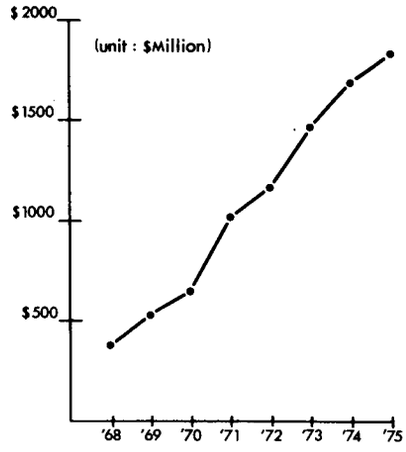


Fig. 24. Japan's stereo equipment sales.

for an engineering committee to review common technical problems among the members. Record, studio, recording, and other subcommittees are also provided for. New technology introduction, problems requiring discussion and adjustment among the members, and standardization matters are discussed in this committee. The committees are organized by engineers from the member companies of the Japan Phonograph Record Association, and they continuously work closely with and cooperate with the EIAJ, RIAA, RIEE, and IEC. The Record Association's aim is to further contribute to technology exchanges and international standardizations between the various industries and between the various nations as well.

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