

Further Study on Application of the Book of Changes in Metal Casting

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Abstract

With mathematical mode, the existence, uniqueness and limitless of metal casting have been revealed. The problem “where is metal casting from? where it go?” has been answered. The research result indicated that metal casting is not only technology, but also science, as well as civilization. Specially, afresh evaluation on metal casting, finally, metal casting has become fully deserved an ancient first great invention in China. It had never been really understanding before.

Keywords: origin of casting, a large scale system of metal casting, mathematical mode of casting

1. Introduction

In China there though was full evident 5000 years foundry history, there were a few of foundry technical literature in history records. Many traditional technology have almost been lost. We should like to ask, where has been the metal casting from? where will it go? What is essence of metal casting? Does metal casting be technology or science and civilization?

In 69thWFC the author has written an article about “Yi Jing and Casting”(2), in which a new theory and new concept has been put forward.

2. The New Theory and It's Mathematical Mode

Using Yi Jing's concept viewing the situation as a whole, we regard all castings of Chinese 5000 years as a large scale system of castings. From this time on, we may able to study metal casting from the overall, other than one by one, therefore to explore their changes and develop.

According to the view of yin and yang in the Book of Changes, we have the Dao of metal casting.

The Dao of metal casting is Law of yin and yang,
Yang is the pattern (or melted metal),
Yin is the mold cavity.
The yang from among yin is core,
The yin from among yang is cave.
Yin cavity and yang pattern,
Like a seamless heavenly robe.
Through their interactions,
Till a casting was produced.
Thus a cycle finished.
All castings correspond theirs-self endless cycles.

In addition, the Dao of metal casting has been expressed as following Three Laws in mathematical mode.

The Three Laws of Metal Casting

First Law. (existence)

The Castability Really Exist and Follows the Dao of Casting.

The necessary conditions of existence of metal casting

are three factors: heaven, earth and people. Not a single one of three conditions can be dispensed with. This is concrete application of holism of human beings and universe of the Book of Changes.

Second Law. (uniqueness)

The Metal Casting is an Unique 3D Duplicate Technique in Metal Manufacture.

Please see part 3 about essence of metal casting.

Third Law. (limitless)

All Shapes of All Castings May Be Arbitrary. All Weights of All Castings May Be Arbitrary, but Bounded.

Here limitless means arbitrary.

3. Further Understanding Origin of Metal Casting

This section we will answer question: Where metal casting came from? And where it go?

According to the Book of Changes, one is called as the supreme ultimate. Two is yin and yang. We do not possible and not necessary to know which day metal casting star at? However, we can affirm that origin of casting has stared at one period or at initial period. About 6000 years ago, we supposed that someday a worker accidentally discovered a pit, which can shape melted copper. The initial shape was fuzzy. But it carried within itself the seeds of casting. Many years had passed. Once birth of casting technology, it has been divided in yin and yang, two opposite sides: yin cavity and yang pattern. This was one produced two. It is mentioned that the process of one to two experienced a long evolution in the remote antiquity. Archaeological result tell us that from the earliest excavated fuzzy brass plate in Banpo Shanxi to a shape bronze weapon in the village of Erliton Henan (started at the place Chinese casting), the period have just proved our true supposition: the evolution of one to two was about 2000 years and more.

In ancient China the metal casting was richly endowed by nature and possessed vast reserves of manpower. It was necessary condition that metal casting have created a brilliant 5000 years foundry history. We may suppose next 5000 years or 10000 years, If the human beings exhaust all mineral resources, or do not need any more castings, then metal casting will not be sustainable and lose itself.

4. Further Understanding the Essence of Metal Casting

Our investigation indicated that the metal casting in China is not only a technology, but also science, as well as civilization.

4.1 Metal Casting is a Duplicate Technology

Please be specially aware that metal casting is 3D-duplicate technology. This is different from any other manufacturing method. Here, 3D means three-dimensional space.

Mathematically the duplicate method surpasses

processing ability of all different machine-manufacturing. Drilling machine only can make a hole. Planning machine can make only a plan. Turning lathe can only make a circular bar. No matter what levels of machine, locus of cutter's motion will not be able to change. However, the duplicated method can make products of any shapes. This method even surpasses finite element method in mathematical principle. It can make some most exquisite and most complicated castings, and can not be replaced by any other methods.

4.2 Metal Casting also is a Science

In Chinese foundry dictionary metal casting has been regarded as a science long ago.

4.3 Metal Casting is Civilization as Well

4.3.1 Metal Casting Created Chinese Civilization

The Chinese civilization has began with the Xia Dynasty (approx 21st century BC to 16th century BC), when the Bronze Age of China started. The Xia was a slave society. All bronze utensils have been owned by aristocrats. The slaves have not right to possess any bronze utensils. In that time the bronze have become a symbol of property and right. Therefore the appearance of classes and form of nation both were inseparable from the bronzes. China has a splendid Bronze Age of 2000 years which laid the foundation of the Chinese civilization. Just in the Bronze Age of great prosperity, the Book of Changes was produced. So we have every reason to think that metal casting created the Chinese civilization, both material and spiritual.

4.3.2 Metal Casting Promoted Development of the Chinese Civilization

There are many examples. We selected typical one. Following the Bronze Age was the Iron Age of about 2000 years, in which iron casting was mainly used to make tools and weapons. Among them the ploughshare was a very special and very amazing farm implement. Up to present the ploughshare still is applied in some rural areas of China. The tool made output of food to increase by 2-3 times or more. As a big agricultural country with a history of thousands years, ploughshare, a iron castings, played a key great pushing effect on agricultural production in China.

4.3.3 Metal Casting Witnessed the Chinese Civilization

Sichuan Chengdu has formerly been recognized a city of 2000 years history. However in 2001 year Jinsha site and thousand bronze tools has been discovered. The great important discover made the history of Chengdu as the same step as the Chinese civilization. The history of Chengdu has been pushed back for 1000 years.

4.3.4 Metal Casting Disseminated Chinese Civilization

Ding has special meaningful casting article. In the Chinese history Ding was deeply respected. According to records of the Grand Historian of China, long long ago Fuxi has made a value ding. After hundreds years yellow emperor also has made a value ding. Up to Dayu of the Xia Dynasty the 9 Dings has been made as a symbol to conger and rule the country.

Later the 9 Dings have been disseminated from generation to generation, but to the First Emperor Qin the 9 Dings have lost. In China casting dings were continued for thousands years.

It is mentioned that the dings made by the honor of top leader have almost lost over 5000 years. Only the Century Valuable Ding and the United Valuable Ding exist now. The former sets in the United Nations which is the symbol of the world peace, the later is in memory of the Chinese nation union. Two significant articles have become the best examples of casting disseminating the Chinese civilization.

Therefore, in China metal casting has been recognized as an important part of Chinese civilization

5. Afresh Evaluation of Metal Casting in the View of New Theory and New Concept

Now we can get following several "the most" easily.

5.1 Metal casting was the oldest technology and

invention in China. Its long history of 5000 years was unparalleled.

5.2 Metal casting have the most long life.

5.3 Metal casting is the most primitive and the most modern.

5.4 Metal casting has the most wide-spread application in Chinese nation economy.

5.5 Metal casting created the most many miracles: historical, real and living.

5.6 The number of casting products were and are the most great in China industry.

5.7 The shapes of casting products were and are the most complicated. The changes of casting shapes were and are the most.

5.8 It is the most Chinese. Among four big civilization ancient countries around the world, the Chinese civilization was the most successive. Because China had a period of the Bronze Age of 2000 years, which made no division of Chinese history into periods.

In a word, in Chinese ancient science and technology metal casting was incomparable in space, in time, and in social effects. It is has fully deserved an ancient Chinese first great invention. It had never really understood before. We have to say, in some instance metal casting also was a lost civilization.

6. Conclusions

6.1 Using Yi Jing's concept viewing the situation as a whole, we have designed a large scale system of all metal castings of Chinese 5000 years history, in which three laws have been induced.

6.2 Using the holism of human beings and universe of the Book of Changes, we have analyzed a close relationships between metal casting and Chinese civilization, and metal casting have made great influence for civilization.

6.3 We have afresh evaluated a great effect of metal casting. Finally, the metal casting has become fully deserved an ancient Chinese first great invention. It is really a new great discover.

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