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TEN YEARS IN CHINA'S MACHINE INDUSTRY

- COMMUNIST CHINA -

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TEN YEARS IN CHINA'S MACHINE INDUSTRY

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1. Results of Ten Years' Development of Machine Industry

A normal development of modern industry [in China] was impossible under the semi-feudal and semi-colonial society that existed before the liberation. Even among the industries that were almost negligible, the machine industry was the most backward.

In 1949, the year of liberation, the machine industry accounted for only 1.7 percent of the gross value of industrial production in China. By 1952, principal industrial output either surpassed or regained the pre-liberation peaks, but even then the share of the machine industry was only 5.2 percent [of the gross value of industrial production].

However, at present the machine industry is presumed to account for more than 10 percent. Even though the absolute quantity of annual production of many products has not been made public, the rapid rate of development is quite conceivable. The size as well as the precision of machinery now produced are approaching advanced international standards.

The rate of achieving self-sufficiency in the supply of machinery is also rapidly rising. While the accurate rate of self-sufficiency attained in the supply of machinery in pre-war China cannot be ascertained, it is known that this rate of self-sufficiency reached, on the average, about 40 percent by 1952. The First Five-Year Plan envisaged an increase of this rate to 50-60 percent. In fact, the highest rate of self-sufficiency attained in the peak year

during the First Five-Year Plan was about 60 percent. During the time of the First Five-Year Plan, which was aimed at building a preliminary foundation for the socialist industrialization of the Chinese economy, the goals were successfully fulfilled, thus bringing about such a development.

The main proposal (of the Eight Party Congress) in the Second Five-Year Plan adopted in 1956 provided for a rate of self-sufficiency in the supply of machinery required for the construction of the national economy of about 70 percent. This rate, to be achieved in the last year covered by the Second Five-Year Plan, was raised to 78 percent as early as in 1958 as a result of the great leap forward in production. Differently stated, as far as this target was concerned, the Second Five-Year Plan was remarkably overfulfilled within the first year of the Plan.

In particular, the principal plant facilities, e.g., power generating facilities, metallurgical facilities and other heavy-duty machinery are now chiefly supplied by domestic sources. In addition, it is said that this rate will exceed 80 percent this year. (CHAO Erh-lu, Vice-Minister, First Ministry of Machine Industry, "Ten Years of Machine Industry," Jen-min Jih-pao, 24 September 1959).

As this rate indicates, the development of the machine industry is proceeding very rapidly. The average annual rate of development during the period of the First Five-Year Plan was 30 percent and the highest rate was 61 percent, which was achieved in 1956. But this rate of development was incomparably higher in 1958, when the annual rate of increase reached 160 percent. With regard to production increases in 1958 by sectors, the output of metallurgical facilities increased 700 percent (which is twice as large as the gross value of production during the entire First Five-Year Plan).

Other sectors are also said to have increased their production at a comparable rate. The output of machine tools (excluding simple machine tools) increased from 28,000 sets in 1957 to 50,000 sets in 1958 (an increase of 79 percent). And in 1959 it is expected to reach somewhere between 70,000 and 75,000 sets.

A great leap forward is again in order for 1959, and by the end of August 1959 the output of metallurgical

facilities reached 132,000 tons (while the Second Five-Year Plan envisaged a corresponding output of 30,000 to 40,000 tons for 1962, the last year under the Plan). Also during the same period (January through August 1959), the output of cement production facilities reached more than 10,000 tons (as against 9,000 tons earmarked for 1962 under the Plan), and that of powered machinery (doryoku-kikai) reached 2,520,000 HP (as against 1,700,000 HP earmarked for 1962 under the Plan).

The output of other machinery in 1959, such as power generating facilities, machine tools and paper making machinery is said to have already reached or surpassed the goals set for 1962 under the Plan (op.cit. supra). As a result, between 1949 and 1958 the gross value of production of the machine industry in China has increased about 40 times. Hence, already in 1959 it is expected that China will surpass Great Britain in the output of machine tools.

The number of large scale enterprises newly established or expanded in various sectors of the machine industry in the course of the great leap forward in 1958 is about 220. In addition, tens of thousands of medium and small enterprises were also established. Machine building plants were established one after another in areas where the production of modern machinery had hitherto been impossible.

While power generating facilities were previously produced in Shanghai and Harbin, they are now produced in 15 provinces and cities. And whereas vehicles and tractors were formerly produced mainly in Ch'ang-ch'un, more than ten provinces and cities began to produce them in 1958. Self-sufficiency in the supply of power generating facilities is expected to be achieved by 1962.

As for the regional distribution of the machine industry, it was previously concentrated in 10 or more large cities. But they [machine plants] are now even being constructed in remote regions inhabited by national minorities and, though small in scale, [machine plants] are being established in innumerable rural areas by the people's communes. A modern machine industry is being developed not only in medium and small cities, but also in cities so remote that even the provinces in which they are located were not known to us before.

Some examples of the products [which are characteristic] of an advanced machine industry that have been put into production after successful pilot production, or are already being mass produced are the following: roughing mills with rollers having a diameter ranging from 750 mm to 1150 mm; free forging type (jiyu-tanzosiki) hydraulic presses with a 2,500-ton capacity; large blast furnaces with a capacity of 1,513 cubic meters; 50,000-KW steam turbine generators; 72,500-KW hydro-turbine generators; precision jig boring machines; gear-hobbing machines; and various other gear cutting machines and grinders.

In addition, there are products which are collective expression of an advanced modern technology, such as vehicles, planes (including jet planes), electric locomotives, internal combustion locomotive engines, 5,000-ton capacity marine coastal freighters (one of the 10,000-ton class are currently under construction), various tractors, electronic computers, and various weapons for national defense. All of these may be said to indicate the level of development of the machine industry in China.

2. Current Bottlenecks Encountered by the Machine Industry in China

Although, as mentioned above, the Chinese machine industry has rapidly developed and reached a high level, there seems to be various bottlenecks because of the short history of the industry. For example, there is a backwardness in the field of production of important machine facilities and materials.

Furthermore, as a result of the great leap forward on "two feet" in production, a problem of how to utilize poor quality pig iron produced by "backyard furnaces" (dohosen) [lit., earth method pig iron] for the production of high quality machine facilities has risen. In addition, while it is pressing to overcome the relative backwardness in the production of raw materials and necessary to economize on materials, there remains the problem of how to utilize them.

For example, there is a problem of eliminating spoilage of materials when they are processed. This is also connected with the problem of backwardness in the sectors of forging and casting. Elimination of this backwardness

calls for a change-over from forged goods to cast goods. In the casting sector, an effort is being made to have metal-frame casting replace China's traditional earth-frame casting in order to increase production efficiency. Since it is impossible to describe here all of these problems in detail, they will be generally described below.

A. Sectors Which Require Strengthening and Their Levels of Development

Of all the sectors of the machine industry, there are six so-called large facilities sectors in which increased output and development are badly needed at the present time. These so-called large facilities sectors are: (a) metallurgical and refining facilities, especially rolling mill facilities; (b) machine facilities for use in mining; (c) coal dressing (sentan) and coke making facilities; (d) machine facilities for use in electric power plants; (e) drainage, irrigation machinery and crop combines; and (f) locomotives, rolling stock and parts for them.

With regard to these machine facilities, it is true that there is a problem of quality, but the main problem is the quantitative shortage which exists. Some machine facilities are of high quality, to the extent that they are not inferior to those produced in advanced countries. For example, the 1150 mm roughing mill which was designed in China and has now reached the manufacturing stage has the following characteristics as compared with the same type of 1150 mm roughing mill designed and manufactured by the Soviet Union for India:

Characteristic	1150mm roughing mill of a certain roughing mill plant	1150 mm roughing mill designed by USSR for India	1150 mm roughing mill of new design
Weight of steel ingot (ton)	7-15	6-10	7-10
Height of steel ingot (mm)	1,850	--	2,300-2,600
Size of the section of rough material (mm)	200x200-400x400	180x180-400x400	200x200-400x400
Length of rough material after cutting (m)	100-200 thick 600-1500 wide	100-200 600-1000	100-200 600-1000
Heaviest weight of rough material after cutting (ton)	1.2-6	1.2-6	1.2-6
Average hourly output (ton)	210-390	145-215	329-488
Main electric motor (N.KW)	4,560	4,000	4,560
Length of main pressure line (m)	157,035	153,250	142,285
Total Weight of the rolling line machine facility (ton)	5,969	5,000	4,347
Total Weight of parts (ton)	406	400	500

Note: Heavy Machinery, No 10, 1958.

As these indices indicate, the quality of products is not necessarily inferior to those of advanced countries, but it is clear that [China] cannot compete with advanced countries in terms of quantity.

But, at any rate, it is only in the last one or two years that the Chinese people themselves have designed and produced rolling mill facilities, and the [present] facilities are not sufficient to provide the facilities necessary for the production of steel materials, which is increasing by millions of tons every year.

The utility rates of blast furnaces, open hearths, converters and electric furnaces are all rapidly rising and outstriping the advanced countries. However, there are things [problems] that a rise in production efficiency of rolling mill facilities alone cannot solve.

It goes without saying that the 117,000 tons of metallurgical facilities constructed from January through 20 August 1959 constitute an important force ensuring the future development of the metallurgical industry. These 117,000 tons of facilities include over 10 open hearth facilities with an annual production capacity of more than 2 million tons of steel ingot, over 60 blast furnace facilities with an annual production capacity of more than 4 million tons of pig iron, and over 40 rolling mill facilities.

This exceeds by far the target set forth under the Second Five-Year Plan, and the total output in all of 1959 may reach somewhere around 150,000 tons. Accordingly, it may be well to note that about 80 percent of the required quantity could be self-supplied. But, at any rate, the metallurgical sector is a central bottleneck in the development of the whole Chinese national economy. For this reason, the necessity of further developing the machine industry which is responsible for the supply of machine facilities has become very evident.

B. Power Generating Facilities Manufacturing Sector

This year, the total output of electricity--both hydro and thermo-electric power--is expected to reach 39 billion KWH, and the capacity of [generating] facilities, including this year's expected increase of about 2.3

million KW, will be about 9 million KW. Generating facilities produced in the machine industry sector during 1958 had a capacity of about one million KW, and those produced in 1959 will be 1.7 to 1.8 million KW assuming an increase in production of 70 to 80 percent. (Of course, an increase of 70 to 80 percent is not an easy task).

But during 1958 and 1959, the construction of 10-odd large scale generator manufacturing plants has been accelerated. At the same time, the construction of medium and small plants to manufacture generating facilities has also been facilitated. As a result, the shortage of supply facilities may be solved within the next two to three years.

Especially, pilot production and actual manufacturing of large scale generating facilities have proceeded one after another, and the period required for pilot production is also being greatly reduced. For example, while the No 1 [First] 25,000-KW steam turbine generator was completed at the end of 1958 after one year's pilot production, the building of the No 1 [First] 50,000-KW steam turbine generator (hydrogen cooled) was completed as early as before the National Holiday in 1959. And, it has already been entered into mass production.

Since it is said that there no longer exists any technological difficulties in the way of manufacturing thermo-electric generators with a capacity of between 100,000 and 300,000-KW, pilot production as well as the manufacture of 100,000-KW thermal-power generators may be realized in 1960-1961.

Nevertheless, as more than 20 million KW of generating capacity will be required by the end of the Second Five-Year Plan, the task to attain that capacity is not an easy one, as viewed from the present pace of economic development in China. Accordingly, in this sector too lie great difficulties and bottlenecks.

C. Coal Dressing and Coke Making Facilities

The construction of plants specializing in the production of machinery for use in mining development has been under way from the outset of the First Five-Year

Plan, and the preliminary foundation of that sector has been already built. Coal dressing plants are currently under construction in large numbers. There still remains a problem, however, of developing this sector at a pace corresponding to that at which the other sectors are developing.

On the other hand, few coke making plants were built before, and because their development requires close and important coordination with the chemical industry, they have not been developed to any marked extent.

But it is certain that the construction of a few large scale coke plants has been under way since the beginning of 1959 and this work is being accelerated. Accordingly, though the situation of producing machine facilities for use in coal dressing and coke making is not clearly known, it may be certain that progress have been made to a certain extent.

D. Drainage, Irrigation and Other Agricultural Machine Facilities

With a view to attaining a balanced development of agriculture and industry, the People's Government has hitherto devoted a great effort to the development of agriculture. On the basis of the socialist transformation of agriculture, the mechanization of agriculture has been facilitated. In the course of that, the communalization movement has also been actively conducted. Even leaving out these considerations, great aid has been rendered [to the development of agriculture].

Steel materials that the machine industry has consumed for agricultural purposes in China accounted for 6.4 percent of the total consumption of such materials (excluding the pig iron and steel produced in "backyard furnaces"). This proportion increased to 7.4 percent in 1958. Expressed in terms of real numbers, this means an average of 75,000 tons [for agriculture] every year during the First Five-Year Plan period. In 1958, it rose to 156,000 tons. A great increase is also expected in 1959.

Expressed in terms of various kinds of machinery [implements], items that will have been supplied by the

end of 1959 are 55,000 tractors (15 HP per tractor), 100,000 machine drawn farm implements, 4,500 crop combines, 7,500 mobile threshers, drainage and irrigation machinery with a total of 2.8 million HP, rural electric power plants with a total capacity of 250,000 KW and 13,000 trucks.

Furthermore, the total motive force of all the machinery owned by agriculture will reach 5.2 million horsepower by the end of 1959. Even with this, however, the arable area cultivated by mechanical means will account for only about 4 percent of the total arable land area, and the area affected by water conservation and irrigation through machinery accounts for only about 10 percent of the total area under irrigation.

In view of these facts, it is clear that use of farm machinery has been extended to only a limited segment. Although this did not constitute a serious problem before it presently does since it is entangled with the problem of a labor shortage in rural areas. Hence, neither the development of agriculture nor a balance between industry and agriculture can be ensured unless farm mechanization is universally extended and the process of modernizing agriculture is carried out. But, in view of the above circumstances, there again is a limitation to any increase in the supply of farm machinery to that end. Here lies the crux of the problem.

E. The Production of Locomotives and Rolling Stock

The output of locomotives and freight cars during the first half of 1959 has increased 26 percent and 18 percent, respectively, over the corresponding period of 1958. But during the first half, the 1959 plan was only 40 percent fulfilled, leaving the remaining 60 percent to be met in the second half of the year. More concretely stated, during the second half rail-born freight volume is expected to increase by 30 million tons, an increase of 6,000 car loads of freight every day. It is said that in order to meet this requirement about 8,000 freight cars will have to be built during July-October [1959]. However, it is also said that there are great difficulties to be overcome if this is to be achieved.

Bottlenecks are said to particularly exist in the area of metal refining and casting. Although the output of molten steel (kosui) [lit., steel water], by the rolling stock plants during the first half of 1959 increased 38 percent over the corresponding period of 1958, it was about the maximum that could be achieved. Besides this, there are problems in the casting processes and casting facilities--the problems which are the greatest bottlenecks. In addition, [it is to be pointed out], that the casting sector is the core of the whole transportation development, and not only does this sector account for a large quantity [of metal utilization], but cast parts are also the most important parts of machinery and the parts which are put under the impact of the heaviest load.

As a result, improvement in casting technology has become an important current task, and at present the universalization of earth-frame casting technology is planned as a means to that end. This technology is a traditional one successfully used in China from ancient times. Under this technology as currently adopted, the main materials of the [casting] frame are slaked lime and clay with coke powder or saccharide added. This frame is said to be semi-permanent, and compared with sand-frame casting, its productivity is said to be three times greater.

3. Two or Three Examples of Overcoming These Bottlenecks

As described above, while playing a role of the rivet of a fan in the great leap forward of the entire economy of China, China's machine industry is hampered by bottlenecks and difficulties from many sides in its effort to meet requirements [newly arising] because of the too fast development in other sectors. The measure aforementioned to universalize the earth-frame casting method has been created as a means of overcoming these bottlenecks.

In addition, as I indicated eralier, the wide adoption of spherical graphite cast iron, the manufacture of which is simple and easy, is also another means [of overcoming these bottlenecks]. This has an advantage in that it can utilize even the "backyard furnace" produced pig iron which contains a comparatively large amount of

sulphur. A systematic study of this cast iron has been going on in the Academia Sinica, and the production of rollers of roughing mills to be used for rolling purpose utilizing this cast iron has been splendidly successful.

This cast iron is also used in the manufacture of various machine parts. In addition, as a result of the studies carried out by the Academia Sinica, it has been clearly demonstrated that the spherical graphite cast iron has [high] plasticity and is able to endure rolling and forging.

Furthermore, the introduction of converters has made the production of steel easy and possible with only a small investment, and even pig iron containing a comparatively large amount of sulphur can now be utilized. As a result, China is actively expediting a rapid increase in the proportion of steel produced by converters.

In 1957, converter-made steel accounted for 14.9 percent of the total output of steel ingot, and this proportion is earmarked to increase to 32 percent in 1959. This is an additional method by which China is striving to overcome bottlenecks in production.

Next, it is well known that China is widely using substitutes as still another means of overcoming bottlenecks. Chrome wire is widely used as a substitute for copper, and, as is well known, cement poles and cement supports (daika) as bases for machinery are being used in place of steel materials and steel ingot.

To begin with, the wide range of uses of spherical graphite cast iron as a substitute for steel materials may be well observed from the next example.

The Wang-chiang Machine Building Plant, which specializes mainly in the production of speed reducers to be used in rolling mills, has used various substitute materials in the manufacture of parts and has succeeded in saving a great quantity of steel materials. In this case, the Plant has used the following substitutes:

Number of Part	Name	Materials Previously Used	Substitute Materials Currently Used
5925-8	Upper bearing	USSR No 25 steel	Spherical graphite cast iron
5925-9	Middle upper bearing	" " "	" " "
5925-10	Middle lower bearing	" " "	" " "
58926-7	Roller	Cast steel, cold-strip hard cast iron	" " "
58926-15	Upper roller bearing	No 35 steel	" " "
58926-17	Lower roller bearing	" " "	" " "
58932-48	Upper lid	" " "	" " "
58927-10	Lower roller bearing	" " "	" " "
58918-7	Right upper beam	" " "	" " "
58918-8	Left upper beam	" " "	" " "
58920-24	Bearing pad (dai)	No L 35 steel	" " "
58920-29	Middle roller lower bearing pad	" "	" " "
58920-36	Roller	No L 35 steel	" " "
58958-6	Upper bearing	No 35 steel	" " "
58958-8	Middle (upper) bearing	" "	" " "
58958-10	Middle (lower) bearing	" "	" " "
58958-11	Lower bearing	" "	" " "

However, this is only a partial list of parts. Besides this, there are numerous other varieties of parts. Many forged and rolled parts have been or are being replaced by cast parts. In addition, for the casting [of these parts] spherical graphite cast iron is used, which can be easily produced even from pig iron containing a comparatively large amount of sulphur. This contributes to a great reduction in material and processing costs.

Furthermore, it is clear from the following table that the production of cast goods is highly advantageous and that it contributes to a reduction in cost:

Index of Competition in Production and Quality of Cast Steel and Cast Iron

Cast Steel	Plant (or shop)
Large cast goods plants	
Monthly output per unit area of casting mold	0.8 ton
Monthly output per castwright	9.0 ton
Medium and small cast goods plants	
Monthly output per unit area of casting mold	1.2 ton
Monthly output per castwright	12.0 ton
Cast Iron	
Fully mechanized plants	
Monthly output per unit area of casting mold	1.0 ton
Monthly output per castwright	14.0 ton
Partly (kantan) [lit., simple] mechanized plants	
Monthly output per unit area of casting mold	0.7 ton
Monthly output per castwright	7.0 ton

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