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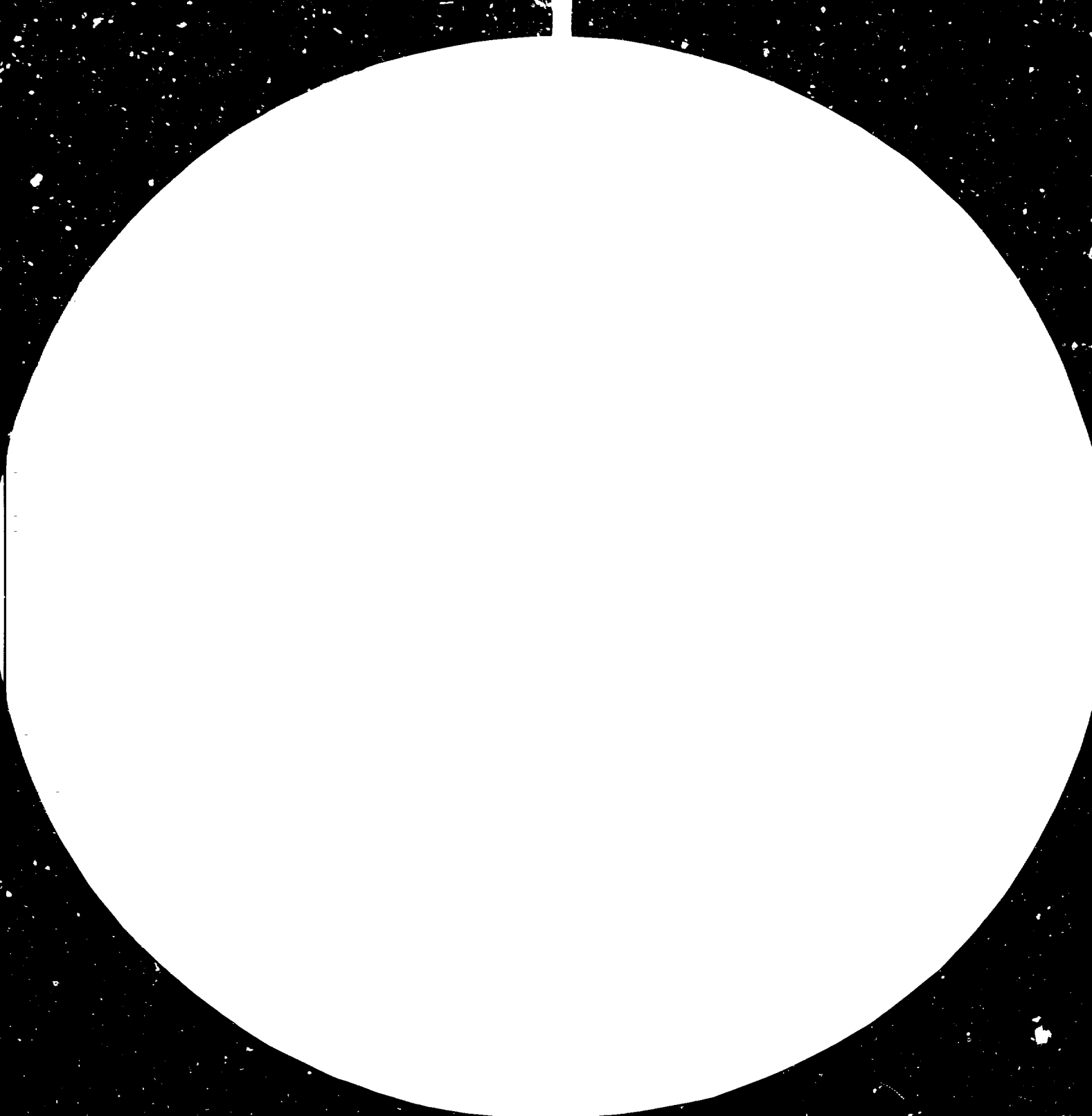

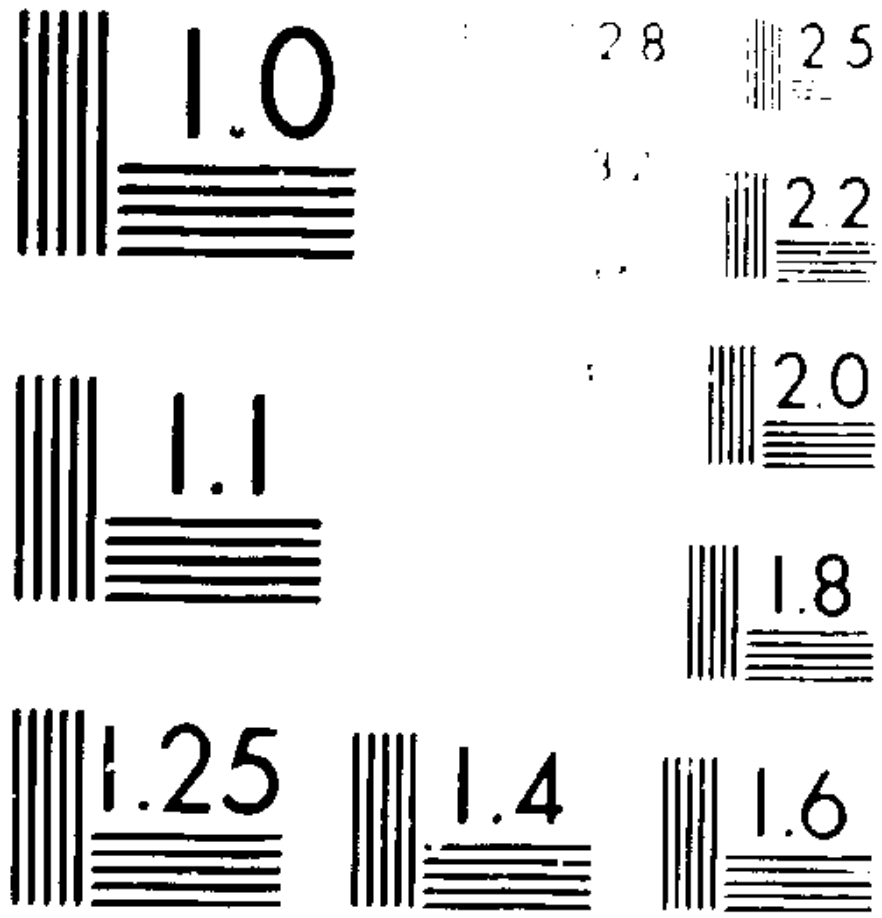
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HOW CHINA HAS DEVELOPED ITS ABILITY OF BUILDING NITROGENOUS FERTILIZER PLANTS*

by

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Abstract

This paper presents the development, salient features and concrete methods of building nitrogenous fertilizer plants in China.

1. OUTLINE OF THE DEVELOPMENT IN BUILDING OUR NITROGENOUS FERTILIZER INDUSTRY

The People's Republic of China has developed its ability of building nitrogenous fertilizer plants through a gradual process, starting almost from scratch at the time of its founding and expanding the scope of such construction step by step. We began the endeavour to develop such ability in early post-liberation years by rebuilding two plants left over from old China to resume production. The task force specializing in the construction of nitrogenous fertilizer plants grew rapidly in numbers and strength in the 1950's and 60's when plants producing an annual output of 5,000 to 60,000 tons of ammonia were built all over the country. The construction of plants with an annual production capacity of 300,000 tons in 1970's, in its own way, helped raise China's technological level in this field to a new high. The overall planning, designing of the down-streams, construction and trial runs of these plants were done entirely by China itself, while a small number of foreign experts worked at the construction sites of the large imported plants. Through practice we have accumulated sufficient experiences to be able to cut the construction period of plants. We are now able to complete the building of a 10,000 ton/year ammonia plant within one year, and a plant producing 60,000 or 300,000 tons needs only two or three years.

2. SAILENT FEATURES AND SOME CONCRETE METHODS OF CHINA'S CONSTRUCTION OF NITROGENOUS FERTILIZER PLANTS

In building nitrogenous fertilizer plants, we strive for high speed of construction and good quality of the work, by following the principle of keeping the initiative in our own hands and relying on our own efforts, by acquiring advanced experience and using it in the light of China's concrete conditions and by adopting such methods which are within our reach and meeting the technical requirements of our nitrogenous fertilizer industry.

Chemical fertilizer plants, the nitrogenous plants in particular, call for extensive use of special parts and equipment -- parts that are able to stand high temperature and pressure and equipment that is large in size and can perform heavy duties, with high rotational speed and precision -- as well as self-control, self-adjusting systems. These are difficult to design and manufacture. Requirements for on-site construction, transportation, erection, assembling and calibration are very strict too. It is particularly difficult , for example, to weld high pressure and temperature-resisting materials, transport and erect heavy-duty equipment, install high-speed machines and test and adjust self-control systems.

Large numbers of competent managerial and technical

personnel are needed in building such plants, and so are skilled workers -- welders, crane operators, assembling workers, pipe fitters and instrumentmen and inspectors. Also needed are large transport, hoisting and lifting equipment, machines and tools of medium and small size and testing and adjusting instruments of high precision.

In accordance with the industrial and technical level of our country, we have adopted some scientific and effective managerial and construction methods in order to ensure smooth construction of these plants. These methods are as following:

A. Based on the specific conditions of each plant, the theory of operational research and the Programme Evaluation and Review Technique (PERT) is used to guide the construction of these plants.

This means that we analyzed in great details every step and procedures in the construction of a plant and found out their inter-relations, and this process enabled us to pinpoint what was called the "main paths", or items of work which were of an overall significance. Then a time table would be worked out for the completion of the items one by one. Changes and adjustments were made to

the time table whenever things unexpected happened. In order to get an optimum construction proposal, we used charts and math models to indicate the actual situation at the construction site, on the basis of which we made simulating tests by means of feedback control. Also important to the preparations of the construction proposal was an investigation into the conditions under which a plant was to be built -- the surrounding natural conditions, the social environment, transport conditions and the competence of the staff. Preparations for the early stage of the construction, such as engineering design, order for equipment and materials, construction arrangements, as well as unit commissioning and test run were also regarded as an important part of the PERT and written down in the overall construction proposal.

We also prepared a schematic chart indicating the planning for the completion of the part of work which affected the entire construction. For example, in building an ammonia plant using natural gas as feedstock, efforts were concentrated on the primary reformer, which was regarded as the factor affecting the entire work as it called for a long construction period and a large amount of labour done in close coordination by people working on a multitude of jobs. When proper arrangements were made , the construction period of the reformer could be cut down from seven to nine months to only six.

In executing the PERT and preparing the "main paths", we paid close attention to ensuring the proper sequence of the construction work underground and above the ground. We persist in such sequence "first underground, and then above ground". In this way, we succeeded in keeping the construction site clean and in good order and the roads unobstructed.

B. Using equipment and technology available in China to transport and lift oversized and overweight items

China is vast and has complicated terrains and poor transportation. Because of this, it is impossible for us to transport and lift all the oversized and overweight items by using conventional highway platform trucks and heavy cranes. Instead, the work has to be done by using whatever is available in China in the light of the conditions of different localities.

An example is the transportation of a 340-ton ammonia converter from Shanghai to the construction site of the plant in Chengdu, Sichuan province. In Shanghai, people managed to load this ammonia converter onto a barge, which then sailed upstream along the Yangtze River to Leshan, Sichuan province. In Leshan, it was unloaded from the barge and placed on a platform trailer bound for Jiajiang, where a train was ready to get it to

the destination, Chengdu. In the entire process described as "four unloadings and three loadings", in addition to the modern handling equipment, we effectively use all the available conditions, such as ebbs and flows of the sea and sliding the equipment onto platform trailers. (Photo 1)

Gin poles have also been used in lifting major items. Compared to the conventional double-gin pole method, it saves half the tools and machines, takes less time and the cost is only 60% of that of double-gin pole methods.(Photo 2)

We have even succeeded in lifting items weighing up to 100 tons without using a single gin pole. The item to be lifted is placed horizontally on the ground. Using a "Ri" frame, a sliding rail set and a hinge point, the workers push it up and make it stand vertically and then move it to the proper position. This sliding push-up method without anchor point reduces still further the use of labour and the number of machines and tools.

Buoyancy of water and air pressure can be used to assemble some items, such as big oil tanks or cylinrical storage tanks. We can achieve the purpose by filling the oil tank or storage tank with water or compressed air. In each case the maximum height to be raised was 25 meters and the total weight over 100 tons.(Photo 3)

C. Using pre-fabrication and pre-assembly to save manpower and shorten the construction period

Piping usually accounts for 40 per cent of the total amount of work involved in building an ammonia plant. It is labour-consuming and takes much time. Because of this, piping is of key importance to the entire project. In China, pre-fabrication and pre-assembly of pipes are done at the construction site. In this way, we have speeded up the construction and saved money while ensuring quality in the work of fabrication and welding. Under the present circumstances in China, pre-fabricated pipes usually account for 30 per cent of the total needed in the construction of a plant. Pre-fabrication and pre-assembly are applied to other work including heat-resistant concrete lining and sheathing of insulation materials and insulation blocks.

Thanks to the improvement we have made in hoisting techniques, hoisting of equipment with big tonnage is now absolutely safe. In assembling machines or pipes, we are now able to hoist complete or combined pieces rather than do the work piece by piece as in the past. A convincing example is the lifting of high towers. Before lifting and erecting towers, all the attached pipings, platforms, ladders, electrical and instrumental items and insulation are pre-assembled on the ground.

Immediately after the towers are set to their proper positions, electric current is switched on and lamps are lit up. (Photo 4) By doing this, it can save manpower, costs and cuts operations high above the ground, and ensures safe operations.

Pipes can be lifted and installed in rows and conduits and ducts in bundles. Pipes can also be preassembled to their consoles to be hoisted as complete pieces. The result is satisfactory, too.

D. Establishing strict managerial regulations and tightening quality control

The quality of construction work is an important part of the management affairs, since it directly affects the safety in the operations of a plant as well as its cost of production and profits. We have ensured good quality of construction work by instituting a system under which preventive measures are adopted to supplement regular, strict check-ups, check-ups by workers themselves are encouraged to supplement check-ups by quality control personnel, and "three-in-one" groups (consisting of leading cadres, workers and technical personnel) are organized to analyze and tackle problems of quality. In addition, there is the system of job responsibility.

As a matter of fact, quality is the focus of our attention in every aspect of our work, from pushing the total quality control system and executing codes for related technologies down to technical management, including preparing design for construction organization, examination and approval of drawings and selection of construction proposals and codes.

All the people participating in the construction of a project -- leading cadres, workers and technical and managerial personnel -- are taught the importance of quality control to ensure the best service to the user of the project. In addition, other campaigns are started to guarantee the quality of the work in different stages of construction and maintain its good reputation.

E. Stepping up technical training to keep up with the development of construction of ammonia plants

The development of agriculture in our country requires a bigger development of ammonia industry. To tackle the technical problems, we have not only trained a lot of technical personnel from the universities, colleges and technical schools, but also run various kinds of short-term training courses for the workers and staff to raise their technical level. For instance, we have organized special training courses for our key

personnel specializing in lifting, welding, erection of compressors, piping, furnace building and meters and instruments. We've invited teachers from the universities or colleges, the experienced technicians and engineers and skilled workers to give lectures at the training courses. Through study and discussions, both sides learn and benefit from each other. By stepping up technical training, we try to keep up with the development of the construction of ammonai plants.

For example, thousands of competent welders are deadly needed at different construction sites. Therefore we have organized training courses for the welders. Working hard, they have acquired sufficient knowledge of imported materials and learned to do welding on special materials or of special positions. Most of them are good at work though young, able to do quality welding on more than 90 per cent of the pieces they are supposed to work on at just one stroke. Particularly worth mentioning are women who account for a significant part of the young welders. Working with care, efficiency and patience, they are working with enthusiasm on the construction site.

Though a developing country, China has built a fairly big industrial foundation over the past three decades. Nevertheless, the industry is far from being able to meet the needs of such a vast, populous country

country as ours. We are determined to modernize our chemical fertilizer industry by following our own way, the way of making full use of our industrial foundation by giving full scope to what is advantageous to us while avoiding what is not, and of incorporating advanced experience and technology into our own development.

After the birth of New China, our corporation, the China National Chemical Construction Corporation under the Ministry of Chemical Industry of the People's Republic of China, has accumulated sufficient experiences in the construction work over the last three decades. Now we are able to build modern chemical fertilizer plants, chemical plants and refineries to serve the needs of China and foreign countries.

- the end -

Photo 1

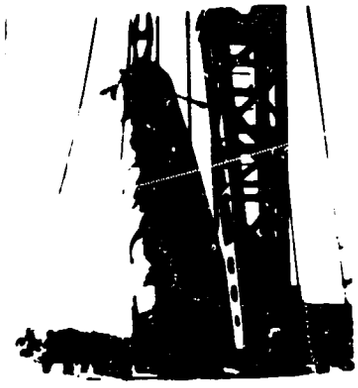

Photo 2

Photo 3

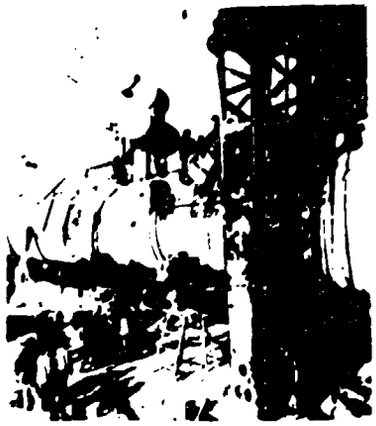

Photo 4