RECENT NEW PRODUCTS OF THE CHINESE PRECISION MACHINE INDUSTRY
- ELECTRONIC COMPUTER, ELECTRONIC MICROSCOPE, AND OTHERS -

/Following is a translation of an unsigned article in the Japanese-language semimonthly publication of the Ajiya Tsushin Sha (Asia News Service), Chugoku Sangyo Tsushin Shashin (Photos and Features on Chinese Industry), No. 55, Tokyo, 1 November 1965./

In China at present, a great technical revolution movement is being unfolded, mobilizing all workers and technicians. This movement is "being advanced with the objectives of developing new products, applying as widely as possible new techniques and latest scientific discoveries, and step-by-step semi-mechanization, mechanization, semi-automation, and automation" (New China News Agency dispatch, 27 September 1965), and its scope extends widely from small changes in work processes to development of new materials, new equipment, new technology, and new work processes, and from changes in individual design to technical reorganization of entire plants.

In this great technical revolution movement, energy has been especially devoted for the last several years in the Chinese machine industry to development of large-sized precision machines, which had previously been nonexistent, and with the policy of quickly catching up to the world level, amidst poor technical resources they are displaying the spirit of self-salvation and are striving whole-heartedly. And, this effort is continuously blossoming and bearing fruit.

In considering precision machines, this year alone a large number of precision machines and tools which had not previously been manufactured in China have been successfully trial-manufactured and entered into quantity production, including a 24-stage medium-sized electronic computer, a large-sized electronic microscope with a magnifying power of 200,000 and a resolving power of 7 angstroms, a high-precision measuring device which can measure errors of 5/100,000 mm., a large-sized X-ray flaw detector for industrial use, a new-model supersonic thickness measurer, a transistor supersonic rail flaw detector, a mechanical process-controlled automatic carbon

measuring device which analyzes carbon content of iron and steel, a transistor nuclear propelled type magnetometer used in prospecting, a precision micro-scale which has a minimum weight sensitivity of 1/1,000,000 gram, a photoelectrically controlled automatic material mixing scale, a traction measuring instrument, a radio altimeter and radio orientation meter for aerial measurements, a high-temperature water surface meter used in observation of water surfaces and oil, an electronic clock corrector, a solar telescope, and an electromagnetic oscillation tester. As a result of inspection, these precision machines and tools have all been proved to be of good efficiency, and there are many which surpass previously imported products and are not inferior to the internationally advanced level. Also, such things as the electronic computer and electronic microscope were displayed at the Chinese Economic Construction Exhibition in Rumania (September-October 1965) and the Chinese Measuring Instruments Exhibition in Cairo (September 25 to 4 October 1965), and were favorably received. For example, Minister of Scientific Research Tourky and Minister of Education Yusif of the United Arab Republic wrote in the record of impressions, "This exhibition shows China's great advance in the field of manufacture of measuring instruments."

Below, we would like to introduce new precision machine and tool products recently reported, as reference for becoming acquainted with part of China's precision machine industry.

Electronic Computer

A 24-stage medium-sized analog electronic computer was recently successfully trial-manufactured at the Tientsin Electronic Equipment Plant (Chungkuo Hsinwen, 8 June 1965). As a result of appraisal by the related department, its principal performance conformed to standards of the original design and initiation of production as a type model was authorized. Analog electronic computers were originally a blank spot in China, but following successful trial-manufacture at the Tientsin Electronic Equipment Plant in the summer of 1963 of an analog electronic computer and in 1964 of the FM-8 analog electronic computer (the performance of this FM-8 analog electronic computer reaches the international level of the same model product and it has already entered into quantity production), a 24-stage medium-sized analog electronic computer was recently successfully trial-manufactured. This electronic computer is a multi-shelf type and consists of such calculators as adding machines, multiplying machines, squaring machines, function development machines, and changed coefficient machines, and it can calculate 24-stage linear as well as non-linear differential equations, and when operators set up the program and a switch is turned on, in from a few seconds to a few minutes solutions are obtained, making calculations which could with difficulty be completed by several tens of persons in several months. In addition to being used as a computing tool, this computer can be used for such things as control, design, and analysis related to industry and national defense.

The Tientsin Electronic Equipment Plant was formed in 1958 from a combination of about 10 handicraft cooperatives and small plants and at first could manufacture only a few electrical products such as electric irons, but the same plant, by means of ardent self-effort and self-salvation has in the last few years already successfully trial-manufactured and produced more than 30 comparatively high-grade precision products, and has played a great role in filling up blanks in the field of China's electronic measuring instruments.

Production of electronic computers in China was initiated in July 1956 by a preparatory committee of the Computation Technology Research Institute of the Chinese Academy of Sciences, and trial-manufacture was first started in the following year of 1957, and in 1958, analog and digital electronic computers were trial-manufactured at some plants, universities, and research institutes, and also, trial-manufacture and research of numerical value controlled machine tools was begun by some universities.

In 1958, Shanghai's Electromagnetic Equipment Plant successfully trial-manufactured a large-sized analog electronic computer, and also, in the same year, the first domestically-produced small-sized digital electronic computer "81 Digital Electronic Computer" was trial-manufactured. In this small-sized digital electronic computer are used 4,000 germanium diodes and 800 electronic tubes.

The automatic control section of Chinghua University (Peking) has also succeeded in trial-manufacture of a high-speed general-use digital electronic computer which can make 10,000 computations each second and an automatic search-type analog electronic computer.

Accompanying successful trial-manufacture of electronic computers seen above, their sphere of application has gradually broadened. Digital computers have been used in China for the last several years in making a large quantity of computations and solving many problems in design of various kinds of construction works, design of many complicated machines and electrical machine products, in land surveying, and in research in such things as dynamics, atomic power, physics, chemistry, astronomy, and biology.

For example, in the field of weather forecasting, electronic computers have been used widely in short-term weather numerical value forecasting since the winter of 1960. The high-speed digital electronic computer installed at the Computation Tedhnology Research Institute is used in computations for this weather forecasting. When the meteorologists operate the computer on the basis of high-altitude weather charts, results are obtained in less than an hour. On the basis of these results, the weather situation of the entire country can be obtained within 48 hours. Electronic computers are also used in forecasting trends in rainfall and temperature for each month and each year.

At the Shanghai Astronomical Observatory, since they have come to measure standard time with the electronic computer which was manufactured in 1958 by the Huatung Computation Technology Research Institute, the calculation speed has increased as compared with before, and time reports have become more accurate. Also, at present, precision measurement of standard time measured by China's time-reporting

system has an error of less tham 2/1000 second, and has reached the international advanced level.

Electronic computers are also used in the field of commodity transportation. In April 1963, an all-country nitrogenous fertilizer delivery plan was formulated on the basis of numerical values of electronic computers, and it was possible to save more than 2,600 tons of tranported amount above the plan formulated on the basis of experience.

Research into numerical value controlled machine tools controlled through use of digital electronic computers has also been advanced since 1958 at Chinghua University, and the principal efficiency of trial-manufactured products has reached a quite high level. In related departments, at the end of 1964, manufacture of product samples of a program-controlled milling machine and a program-controlled drilling machine was begun, and preparations for initiation of production are being advanced. By the appraisal in July of this year of the appraisal committee formed by 15 units of related leadership organs, research institutes, and plants, it was proved that the control system of the machine is stable and fully reliable, and that precision of model processed items fulfills design requirements.

Also, automatic control equipment, remote control measuring equipment, electronic computers, "SZ-1 figure tubes" which are an important part of computer-type measuring instruments, and iron, chrome, and aluminum electric resistance parts used in remote control and remote measurement, have recently been successfully manufactured.

The "SZ-1 figure tube" was successfully trial-manufactured at the Shanghai Electronic Tube Plant, and it shows Arabic numerals from 1 to 0, and when several of the same tubes are placed side by side, figures of 1, 10, 100... can be brought forth in the indicator portion of the computer, and it can be directly read in figures at the time of measurement. After strict examination, it was proved that the sensitivity and accuracy of this figure-showing tube are very high and that moreover its useful life is long. It has already entered into small-quantity production (New China News Agency, 12 September 1965).

Next, iron, chrome, and aluminum electronic resistance parts were successfully trial-manufactured at the Peking Steel Thread Plant, and these parts which are thin and can hardly be seen with the naked eye are used in such precision equipment as measuring instruments, medical equipment, and radio communication equipment, and accurately reflect faint motions and various wave forms which people wish to know. This precision product is at present produced in only a very few countries of the world (New China News Agency, 15 September 1965).

Electronic Microscope

At the time of the old China, even ordinary optical microscopes had to be imported, but after establishment of the new China, microscope engineering developed rapidly, and recently, they have come to be able to manufacture a large-sized high-efficiency electronic microscope with a magnifying power of 200,000 and a resolving power of

seven angstroms, which can be manufactured in only a few technically advanced countries.

This large-sized electronic microscope was successfully developed by the Shanghai Electronic Optical Research Institute, and it was designed through cooperation of Chinese scientists, technicians, and workers, and was manufactured completely using domestically-produced materials. At a recent all-country conference held in Shanghai, specialists, professors, and technicians from various cities who participated expressed great satisfaction with the completion, blueprints, and technical data of this new electronic microscope by means of severe tests.

Manufacture of an electronic microscope was initiated at the Shanghai Electronic Optical Research Institute in 1959, and in a period of three years, it became possible to manufacture an electronic microscope with a resolving power of 30 angstroms, and subsequently, after more than two years of endeavor, an electronic microscope with a resolving power of more than 20 angstroms and a magnifying power of 200,000 was manufactured, and after eight months of further endeavor, an electronic microscope with a magnifying power of 200,000 and a resolving power of seven angstroms was successfully manufactured. This electronic microscope consists of more than 10,000 parts, and new products of modern scientific fields have been introduced, such as an electronic lens, precision machinery, precision metallurgy, radio electronic engineering, ultrahigh voltage, and ultrahigh vacuum.

As was stated at the outset, at the time of the old China, even ordinary optical microscopes had to be imported, but at present, tool microscopes, metal microscopes, microscopes for medical use, microscopes for biology, and polarization microscopes are manufactured, and an infrared microscope which requires a high level of technology is also manufactured.

High-Precision Measuring Instrument

At the Dairen Barometer Company, a high-precision measuring instrument used in precision measurements of items processed by the machine industry is produced in quantity. This was designed and successfully trial-manufacured by professors and students of the Dairen Engineering College, and in conformity with air pressing upon a column of mercury, causing it to go up and down, it measures such things as precision-processed linear dimensions, surface texture, small holes, and airtightness. If a separate head or accessories are attached, it can also measure the precision of round shapes, round holes, and various forms of processed materials. With a micrometer can be measured only 1/100 mm., but this high-precision measuring instrument can measure an error of 5/100,000 mm (New China News Agency, 6 September 1965).

Large-Sized X-Ray Flaw Detector for Industrial Use

China's first domestically-produced large-sized X-ray flaw detector for industrial use was recently manufactured at the Tantung Tool Plant in Liaoning Province. This X-ray flaw detector for industrial use can detect flaws such as cracks, foreign elements, and air holes, in steel plate of a thickness of 60 mm., correctly determining their location and size. The quality situation inside of magnesium, aluminum, and other light metals as well as plastics, rubber, and other non-metallic materials, can be clearly inspected with this machine.

Heretofore, the greater part of China's flaw detectors for industrial use have been imported. During the last few years, China has begun production of several X-ray flaw detectors for industrial use, but the number of models was small, their penetration capability relatively low, their continuous period of use short, and they could not fulfill production requirements.

This X-ray flaw detector for industrial use which was recently successfully trial-manufactured has high voltage, large electric current, the depth of penetration is three times greater than X-ray flaw detectors previously produced domestically for industrial use, and since the length of time it can be continuously used has increased five times, its sphere of application has been expanded and it has come to more excellently fill needs of industrial sectors such as aviation, machinery, electricity, the chemical industry, and plastics and food products. As a result of strict inspection by specialists, it was recognized that efficiency of penetration, sensitivity, and the full-load continuous operation condition of this X-ray flaw detector for industrial use, as well as acuteness of the various control mechanisms, all meet standards of design requirements (New China News Agency, 21 September 1965).

Supersonic Thickness Measurer

A new-model thickness measurer created by Chinese technicians recently entered into quantity production at the Shanghai Chungyuan Electrical Machinery Plant. This thickness measurer which is called a supersonic pulse-type transistor thickness measurer can accurately measure the degree of corrosion as well as excess thickness of such things as various kinds of metal slabs, pipe, boilers, and high-pressure containers while in use, and is convenient for disassembled repair. This precision measuring device is necessary in all industrial branches such as shipbuilding, aviation, petroleum, and chemical. By scientific inspection, it was determined that its structure as well as performance were both very advanced, and it is used at present in such branches as ship repair and the petroleum and chemical industries, and is producing very good results. This thickness measurer is only about the size of an ordinary aluminum lunch box, and with one short cable attached, the total weight is only 1.6 kilograms. The measuring device is carried in one hand, and in one hand is held at one end of the cable what is called a switchboard, which is a metal capsule the size of a thumb, and when the steel plate of the ship's hull under repair is

lightly passed over, the indicator of the measuring device immediately shows on the graduated scale the thickness of the steel plate at that place. When only a few individual locations of the steel plate are passed over with this measuring device, the status of corrosion of the steel plate during navigation as well as whether there is any necessity for replacing it, can be quickly determined. Its sensitivity can even measure small holes and foreign elements in steel material. In maintenance and repair of ships, it is necessary to measure the thickness of many structural items, and in the past, thickness of steel plate was measured by making a hole in the ship's hull, welding the hole closed after measurement. In measurement of 5,000-ton ships, from 500 to 1,000 holes had to be made, and the expense reached many thousands of yuan. Not only was labor and expense involved, but the time for the ship was long, and it also affected the life of the steel plate of the ship's hull. If this thickness measurer, which utilizes a semi-conductor, is used, such problems are solved (New China News Agency, 26 October 1964, 26 April 1965).

Supersonic Rail Flaw Detector

At the Shant'ou Supersonic Electronic Equipment Plant in Kwangtung Province, the CTS-4 model rail air-pressure welding supersonic flaw detector is being produced in small quantity. This measuring instrument seeks out and measures flaws in rail air-pressure welding, and its frequency is higher and sensitivity better than ordinary supersonic flaw detectors which are manufactured in China. Using a frequency of 2.5 megacycles, it can seek out and measure flaws of more than 0.3 mm. at a depth of 200 mm., whereas ordinary flaw detectors can only seek out and measure flaws of more than 1 mm. at a depth of 200 mm. The Shant'ou Supersonic Electronic Equipment Plant is a small plant with only about 100 employees, but in the past two years, it has successfully trial-manufactured new products not produced very much at other plants in China, such as supersonic diagnosis instruments, supersonic head and brain diagnosis instruments, and supersonic flaw detectors. This new rail air-pressure welding supersonic flaw detector became necessary as the railroad branch adopted new technology, and it was successfully trial-manufactured having been commissioned by the Railroad Department (New China News Agency, 21 September 1965).

Also, the Wuhan Electronic Measuring Instruments Plant recently designed a handy transistor supersonic rail flaw detector. This measuring instrument has a weight of only four kilograms, and its volume is also small, and when operating, it is not necessary to carry it on the back, it being convenient to carry, and the performance of the measuring instrument is quite good and it can investigate not only longitudinal flaws inside the rail, but also lateral ones (Jenmin Jihpao, 27 August 1965).

Precision Micro-Scale

A precision micro-scale which has a minimum weight sensitivity

of 1/1,000,000 gram and a maximum weight capacity of 2 grams was recently manufactured at the Shanghai Scales Plant. The weights of this precision micro-scale are smaller than a crystal of white sugar. Its sensitivity is very keen, and when a person brings his hand near, the change in weight of an object produced by the person's body temperature can be felt by the scale. Thus, the scale is placed in a room with constant temperature, and isolated equipment is attached on the outside. The item to be weighed and the weights used are both sent in through two windows by means of a revolving tray of the scale. The window is always closed, and the opening and shutting is done completely from the outside.

This precision micro-scale is used in measurement of first-class weights in state weight measurement inspection organs, and it is also necessary when measuring mass of matter in laboratories and test-rooms in scientific research units and universities and specialized schools.

The Shanghai Scales Plant in 1960 manufactured a micro-scale with a weight sensitivity of 1/200,000 gram, and subsequently at the beginning of 1963, undertook the task of trial-manufacturing a precision micro-scale with a weight sensitivity of 1/1,000,000 gram, and at the end of 1964 it was successfully trial-manufactured. According to related data, in foreign countries, copper and aluminum are used as material for weight levers, but the design personnel of the same plant have made levers using a more ideal material. The weight of this material is comparatively light, its mechanical strength high, and the effect of heat is comparatively small. When the manufactured article weighs matter, the error is one graduation (1/1,000,000 gram), and this index attains a quite advanced level internationally (New China News Agency, 17 October 1965).

The same kind of precision micro-scale is also being manufactured at Peking.

In addition, as related to scales, the Shanghai Tungfang Scales Plant has this year successfully manufactured 13 kinds of high-grade scales. These scales are all urgently needed in Chinese industry and agriculture and in communication and transportation undertakings, and included in them are important new products manufactured for the first time in China. Among these new products are measuring instruments for tensile strength, traction strength, and pressure, for example, the "chain strength measurer" and the "traction strength measurer," and these are used in measuring the tractive strength of airplanes, trains, automobiles, ships, and tractors. In addition, there are various kinds of scales for specialized use. For example, the "photoelectric controlled automatic material mixing scale" is used in large-sized automated enterprises, and it can automatically feed, weigh, and select materials, and since it is photoelectrically controlled, workers can operate it from afar (New China News Agency, 20 October 1965).

The Shanghai Dynamometer Plant this year manufactured three kinds of high-precision, large weight standard scales with a loading capacity of 1, 5, and 20 kilograms. These standard scales are pre-

cision scales necessary in industrial and mining enterprises, scientific research branches, and in laboratories of universities and specialized schools, and their graduated values are respectively 0.5 mg., 2.5 mg., and 10 mg., their precision at full scale all being 1/2,000,000 (New China News Agency, 16 April 1965).

New-Model Carbon Measuring Device

A mechanical process controlled automatic carbon measuring device which can quickly and accurately analyse the amount of carbon in such materials as various kinds of steel, pig iron, and cast iron, has been successfully trial-manufactured at the Shenyang No. 1 Machine Tool Plant. It is said that this carbon measuring device has a structure which is advanced over imported carbon measuring devices, and also that its efficiency is superior. In chemical analyses with this, the test piece is put in a tube furnace and oxidized, and then it is only necessary to turn on a switch, and the machine automatically conducts the chemical examination in a processing manner, and in a mere three minutes, the results of the examination are automatically and accurately shown on the graduated scale of the carbon measuring device (New China News Agency, 13 September 1965).

New-Model Magnetometer

The Peking Geological Equipment Plant recently manufactured a transistor nuclear propelled type magnetometer for use in prospecting. On the basis of experimental use in field investigations, its discernment capability is much better than that of foreign products of the same kind, and moreover, its volume is small and its weight light, and geological survey personnel report that it has been demonstrated to be very suitable for investigating mineral deposits of weak magnetism in hilly and mountainous regions, and small-quantity production of it has already begun (New China News Agency, 21 September 1965).

Model 62A Solar Telescope

The model 62A solar telescope used for study of physical phenomena of the sun has been successfully trial-manufactured by cooperation of the Chinese Academy of Sciences, the Shanghai Scientific Instruments Plant, the Nanking Astronomical Instruments Plant, as well as related units. This model 62A solar telescope is an astronomical optical machine which has photoelectric induction semi-automatically controlled equipment. When a high dispersion and diffraction lattice spectroscope is attached to the telescope, the spectrum of the sun can be studied with photographs or optical methods, and physical processes of solar surface activity, for example explosion of flares, can be investigated. The precision and sensitivity of this solar telescope are quite high, and when it is turned to the limit position, protection equipment on the machine automatically cuts off the power source and sets off an alarm. In addition to the fact that the exposure time of

spectrum photography can be manually controlled, it can also be controlled by automatic timing. This solar telescope has already been delivered to the Peking Astronomical Observatory and is being tested (New China News Agency, 7 April 1965).

Electronic Clock Corrector

The Nanking Tzuchinshan Clock Plant in 1964 successfully trial-manufactured an electronic clock corrector and this year began small-quantity production and is advancing preparation for supplying it to clock plants, scientific research units, and universities and specialized schools. When measuring with this corrector, it is learned whether or not the running of the clock is normal in only one or two minutes. When using this electronic clock corrector and comparing a standard frequency of very high precision with the frequency of the clock (striking of seconds), the operational status of the clock is automatically recorded by dots on paper. Subsequently, when the inclination of the recorded line is reflected on a number reading panel, the momentary error and night and day error of the clock are immediately read. This electronic clock corrector can correct the momentary error and night and day error of various kinds of clock equipment. Previously, it was not possible to manufacture the electronic clock corrector in China, and comparatively few had been imported (Jenmin Jihpao, 6 June 1965).

High-Temperature Water Surface Meter

A high-temperature water surface meter which could not previously be manufactured in China has been successfully manufactured at the Taiyuan Chungyuan Glass Plant. This is also called a fluid surface glass plate, and it can withstand the high temperature of 400 degrees centigrade and is used in observing water surfaces and oil in industrial branches such as petroleum, chemical, and electric power, and in communication and transportation branches, and quantity production has already begun and it has begun to be supplied to many regions in the country (New China News Agency, 19 August 1965).

Food Provisions Moisture Measuring Device

A portable measuring device used for measuring moisture of food provisions has been successfully trial-manufactured by the Wuhan Telegraph Plant. This is called an electric capacity type food provisions moisture measuring device, and is a measuring device which cannot be lacking in food provisions purchasing, storage, and processing branches, and it has many points which are superior as compared with the heretofore widely used in China electric resistance type food provisions moisture measuring device. That is to say, its volume is small, the weight is light, and it is convenient to carry, and moreover, since it uses flashlight batteries as a power source, it can also be used in places where electricity is not supplied. The operation is also very simple, and when the food device is pressed into the container and the power source connected,

the correct moisture content is learned from the meter needle (New China News Agency, 24 September 1965).

Measuring Instruments for Paper-Making Plants

Paper thickness meters, tearing strength measuring devices, paper air permeability measuring devices, and paper pulp rupturability measuring devices, which are considered urgently necessary in measuring quality of products in the paper-making industry, and especially in medium and small-sized paper-making plants, have been successfully trial-manufactured at the Changch'un Non-Metallic Materials Testing Equipment Plant. As a result of inspection, these four measuring instruments conformed to design requirements and the performance was comparatively good, and small-quantity production has begun (New China News Agency, 21 July 1965).

Electromagnetic Oscillation Tester

A measuring device used in measurement tests of the oscillation resistance capacity of various kinds of machines, electrical machinery products, parts, measuring instruments, and meters -- the electromagnetic oscillation tester, was successfully trial-manufactured at the Suchou Testing Equipment Plant and has already entered into quantity production. Domestically-produced materials were used completely in this electromagnetic oscillation tester.

Radio Altimeter and Radio Orientation Meter

The Chinese Academy of Sciences Surveying and Geophysics Research Institute has manufactured a radio altimeter used in aerial surveying and a radio orientation meter which determines the position of airplanes and ships. The performance of these two measuring devices is good, and they are not affected by poor vision or weather or by complexity of topography. In aerial photography, land surface altitude and object positions which are simultanesouly measured by these two measuring devices can be automatically recorded (New China News Agency, 10 August 1965).

Titanium Diffusion Pump

A titanium vaporization pump (titanium diffusion pump) which was trial-manufactured with the cooperation of the Chinese Academy of Sciences Scientific Instruments Plant and the Chinghua University radio telegraph and electronic departments, is important equipment of the large-sized electronic tube which makes high vacuums, and can produce a vacuum of up to 10^{-9} mHg, and the several which have at present been trial-manufactured have already begun to be used, and quantity production will soon be conducted (Kuangming Jihpao, 29 August 1965).

Bearing Measuring Device

China's first bearing measuring instruments plant -- the Yentai Bearing Equipment Plant, was formerly the Yentai Measuring Instruments and Cutting Tools Plant, and could only manufacture such products as drills and dies, but with the policy of self-salvation it developed from small to large and has until now manufactured more than 40 kinds of bearing measuring devices for various uses, supplying them to various bearing plants and related branches in the country, and has played a great role in promoting development of China's bearing industry (New China News Agency, 19 September 1965).

Also, in the manufacture of such things as high-grade precision machine measuring devices and wrist watches, various micro-drills are necessary, and China has heretofore depended on importation of these, but Engineer Chu Fu-lin, a worker at the Shanghai Tool Plant, in order to meet demands of development of China's precision machine and measuring devices industry, and overcoming various difficulties in cooperation with other workers under a very crude situation of equipment conditions, successfully trial-manufactured various kinds of micro-drills one after the other, and at present, quantity production of these drills is becoming possible in the same plant's small-sized cutting tool department (New China News Agency, 16 June 1965).

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CHINA'S UNIVERSITY GRADUATION PROJECTS FOR DEVELOPING ADVANCED TECHNOLOGY

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- Principally Concerning Research in Program-Controlled Machine Tools and Strength of Machine Metal Materials -

In 1958, the Central Committee of the Chinese Communist Party clearly set forth the policy of "making education serve proletarian government and linking education and production labor," and this policy is firmly carried out in China's university education and gradually seems to be gaining sound results. This policy is also carried out in the educational system of working and studying expressed recently by such words as "half work and half reading" and "half agriculture and half reading," and in the case of regular university education, it often appears as the graduation project. These graduation projects are expressed in China as "real sword and real spear" graduation projects, which has the meaning of "fighting with real swords," and university students who have not yet graduated join up with plants and other production units which have the same respective specialties and fields, and deeply entering on-the-spot into these production units and seizing a technical problem point in production, they make solution of this the theme of a graduation project. This was started by various universities in 1958 when the above-mentioned educational policy of the Chinese Communist Party was put forth, and this policy, together with supplying young technicians to various production units which have the necessity of solving technical problems pressing upon them from the point of view of production, is also considered to be "an effective method for breaking through the foreign framework, training students in practices of the production struggle and scientific experimentation, and quickly bringing about growth."

From 5 to 12 October of last year, a graduation projects operation meeting was held at Sian Chiaotung University in which more than 60 department heads and professors of ten engineering universities directly under the Higher Education Department participated, and according to points agreed upon by these participants, new development in 1965 was seen in graduation projects (including graduation theses) operations of engineering universities directly under the Higher Education Department, and most students had conducted graduation projects linked to actual tasks of production construction or scientific research. These ten schools last year had 16,000 graduates, and more than 15,000 had graduation projects, which was more than 95 percent of the total number of graduates, and there were more than 4,000 graduation project subjects combined with actual tasks, which was more than 95 percent of the total number of subjects. Subjects of these more than 4,000 graduation projects combined with actual tasks are roughly half items which have already been started in production or have been adopted in production departments and scientific research units, and some of the items are gradually gaining results. Taking Dairen Engineering College as an example, of the 364 graduation project subjects of last year, 160 have already entered into production and 108 have been adopted by production departments.

That such student graduation projects are in large number being directly adopted in production is in itself a characteristic differing from Japan and is very noteworthy, and it should also be mentioned that some of the items of the various schools have surmounted technical obstacles and reached a very high standard, and top-level projects and research are being conducted which will boost China's science and industrial technology to a new level. Seen in this way, this trend in university education can be said to stir an interest which cannot be disregarded by those who have interest in China's industrial and scientific technology.

For example, according to the above-mentioned conference, in last year's graduation projects, professors and students of Huachung Engineering College, in cooperation with the Wuhan Diesel Engine Plant, jointly designed China's first movable air-cooled diesel engine and succeeded in its trial-manufacture. Professors and students of the Huatung Chemical Engineering College, in cooperation with a plant, reformed China's sugar-refining process, and solved such problems as that there were many manufacturing processes, the taste was sharp and the granules were small. Also, professors and students of Huanan Engineering College designed a passenger and freight ferryboat to be placed in service in the Hainan Straits, and this is said to have definite significance in development of Hainan Island. The stageless variable speed elevator which was studied and trial-manufactured by professors and students of Tientsin University reached an advanced level, and one is already in use in the Peking Civilian Navigation Bureau Building. Professors and students of the Insulation Department of Sian Chiaotung University participated in trial-manufacture at the Sian Condenser Plant of chlorophenyl benzene condenser insulation oil and reduced the loss of induced electricity in domestically-made

trichlorophenyl benzene, and this is considered to have important significance in raising the level of China's condenser production. Also, the machine traction harrow which professors and students of Chekiang University successfully studied and which used white cast iron of high pliability instead of manganese steel has a life three times as long, and the cost is only one fifth that of manganese steel. Professors and students of the Nanking Engineering College, in cooperation with the Shanghai Electron Tube Plant, successfully trial-manufactured a low-base discharge computation tube and accomplished standardization of the product.

The above are but examples of the level of such graduation projects, and since according to Chinese newspaper reports many graduation projects besides these which should be noted have been conducted, below we shall look at ones among them which may be considered to be especially important.

Chinghua University Which Is Obtaining Numerous Results

One of the universities which is obtaining especially outstanding results in graduation projects is Chinghua University in Peking. Since 1958 this university has adhered to the course of graduation projects which are truly of use to production, and all of last year's graduates conducted graduation projects linked to actual production tasks and scientific research, and obtained great results. According to approximate statistics, the 2,000 students who graduated last year, under guidance and assistance of instructors, joined several tens of related units outside the university and completed more than 150 actual task items. Among these, a considerable part of the themes are considered to have a quite high scientific and technical level or quite great national economic significance. Research into several items among them of a comparatively large scale was begun several years ago and finished by being "relayed" to successive graduation projects. In addition, more tham 70 items have not yet been completed but have generally obtained results. Graduation project items of Chinghua University can be generally divided into three kinds.

The first kind is trial-manufacture of new products. For example, the several kinds of automated machine tools controlled by an electronic computer trial-manufactured by the Precision Measuring Instruments and and Machine Construction Department and the Electricity Department in collaboration with related departments of the Peking No. 1 Machine Plant and the Peking No. 3 Machine Plant and others, can directly process machine parts of complicated form and very high precision without using die plates. Also, the titanium evaporation ion pump (titanium diffusion pump) trial-manufactured by the Telegraph and Electronics Department with the Chinese Academy of Sciences Scientific Instruments Plant is important equipment for large-sized electron tubes which manufacture high vacuums, and can make the degree of vacuum 10^{-9}mmHg (in such a high vacuum, gaseous elements are only contained to the extent of 1/760,000,000,000 of ordinary air). It is said that several which were trial-manufactured have already begun to be used and soon will enter

into quantity production.

The second kind is technical innovation. Many students have deeply entered into related plants and assisted in solving some technological problem point in production. For example, instructors of a physics instructors' research group, leading students of the Manufacturing Processes Physics Department, joined with a certain iron and steel plant, and using radioactive isotypes, conducted an automatic control operation of the hot metal fluid level of steel ingot continuous casting, increasing the formation rate and quality of steel ingots and improving working conditions for the workers. Also, instructors and students of the Metallurgy Department, in connection with graduation projects and in cooperation with the Loyang No. 1 Tractor Plant, solved a problem of the surface quality of cast-metal parts. With previous cast-metal parts of the Loyang No. 1 Tractor Plant, sand would stick and pustules often formed, and for this reason, not only was the rate of waste articles high and longevity short, but it also affected the attractiveness of the tractors, and the instructors and students, in cooperation with factory personnel, conducted 1,000 experiments, and the phenomenon of waste articles arising because of inferiority of the surface of cast-metal parts was almost eliminated, quality was remarkably improved, and cost lowered.

The third kind is special problem experimentation and research. In the process of trial-manufacture and technical innovation of products, special problems which have a ubiquitous significance are often presented, such as loss of electricity, quality of welding, and dam stress. Solution of these special problems which arise in production has a certain investigative nature and requires quite penetrating research, experimentation, and analysis. Completion of these tasks increases by a step understanding of certain kinds of objective laws and provides data for basically solving production problems.

Chinghua University's Program-Controlled Machine Tools

Among the above kind of Chinghua University graduation project results, numerical value program-controlled machine tools controlled by calculation-type electronic computers, together with being production tools urgently needed at present in China's state construction, are considered to show an important course in development of machine tools.

For example, in manufacturing one airplane, first constructing from several tens of thousands to more than a hundred thousand die plates, processing must be advanced on the basis of the form of these die plates. The form of these die plates is very complicated and precision requirements are very high, and according to foreign data records, a step-by-step production preparation period of one to two years is considered necessary. However, when program-controlled machine tools are used, without using die plates, products of various kinds of complicated form can be directly processed, and production efficiency and processing precision are greatly increased. Consequently, in the last few years, development of this kind of machine tool has also been very fast internationally.

Research and construction of these program-controlled machine tools was begun at Chinghua University in 1958. At first, there was intense debate as to whether or not this kind of research and construction was necessary. However, instructors and students of such departments as machinery and electrical machinery thought that not only was there an immediate requirement of state industry for program-controlled machine tools, but that an overall industrial college such as Chinghua University had the conditions for expanding research and construction in this field. Thus, adhering to consolidation of education, scientific research, and production, and cooperating with the Peking No. 1 Machine Plant, in a period of three months they trial-manufactured two different conduction-type program-controlled milling machines and in the following year, again cooperating with a different plant, trial-manufactured one program-controlled drilling machine.

Of course, newly-produced items are always immature, and these machines also had to constantly be improved. Whereas on the one hand they process-tested one of the program-controlled milling machines for a long period in a related plant, on the other program-controlled milling machine, they conducted systematic experimental research and improvement on efficiency and structure of key parts and accessories. Stability of previous electronic computers was inadequate and they often had strange "nervous disorders," and working night and day shifts for several months, they examined the various phenomena disclosed in continuous operation, and finally their laws were ferreted out and stability greatly increased. On this basis, a new electronic computer was designed and manufactured, and with regulation over a short period of time, it became possible to conduct stable operation many times for more than 56 hours continuously. They also conducted several thousands of experiments concerning such parts as drilling guide screws and increased the precision of this milling machine above original design standards. At the same time, the Peking No. 3 Machine Plant, in cooperation with the Peking Electrical Machinery Burea Design Company, successfully trial-manufactured a transistor computer and attained transistorization of a program-controlled milling machine. When this transistor computer, of which the weight and volume are not much different from a six-tube radio, replaced the former electronic computer, the life increased 11 times, electricity consumption did not even reach one percent of that previously, and it was also possible to considerably lower costs.

At present, these three program-controlled machine tools as well as their control systems have gone through rigorous examination over a quite long period of time, and also, appraisal was advanced by means of an appraisal committee formed by 15 units such as related leadership organs, research institutes, and plants, and it was proved that the control systems of the machines are stable and can be adequately relied upon, and that precision of model processed items meets design requirements, and it has been recognized by many people that the performance of these several machine tools can satisfy processing requirements of many processed items and that if appropriate improvements are added, they can be made product samples. And manufacture of product

samples of program-controlled milling machines and program-controlled drilling machines has already begun in related departments, and preparations for going into production are being advanced.

At Chinghua University, with seven years of research into program-controlled machine tools, a program-controlled machine tool laboratory was established and a group of talented people trained, creating conditions for greater expedition of future research in this field and also for increasing the quality of education. Since 1958, successive graduates of related sections of the Machinery and Electric Machinery Departments have reached more than 300, and they have advanced graduation projects linked with this research work and have received useful on-the-spot training, and also, more than 20 research students have written graduation theses concerning this research. Instructors and students have altogether written 72 scientific essays and technical reports, and of these, 14 were read at all-country scientific conferences.

Research of Sian Chiaotung University into Strength of Machine Metals

Aside from the above research results of Chinghua University which should be especially mentioned, there is no end to up-to-date research results which can be enumerated such as the research result of teachers and students extending over eight years which showed that granite of the South China region which had for the past more than 40 years been thought to have been formed in the same geological age, was not formed in the same geological age, which made possible scientific prediction of various kinds of mining products prospecting, the graduation project of five of the first graduates of the workers squad of the Shanghai Scientific and Technological University who successfully designed and manufactured China's first high-precision cycle variable power supply, and the Dairen Engineering College design of the Dairen fishing port which has already been started and will soon be completed, but here we will put the spotlight on another, - research results of Sian Chiaotung University which produced new theories concerning strength of metal materials.

Theoretical research results of Sian Chiaotung University concerning strength of metal materials has already begun to play a role in China's machine industry production. The great significance of this theoretical research is considered to be that it has given a scientific basis for rational selection of materials by the machine-manufacturing industry and has manifested latent strength of modern metal materials.

For many years the thought prevailed in machinery construction circles that in assuring stability of the operating time of engine parts it was necessary to use materials of high "shock toughness." Thus, in determining fluctuations of "shock toughness," the method was used of "bestowing one shock with a large-energy pendulum," and if the energy expended in destruction was low, it was considered that material could not be adopted. Thus, many high-strength materials were not used simply for the reason that their "shock toughness" was low, and moreover, since "toughness" was blindly pursued, they could not but be changed

into low-strength materials, and for this reason, dimensions of engine parts became large, designed parts were heavy and large, and there was waste of metal materials. This was one of the universal problems in machine industry production.

In this regard, in 1958 Professor Chou Hui-chiu, head of the Sian Chiaotung University Machine Department and also head of the laboratory, knowing that the life of well-drilling machine pistons made by a certain factory with brittle materials was twice as great as first-rate nickel chrome cement steel and calling to mind many similar facts of the past, thought it would be greatly significant in China socialist construction if this quite important problem in the machine industry could be solved. Thereupon, he won the support of management and began this research. At first, some persons expressed doubts, and conditions were rather bad and there were many difficulties, but they did not become discouraged. Since there was no testing machine, they themselves designed and built one using scrap material. Thereupon, this research was regarded seriously by related leadership, and establishing a specialized research organization, systematic research in the various fields of strength of metal materials was suddenly begun.

Bringing Forth the Theory of Small-Energy Multiple-Shock Resistance

Research results of the Sian Chiaotung University metal products strength laboratory showed that under ordinary circumstances, shocks received by various kinds of machine parts occur continuously and that the shock energy is ordinarily comparatively low. Under such circumstances, the resistance power to destruction of materials is generally determined by strength, and comparatively little plasticity and "shock toughness" is necessary. Eventually it was shown that latent strength of many high-strength materials which had previously been rejected by single-shock experiments with the large-energy pendulum could be manifested if they were rationally used.

For example, research made clear that whereas previously, high-temperature tempering had been necessary when machine parts were made with medium carbon steel, the tempering temperature could now be greatly reduced, and also, whereas previously it had been required that the carbon content of the core of cement steel generally be lowered to from 0.1 to 0.18 percent, under conditions of small-energy multiple-shock, it was more advantageous if the carbon content were increased to 0.25 to 0.30 percent. They also found that the small-energy multiple-shock resistance of spherical graphite cast iron was superior to medium carbon steel, providing a theoretical base for wide use of spherical graphite cast iron. In past practice it had been thought that low carbon steel could not be strengthened by tempering, but in their research it was shown that low carbon steel could be strengthened by tempering and made into low carbon martensite and that moreover it has excellent overall strength properties suitable for machine manufacture. In addition, they also systematically studied such things as plasticity, fatigue strength, and overload damage susceptibility of various high-strength materials, and thoroughly demonstrated the possibility and rationality of being

able to manifest latent strength of metal materials.

These theoretical research results have already begun to be applied in machine industry production and are producing rudimentary results. The same school, together with the Shanghai Petroleum Machinery Accessories Plant, changed the material and heat-treatment method of 01-03 oil rock drill pistons, and with on-the-spot experimentation with the hardest rocks of a certain copper ore, useful life was increased by from two to three times. At the Changchun No. 1 Automobile Manufacturing Plant, through cooperation of schools with the plant, materials and heat treatment of three kinds of automobile parts have already been changed and formally entered into production, and among them, the "terminal decelerator pinion washer" which was previously manufactured with specially-made excellent no. 45 medium carbon steel plate has now been changed to being manufactured with 16 manganese steel chassis frame cutting scrap, and at the beginning of last year more than 3,000 were produced, and by production practice it was demonstrated that quality requirements could be met and that about 10 tons of specially-made excellent steel plate could be economized. Also, the rivet snap which is used in rivetting is a typical part which receives a multiple-shock load, and the same school, in cooperation with the Sian Vehicle Plant, used as raw material outer rings which had been waste articles, improved the heat-treatment method, and greatly increased the useful life of rivet snaps. In initial production experiments it was shown that whereas previously only 200 rivets could be rivetted on an average with one rivet snap, now 3,200 could be rivetted, and that the cost of material was thus reduced to one tenth.

These theoretical results have already been applied by some production, education, and research units, and several actual problems have been solved. Examples of this are that the Loyang Agricultural Machinery College in cooperation with the Loyang No. 1 Tractor Plant studied strength characteristics and heat-treatment methods of engine cone rod bolts from the point of view of multiple-shock resistance and produced a new method of tempering medium carbon steel, and the Tsinan Shaping Tool Plant and Shantung Engineering College succeeded in research for manufacturing shovels with ordinary carbon steel, and at the Peking Petroleum College they manufactured an oil-well drilling hole-making gun, which had previously been made with high-grade alloy gun barrel steel, using low carbon martensite tempered from ordinary low carbon alloy steel, greatly increasing its useful life.

This theoretical research activity at Sian Chiaotung University has also excercised many propulsive effects in the field of education. Since 1959 more than 160 successive graduates specializing in metals and heat treatment in the Machinery Department have participated in this activity and have written more than 100 graduation theses. Twenty to thirty teachers specializing in this have successively participated in this activity and at present, aside from the more than 20 full-time researchers in the laboratory, twelve instructors of the metal instruction laboratory are engaged here in scientific research. These full-time and part-time researchers have altogether written several tens of theses.

PHOTOS AND FEATURES OF CHINESE INDUSTRY, No. 65, 1 April 1966

Chin-chou, New Industrial Metropolis Developed Within Past Several Years

Chin-chou, a city in Liaoning Province in Northeast China, is currently drawing attention as one of China's new industrial metropolises, which has developed belatedly through the exertion of self-effort. Since 1958, for example, Chin-chou has constructed 47 new industrial enterprises covering eight fields including vacuum metallurgy facilities, quartz glass, rare earth metals, semi-conductors, measuring instruments and synthetic fibers. Although all of these enterprises are small plants with their smallest plants employing several tens of employees and their largest plant employing less than 500 employees, and their equipment are practically all self-manufactured or self-modified "native equipment", they are currently producing 141 types of products and several hundred products in accordance with specifications. The majority of these products are new products that China was incapable of producing several years ago, and the quality and production processes employed are "top level" within China. Moreover, additional new products are reportedly being trial manufactured at the present time.

Prior to 1958, Chin-chou merely comprised of 25 repair plants and small agricultural accessory product processing plants. From the fact that it had constructed new industrial enterprises one after another, which are fairly up to date by world standards, within the past several years, it is probably worth noting that these industrial construction methods employed were typical of Chinese self-effort. The current status and the construction methods employed by the various newly developed industries in Chin-chou are as follows:

Manufacture of Vacuum Metallurgy Equipment

Vacuum metallurgy is an advanced metallurgy technique. The highly refined metals and the high grade alloys smelted by vacuum metallurgy equipment are raw materials essential to the aircraft, electronic and chemical industries. The Chin-chou Electric Furnace Plant is currently manufacturing the latest models in vacuum metallurgy equipment. When this plant was assigned the task of manufacturing vacuum metallurgy equipment, it did not possess the equipment or the experience to implement this assignment but, relying on their own efforts and abilities, the workers of this plant devised the means to manufacture the required equipment. In early 1961, they successfully manufactured their first vacuum induction electric furnace and, in late 1961, they also manufactured the vacuum self-exhausting electrode arc furnace. The vacuum induction electric furnace is capable of smelting a higher quality special refined steel than the ordinary induction electric furnace. A major portion of the huge volume of stainless steel used in the equipment for manufacturing chemical fertilizers in China during the past several years were refined in vacuum induction electric furnaces manufactured by China through her own efforts. The vacuum self-exhausting electrode arc furnace is used to smelt metals having high melting points beyond the range of the vacuum induction electric furnace such as molybdenum and titanium. Product purity is extremely high.

In 1965, the Chin-chou Electric Furnace Plant successfully trial manufactured an electronic bombarding furnace, which is only being manufactured by a few countries throughout the world. This furnace is capable of smelting difficult-to-melt metals and the purity of the products refined by this furnace is much higher than the products refined by other electric

furnaces. The fact that China can mass produce various types of vacuum metallurgy equipment is definitely an indication that she has attained a new level in her metallurgical techniques.

Successful Domestic Production of Quartz Glass

Among the noteworthy results of Chin-chou's newly developing industries is the successful domestic production of quartz glass.

Quartz glass is high grade material, heat-proof, pressure-proof and corrosion-proof, that can also be used as insulation material in the development of modern industry. The Chin-chou Quartz Glass Plant successfully smelted two types of quartz glass - transparent and opaque. This plant did not possess modern smelting equipment but it designed an original "domestic furnace" and proceeded to smelt both transparent and opaque quartz glass. Presently, this plant is producing quartz glass plates and tubes of various sizes and shapes, and over 100 varieties of quartz glass measuring instruments. These products are being supplied in a steady stream to over 200 industrial plants and scientific research organizations throughout China.

These various quartz glass products are products which were banned for exportation to China by western capitalist countries. The Soviet Union reportedly revoked her agreement to supply China certain types of urgently needed quartz glass products. Aroused to action by these conditions, the workers in Chin-chou exercised their spirit of self-effort to embark on the trial manufacture of these products. With the extremely limited data available at that time, the workers in Chin-chou realized that the quartz glass being manufactured in foreign countries employed the high frequency method and the glass fusion method using high frequency furnaces and oxyhydrogen processing equipment. It became clear to them that equipment of this nature

was not available in the plants in Chin-chou; that even if these equipment could be ordered, an extremely long interval would elapse between the time of order and the time of delivery. Accordingly, the workers planned their own design and built a simple smelting furnace from abandoned materials collected from steel scrap piles. They connected two borrowed electric welders together and used them in place of transformers, poured salt water into a water tank and used it in place of a voltage regulator and, after completing 115 laborious tests over a period of 93 days in a make-shift workshop, they finally succeeded in trial manufacturing a 100 mm diameter quartz glass tube. From this unpretentious beginning, they reportedly perfected their own new method of processing quartz glass. Since this new processing method simplifies equipment manufacturing and produces superior quality products than high frequency furnaces, and since product specifications are not restricted, this new processing method is reportedly being employed by the other plants in China where the high frequency method is not employable.

Heretofore, the scarce and valuable kryolite was being used to manufacture transparent quartz glass but the workers at the Chin-chou Quartz Glass Plant discovered a new raw material which is cheap and abundant in China. In comparing the quartz tubes made of kryolite with those made of this new raw material, there are no noticeable differences between them, and technical studies reportedly prove that they are practically identical in transparency and quality.

Early Development of Transistors

Manufacturing of transistors is a new technique that was developed throughout the world within the past 20 years. Chin-chou is one of the

first areas in China to engage in the development of the transistor industry. The two transistor parts plants in Chin-chou do not possess modern moisture-proof structures and workshops but they are producing 11 large, medium and small output transistors/in accordance with 40-odd specifications. Various products for industrial and private use / such as transistorized radios, listening devices/ and automatic control equipment are being produced and trial manufactured in Chin-chou at the present time.

One of these products - high frequency large output transistor - required the use of equipment such as KOKOKU [sic], vaporizers, heat rolling equipment, etc., which necessitated an investment of over 100,000 yuan and the construction of a new building. But female technician CHU Feng-ch'in, who was in charge of the trial manufacturing of this product, reportedly designed /her own crude equipment and conducted test after test until she finally succeeded in trial manufacturing this highly technical high frequency large output transistor. Thereafter, at CHU Feng-ch'in's plant, this new product is reportedly being mass produced by a processing method unexplained in foreign data.

Establishment of the Synthetic Fiber (Nylon) Industry

Among the emerging industries in Chin-chou, the synthetic fiber industry is worthy of special mention. Chin-chou successfully trial manufactured a synthetic plasticizer and, using domestic raw materials and equipment manufactured through her own efforts, she successfully extracted nylon filaments.

In the summer of 1960, the Chin-chou Municipal Committee selected 22 /workers from various plants and assigned them to the trial manufacturing of KAPURON [phonetic] (nylon filament). This trial manufacturing

process was apparently a trying process. An NCNA report described the process as follows:

" At that time, one group of specialists claimed that synthetic fibers could not be produced without a large modern plant and equipment. Even then, the process would require many years to perfect. But the plant organizers did not agree. They were only provided with a small trial manufacturing fund and an animal shed borrowed from the city's business interests. In order to allot their meager trial manufacturing funds to experimental needs, they did not expend funds for unproductive equipment. The animal shed served as their experimental laboratory, office and dormitory for the female workers. The male workers lived in tents outside the animal shed. They also built a small room with dirt and rocks and converted it into a mess hall. In a modern synthetic fiber plant, the spinning section alone requires about three shops. In contrast, their animal shed was slightly over 5 meters tall. Their plant consisted of storage cans resting on shelves under the ceiling windows. When the wind blew in from the crevices around the ceiling window, they plugged these crevices with their blankets to maintain the temperature required for spinning within the shed. Conducting experiments under these trying conditions for a period of four months, they finally succeeded in spinning synthetic fiber filaments. With the coming of winter, the city provided them with a plain unfinished 3-story dormitory which will become a concrete building when completed."

Finally, by April 1961, after conducting a total of over 390 experiments during a trying period of 21 months, they overcame all technical difficulties and reached the stage whereby they were ready to provide the market with huge quantities of their products. Today, their plant is a nylon

plant producing over 100 tons of annually.

Other Rare Earth Metals, Measuring Instruments, Etc.

Other noteworthy results attained by Chin-chou are the smelting of rare earth metals and the manufacturing of ruby for use as bearing material for measuring instruments and precision machinery.

Known rare earth metals number 17 at the present time but the majority of them are just beginning to be used throughout the world. These rare earth metals possess certain special performance characteristics that play vital roles in the optical glass, metallurgy and atomic energy industries. The workers in Chin-chou groped their way through the myriad unknown factors existing in these newly developing industries and, currently, they are smelting various alloys such as rare earth aluminum, rare earth metallic silicon, and rare earth magnesium, and they are manufacturing products such as rare earth optical glass, and rare earth graphite steel. Investigations show that by casting the teeth of non-ferrous metal crushers with graphite steel reinforced with rare metals, their weight is reduced one-third and their life expectancy is prolonged more than 4-fold.

In the field of measuring instruments, Chin-chou manufactures measuring microscopes, high precision measuring instruments and a variety of high precision machinery, and produces navigation instruments such as sound signalling devices and induction devices, high temperature metallurgical measuring instruments, etc. The Ta-lu Instrument Plant in Chin-chou manufactured the "No Contact Point Remote Control Remote Communications Equipment" for the Ta-ch'ing Oil Field. This equipment is considered to be the latest development in Chinese scientific research. It enables one worker sitting at his desk to conduct eight operations including the

temperature control and
operation of 10 oil wells.

The workers in Chin-chou have also successfully trial manufactured other vital products including the rubies being used as bearing material for precision machinery. China has been importing expensive diamond powder to use as the abrasive for polishing ruby tips but, an elderly Chin-chou worker has recently perfected an abrasive using agate powder, which is being produced extensively in the Chin-chou area.

Instead of using imported pyrex glass (manufactured by the US), Chin-chou is successfully mass producing xenon bulbs using ordinary native glass.

TELEVISIONS AND TRANSISTOR RADIOS IN CHINA

Source: Chugoku Shogyo Shashin Tsushin (Photos and Features on Chinese Industry), Tokyo, No. 69, 1 June 1966, pp 1-7

Television Broadcasting in China

It was eight years ago, 1958, that television broadcasting was begun in China. In May of that year, the Peiping Television Station started experimental broadcasting, and launched a program of regular broadcasting from the second of September the same year. All the television facilities at the time were domestic products, which were completed within a short time of one year from design to the final production and broadcasting period. Shouts of joy were heard everywhere, when the image first appeared on the domestic TV screen with the Peiping mark. In the period of eight years since then, fourteen television stations have begun operating throughout China, broadcasting their own independent programs. The Peiping and Tientsin stations mutually exchange and relay each other's broadcasts, and the TV stations in other cities supplement their programs with television programs sent from the Peiping television station.

In China, all expenses of television broadcasting are subsidized by the government, and no fees are collected from the audience. The reasoning behind this is that television broadcasting in China is strictly a means of furthering the education of the people for the purpose of socialist revolution and socialist construction. Consequently, educational activities through the television medium are most active, which presents quite a contrast to the entertainment-oriented television broadcasting in Japan.

For instance, the Peiping Television Station operates

on two channels, one of which is devoted to the administration of a "television university" and its affiliated middle school. The remaining channel is devoted to general programming. The Peiping Television College (a so-called correspondence college in which instruction is given by television broadcast; operated by the Peiping Television Station) was established in 1960. It now has five departments--mathematics, physics, chemistry, Chinese, English--and offers 29 courses. This spring, the number of students of the Peiping Television College was 8,283, and the number of auditors was 7,849 students. In a period of a little more than five years, more than 36,000 students have completed at least one course, and the number of graduates from the regular curricula is 4,845 students. For the purpose of advancing intellectual levels and teaching science and technology to the workers, the television college's affiliated middle school was established two years ago. This middle school offers three courses--language (Chinese), drawing, and mathematics--and has a student body of 3,452 students. Upon graduation from the affiliated middle school, the student can immediately enroll at the TV College.

The broadcasts of the TV College begin at 6:10 in the morning and last until 8:20 in the evening, and the time devoted to educational broadcasting exceeds 40 hours per week. The instruction at this television school consists of three forms of teaching--TV instruction, correspondence instruction, and personal instruction. Any worker with the equivalent of a high school education who passes the entrance examination can enroll at the TV College. Final examinations are administered at prescribed locations, and certificates of graduation and credentials for course completion are issued. There are some 1,000 places in the municipal and suburban areas of Peiping, where one may attend the TV school. These places are not only equipped with staff members who guide individual studies, but also with a small laboratory where experiments in the field of physics and other sciences can be performed. At many plants and people's communes, there are TV classrooms specifically for the students of the TV College to study and prepare for examinations. The students are permitted to devote part of their working hours to their studies.

As an example we note that in the city of Wuhsi in Kiangsu Province, although there is no television broadcasting station, an amateur TV college was established in 1961. This college is run by relaying the broadcasts of the Shanghai Television Station by using the old shrine on the top of the mountain as a relay station. They are now experimenting with heterodyne relay broadcasts of an unsophisticated type. In the course of five years since its establishment, there have been some 330 students at the Wuhsi amateur TV college who have completed on course or another, and have produced a first

graduating class of 39 students.

Speaking of general programming, on the other hand, the Peiping Television Station operates six days a week, and the broadcasting time is about 3 hours a day. It highlights a difference in orientation between Chinese television broadcasting and the Japanese, in which several stations are simultaneously broadcasting from early morning until late evening. For such occasions as holidays, summer and winter vacations from school, special programs are added to the regular ones for the general audience and the young people. The general programming consists of three classes of programs--the news and reports, social education programs, and programs dealing with the arts, of which the arts programming constitutes more than half.

The Peiping Television Station is equipped with three studios, two domestic television relay stations, and a television theatre with a seating capacity of one thousand. The largest studio, with a size of 600 square meters, often broadcasts the TV drama series performed by the television drama group, the performances of orchestras, choruses, folk music groups, and folk art groups as well as broadcasting the performances of well known actors or actresses, drama groups, bands, and presenting concerts and circuses from other areas as well as Peiping. They also do stage relay, and the performances of visiting foreign drama groups and music groups appear on Peiping television.

It appears that in every country, children are a most enthusiastic and ardent audience of television. In China the utmost efforts have been made to produce programs that will foster in children such attitudes as the spirit of serving the people, loving labor, respecting the workers, and the attitude of valuing and loving science and also caring for the group. In devising such programs, care has been made to incorporate the characteristics of children. In Chinese television broadcasts, no programs are allowed that may foster or instill in children a sense of fear, the notion of murder, or a sense of corrupt morality. Programs are usually over by 10 o'clock in the evening, thus eliminating the concern and fear of the parents that their children's health might be impaired or that their children will be deprived of time for studying and preparing school lessons.

Phenomenal Expansion of TV Sales

In comparison to the history of TV broadcasting in Japan, where every household is now equipped with at least one TV set, the present situation of TV broadcasting in China presents a noticeable contrast in terms of program variety and quality and also the distribution of TV sets. However, it is unmistakable that TV sets are being rapidly distributed

throughout the country. Even though national statistics are lacking, in the case of Shanghai, the sale of TV sets has continued to rise. The total sale of TV sets in 1964 was twice as much as that of 1963. The total sale of TV sets in the Shanghai suburbs in 1965 was twice as much as that of 1964. TV sets are being produced in Shanghai and Tientsin, and the first domestic TV sets appeared on the market in Shanghai in October 1960. In the short period of several years since, the quality of TV production has become stable and has improved, showing an expansion in terms of production quantity and variety, with a consequent reduction in sale price.

Against this background of TV popularization, the completion of the TV tower and official commencement of broadcasting at Yueh-hsiu-shan in the city of Canton in Kwangtung Province deserve special note. This is a self-reliant TV tower with a height of 200 meters, the design of which is rich in national characteristics. The tower pillars are of triangular shape consisting of circular rods, with an octagonal top and the tower base is of a diameter of 50 meters. There are two large observation platforms installed, and the tower is also equipped with an elevator.

In this respect, one should also note the progress made in the TV industry. For instance, according to a dispatch of the New China News Agency on 4 December of last year, the Liaoning Broadcasting Instrument Factory has succeeded in its efforts to trial-manufacture kineoscope equipment to be used for TV stations. Due to the lack of special facilities, the broadcasting of movie programs by the TV stations in China up to the present has been done by the method of projecting movies onto a screen and then taking a picture of it with a TV camera. This picture is converted into image and sound symbols, and then transmitted over the antenna of the TV center. Admittedly, this is a simple method. However, the need of having to go through an additional step in transmission results in the reduction of clarity and the picture is inevitably vague on the receiving screen. The newly completed kineoscope has a special device in it which makes it possible to convert movies directly into signals and then transmit them over the antenna. Consequently, the picture projected by the Braun tube is much clearer. The trial production of this kineoscope has been made possible by the assistance of the Peiping Broadcasting Research Institute.

The Anshan Broadcasting Equipment Plant is producing industrial television equipment. This equipment is very useful for the examination of underground petroleum or underwater facilities. The use of this equipment at railroad and freight stations enables the freight clerk to observe at a distance. In many other fields of industry, it makes the work easier, safer, and faster. More important, it frees the worker

from danger and unhealthy work.

Transistor Radios in Great Demand

In the field of radio receivers in China, the production and popularization of transistor radios in recent years is very remarkable. The manufacture of transistor radios in China is a new and rising industry that has made noticeable progress in the past few years. In line with the progress in the wireless electronics industry, the manufacturing technology of transistor radios in China has achieved remarkable progress, both qualitatively and quantitatively. At present, complete systems of production have been perfected, from the manufacture of transistors and miniature parts to the assembly of radios. And all the parts and raw materials are domestically supplied.

At present in China, forty some varieties of transistor radios are being manufactured. Among others, the following brands are of relatively high quality and are popular in the cities and rural communities: the "Mei-to model 28A 8 transistor portable," the "Mu-tan model 840Z 8 transistor portable," the "Hsiung-mao model 801 8 transistor table radio," the "Hung-hsing model 401-A 4 transistor radio," and the "Ch'ang-ch'eng model 644 4 transistor radio."

In terms of circuitry type, the transistor radios in China can be classified into two groups. One is the regenerative type, which has a relatively simple structure, a relatively short distance of reception, and a cheap price. Radios of this type are most suitable for use in or around the cities. The other is the super heterodyne type, which has a relatively complicated structure, a beautiful appearance, and a relatively high electrical and sound quality. Radios of this type are suitable for use in the rural communities far away from the cities or in the field of forestry, stock farming, farming or fishing. On the other hand, with respect to appearance, they can be grouped into three classes: the compact model, the portable model, and the table model. The compact transister radios, made with miniature components, have a size approximately equivalent to that of a cigarette pack, and are easy and convenient to carry. Radios of this type are favored and heavily used by newspaper reporters, geological surveyors, and other people walking constantly outdoors. The table model in general uses large parts and is beautifully styled. It has a clear sound and outstanding tonal quality. Radios of this type are mainly used in households in the cities and rural communities.

The rapid popularization of transistor radios in China stems from a unique condition quite different from the case of Japan. Unlike Japan, China has many remote mountainous and

pastoral areas and rural villages with no source of AC electric power. It is hardly possible for the people living in these remote areas to listen to broadcasts from the people's broadcasting stations in various municipal districts. Under this circumstance, it became imperative for the Chinese Communist Party and the People's Government to rapidly popularize transistor radios for the purpose of massive promotion of the ideological education movement. For this reason, the transistor radio industry in China has become a most rapidly growing industry. The number of models and varieties is increasing rapidly, and only last year several new products appeared on the production line. In each segment of the industry, considerable efforts are being made for research and production of new products. The extent of domestic consumption is extremely high, and despite the several-fold increase of production quantity, the supply still remains insufficient.

Due to improvements in the living standards of a wide segment of farmers, the consumption of transistor radios is constantly increasing. For this reason in the past several years a number of measures have been adopted to increase production variety, improve quality, reduce costs, and expand production. In this manner, the transistor radio manufacturing industry in China is on the road toward ever greater progress and a greater future.

Recent News on Major Plants

In the following, we introduce some recent news on transistor radio plants in various areas.

--The Second Shanghai Radio Plant: produces "2J1 and 2J3 table model transistor radios."

--The Third Shanghai Radio Plant: has been producing the "28A medium and short wave portable transistor radio." As a new addition, it now produces the "27A 7 transistor radio," half the size of the 28A model, which can be easily carried in one's pocket, and produces a clear tone even on the short wave bands.

--The Fourth Shanghai Radio Plant: originally started with the production of "model 4B 3 6 transistor radios" (pocket type, size of a cigarette pack) but now produces the "model 4B 3 automobile radio," thus contributing a valuable item to the automotive industry. Due to the attachment of a 5W amp-speaker, this model can now produce sound nine times as large as the previous model. For this reason, this model can be installed either in small sedans or large automobiles. In addition, other items of production include "4B 1 table model transistor radio," and "2P 1 and 4B 2 simplified 3

transistor radios."

--The Nanking Radio Plant: has been producing the "Hsiung-mao" radios in the past, and in 1963 succeeded in trial manufacture of table model transistor radios. Further, in 1964 it began mass-producing 7 transistor pocket model radios and 8 transistor portable radios. This year the plant has begun production of model B 611 table model transistor radios. This model is comparable in size to a large lunch box, able to receive some 30 stations, has good sound quality and appearance, and more than anything else, costs less. This year the plant has also begun mass-production of the B 302 model, a popular 3 transistor radio primarily for the rural communities. Comparable in size to a large aluminum lunch box, this model has a high degree of sensitivity and can receive not only the Peiping broadcast but also the broadcasts from some ten provinces and cities. Tuning and selectivity are fairly good; even with the jamming of several powerful stations in one district, the noise level is negligible. It produces big sound and has good tone quality. Assuming three to four hours use a day, two simple batteries would suffice for two and a half months. As early as 1964 this plant engaged in test production of the popular model 3 transistor radios. But the designers and technicians were more concerned with the production of technically sophisticated goods. As a consequence, production costs were high (50 to 60 yuan per set), electricity consumption was high and the size of the radio was large. As a whole, the product was not a practical item and had never been produced on a large scale. In view of this condition, criticism that the plant was too exclusively concerned with the production of high-class transistor radios and was excluding products specifically designed for the rural population grew stronger. This criticism is said to have prompted the production of the popular B 302 model 3 transistor radio. It is thus evident that what is most consumed by the rural communities are not the high-class expensive products but the low-priced products of good quality.

--The Kirin Province Radio Plant: this factory has been most successful in producing popular-type radios for the rural communities. The model 464 3 transistor radio for rural use produced by this plant won the first prize in August 1964 at the Peiping national competetive exhibition of radio receivers, and it has also been awarded the praise and encouragement of the nation. The sale of this brand of radios is high, not only in Kirin Province, but also in Peiping and Harbin. Further efforts have been made at the plant to improve the quality of popular products.

--The Peking Radio and Capacitor Plant: in the past, this plant had been producing only a few varieties of capacitors for regular vacuum tube-type radios, but in 1964 it succeeded in the test production and subsequent mass-production of four types of small and miniature capacitors for 7 and 8 transistor radios. In this production list is included the production of tetron capacitors. It is the first time in the history of Chinese industry that the tetron capacitor has been produced domestically.

--The Wuhan First Light Industry Research Center: at the center they have finally succeeded in the test production of colloid electrolyte transistor radio batteries with long life. Ordinary transistor radio batteries last about 30 hours. In contrast, however, this battery when full charged lasts also 30 hours but can be recharged as many as fifty times, thus its useful life totals some 1,500 hours. A micro-charger is attached to the battery, which can be directly connected to any household power outlet. The charger costs 2 yuan, and lasts fairly long. Storage batteries of this type differs from the ordinary type batteries in that the former contain sulfuric acid paste, whereas the latter contain a sulfuric acid solution. This paste is manufactured by a special process; both its water content and its total volume are small. It is quite suitable for use in small batteries. The use of these colloid electrolyte batteries is extensive and includes their use in flashlights, traffic signal lights, mining lights, and all types of measurement instruments.

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Photo Captions

Photo 1: Industrial television installed at the chunk rolling mill at the Second Rolling Factory of the Anshan Steel and Iron Company. The television set was produced by the Liaoning Province Broadcasting Instruments and Materials Plant.

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Photo 2: The "Shanghai" television on the production line at the Shanghai Broadcasting Instruments and Materials Plant. All of the parts are domestically produced.

Photo 3: The "Peking" television being mass-produced at the State-operated Radio Factory in Tientsin Municipality. Ever since the initial production in 1958, product quality has been constantly improved through the efforts of laborers and technicians at the plant.

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Photo 4: Assembly of the model 27 A transistor radio at the Third Shanghai Radio Factory. The production at this plant in the first quarter of 1965 showed a 43% increase over the fourth quarter of 1964.

Photo 5: Inspection of the "Mei-to model 28A" 8 transistor radio at the Third Shanghai Radio Factory before shipment. This set receives both short-wave and medium-wave broadcasts, and the domestic sale is fairly good.

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Photo 6: Inspecting and packing "Hsiung-mao" 601-3G and 601-4G vacuum tube-type radios before shipment at the Nanking Radio Factory.

Photo 7: Shanghai-produced radios and phonographs for sale at a retail store in Shanghai.

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