Origin of the Compass.

by

M. HASHIMOTO.

The invention of the printing press and gunpowder have helped to revolutionize human life. To these may be added the compass, which has been one of the most marvelous civilizing agencies in the world's history. There is little doubt about the origin of movable type and gunpowder, the Chinese having the first record of them. The origin of the compass, however, has been a controvertible question for a long time. When and where it has been first invented, therefore, is the present problem which I hope to define in this short work.

In our country—in Japan—it has been usually thought that the so-called *chih-nan-ch'ê* 指南車 or the "south-pointing vehicle," is identical with that which we call the compass.

In Europe and America, I think, there has been also a similar mistake. J. KLAPROTH, for instance, maintains that in a Chinese lexicon, *Shuo-wên* 說文, completed in 121 A. D. the lodestone is defined as "the name of a stone with which a needle can be directed;" that the earliest application of the lodestone in China seems to have been made for a magnetic two-wheeled chariot, the *chih-nan-ch'ê;* that on this chariot there stood a little doll, whose out-stretched arm always pointed to the south, owing to a magnet concealed inside.[1] And giving the history of the *chih-nan-ch'ê* since Huang-ti 黃帝 and of the magnetic needle, and quoting some passages in the *Ku-chin-chu* 古今注, the *T'ung-chien-kang-mu* 通鑑綱目, the *Yu-hsiao-ku-shih-ch'iung-lin* 幼學故事瓊林, the *Sung-shu* 宋書, the *Han-fei-tzŭ* 韓非子, the *P'êi-wên-yün-fu* 佩文韻府, the *Mêng-ch'i-pi-t'an* 夢溪筆談, the *Pên-ts'ao-yen-i* 本草衍義 and so on, he concluded that the earliest allusion to the compass in Chinese texts dated towards the end of the eleventh century, although we could presume that the Chinese must have used the compass far earlier, for, as above mentioned, the magnetic needle was used about the year 121 A. D., and then their official history tells of ships which were navigated by means of the magnetic device in the years 365–419 A. D., and lastly it may be probable that the Chinese could not find their way without a magnetic needle on such

1) J. KLAPROTH, Lettre à M. le baron A. de Humboldt sur l'invention de la boussole. Paris, 1834; J. KLAPROTH's Schreiben an Alexander von Humboldt über die Erfindung des Kompasses, überg. von Dr. Armin Wittstein. Leipzig, 1884, SS. 2–3.

long voyages as from Canton through the strait of Malacca to Ceylon, Cape Comorin, and then along the coast of Malabar, to the mouth of the Indus, Siraf and the Euphrat, in the T'ang dynasty, or in the seventh century A. D.[1] Mailla,[2] Gaubil,[3] Staunton,[4] and others, believed also the stories of Huang-ti and Chou-kung 周公, or the duke of Chou, who were said to have made "south-pointing chariots," which have come down to us in the form of the mariner's compass.

The early European sinologists, however, all promptly used Chinese texts without examination which resulted in their failure. J. LEGGE questioned the veracity of the stories of Huang-ti and Chou-kung, for he could not find such a story on the "south-pointing chariot" in any trustworthy works as the *Shang-shu* 尚書, the *Shang-shu-ta-chuan* 尚書大傳, or the Introduction to the *Shu-ching* 書經 by FU-SHÊNG 伏生, the *Han-shih-wai-chuan* 韓詩外傳, or the Introduction to the *Shih-ching* 詩經 by HAN YING 韓嬰, and the *Shih-chi* 史記 by SSŬ-MA CH'IEN 司馬遷. And he remarked as follows:

The earliest authority that I have found for connecting the duke of Chow and the embassy from Cochin-china with these chariots is the 中華古今注,[5] a work of the Tsin dynasty, the writer of which, after giving his opinion that the invention was due to Hwang-ti, about 1500 years anterior to the Chow dynasty!.....The general opinion among the Chinese, therefore, that the duke of Chow made the "south-pointing chariot," can not be recieved as resting on a historical foundation.....It would be hard to say that the mariner's compass was the child of this chariot. The truth, I imagine, is this that the Chinese got some knowledge of the compass—found it out themselves, or learned it from India—not long before the Christian era, and that then the fables about the making of "south-pointing chariots" in more ancient times were invented.[6]

Now, there arose some sceptics as Chalmers, for instance, who attacked the Chinese claim to the early invention of the compass, saying that having once or twice already exposed the hollowness of their claim, as in the case of the "striking clock" not regulated by a pendulum but by running water, he felt inclined to pity them when their long acknowledged claim to the early possession of the mariner's compass was called in question.[7] H. A. GILES also

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1) KLAPROTH'S Schreiben, SS. 4–11.

2) DE MAILLA, Histoire Générale de la Chine, pp. 316–318.

3) GAUBIL, Le Chou-King, p. 214, note 4.

4) STAUNTON, Embassey to China, Vol. I, p. 445.

5) The *Chung-hua-ku-chin-chu* 中華古今注 is not a work of the Tsin dynasty, the writer of which is MA KAO 馬縞, who lived in the period of the Wu-tai 五代 about the years 854–933 A. D. It is the *Ku-chin-chu* 古今注 that was written by TS'UI PAO 崔豹 in the Chin (Tsin 晉) dynasty.

6) J. LEGGE, The Chinese Classics, Vol. III, pp. 535–537.

7) The *China Review*, Vol. XIX, pp. 52–54.

asserts, ignoring the work of Ts'UI PAO 崔豹, the *Ku-chin-chu*, on the ground that its genuineness is not beyond dispute, and giving a full translation of the passages on the "south-pointing chariot" in the *Sung-shu* 宋書, or the official history of the Sung dynasty, 420–478, A. D. as an authority, that the account in the *Sung-shu* must be taken to represent all the available information from Chinese sources as to any early knowledge of the compass. He quoted, however, one passage from the biography of Hsü Ching 許靖 in the *Shu-chih* 蜀志, or the history of the Shu kingdom, translated as follow:

You, Sir, ought to take him as a compass (guide); 足下當以爲指南. And he says that this figurative use of the term seems to presuppose the existence of something at any rate which was known to point invariably to the south.[1] It will be clear that he considered at first the south-pointing chariot as identical with the compass. Therefore, investigating passages with regard to a "south-pointing chariot," he noticed an illustration in the *T'u-shu-chi-chêng* 圖書集成 of a form of the chariot to represent the Chinese idea, and then quoted passages in the *Shan-hai-ching* 山海經, the *Huai-nan-tzŭ* 淮南子, the *San-fu-huang-t'u* 三輔黃圖, and the *I-su* 易疏, as the Chinese sources in regard to the lodestone and its property, and lastly an account in the *Mêng-ch'i-pi-t'an* 夢溪筆談, written by SHÊN KUA 沈括, who lived in the years 1021–1085 A. D. as the most important passage of all as to the magnetic needle, concluding that SHÊN KUA lived somewhere about the time at which the compass appears to have first become known to the Western world, and whether the Chinese were aquainted with the magnetic needle before that date or not, the reader will now be able to judge for himself.[2]

Later finding passages, however, that describes the detailed construction of the chariot in the *Yü-fu-chih* 輿服志 in the *Sung-Shih* 宋史, or the history of the Sung dynasty, 960–1279 A. D. he made a full translation of them and asked Professor HOPKINSON's assistance.[3] HOPKINSON's letter to Giles tells us as follows:

I find after consideration of the details of the "compass chariot" that it is rather difficult to reconstruct from the description. The difficulty is the absence of any mechanism for throwing the wheels which are driven by the chariot-wheels into gear with the large horizontal wheel, carrying the figure. .....The words: "so that if the cart goes east the wooden man will be interlocked and point south" look as though some such mechanism were contemplated; but none of the wheels described, so far as I can see, could perform this function. The only possibility is that the two small wheels are made to

1) GILES, Adversaria Sinica, Vol. I, pp. 110–113.

2) GILES gives 1030–1093 A. D. as the years of the SHÊN KUA, but I believe this to be an error, for he died in the eighth year of *Yüan-fêng* 元豐, or in the year 1085 A. D. and was then 65 years old. *Vide* the biography of Shên Kua in the *Sung-shih* 宋史.

3) GILES, *op. cit.*, Vol. I, pp. 113–115.

serve this purpose. There is nothing in the description of these to indicate how they fit into the scheme, so that it is possible that they serve the purpose of the interlocking mechanism, though one cannot say in what manner. As regards these two small vertical wheels, I take it from the description that they are somehow supported beneath the body of the chariot, and that by the words "end of pole" is meant the end where the pole is joined to the axle, and not, as at first sight might be supposed, the vertical or free end. Is there any detailed description of the ordinary chariot of this period? It might be considerable assistance in unravelling the mystery of the "compass chariot".....The only thing in the description which suggests in the remotest degree that the principle of the mariner's compass was employed, is the fact that "an iron rod" is mentioned as connecting together the small vertical wheels at the end of pole. Having regard to the general vagueness of the description, it is just conceivable that this iron rod may have, in some way, operated as a compass needle. Such a suggestion, however, seems extremely improbable, because if the whole operation depended upon the motion of this iron rod one would expect that there would have been some indication of its importance.[1]

GILES asserts, therefore, that it appears that the Chinese themselves have never laid any claim whatever to the invention of the compass, which has been so steadily forced upon them by foreigners, and their "south-pointing chariot," which foreigners have too readily regarded as a vehicle directed by a compass, now turns out to be nothing more than a mechanical carriage, its mechanism involving an arrangement of wheels which, as described above, cannot be made to work.[2]

The Times also reports that Professor Hopkinson, of Cambrige, had been unable to reconstruct it from the specification given under the date 1027 A. D. and it was doubtful if this south-pointing chariot was ever made to work at all.[3]

GILES translated, moreover, an account of the *Chi-li-ku-ch'ê* 記里鼓車, or the "taxicab," in the same chapter of the *Sung-shih*, which was made together with the "south-pointing chariot" in the year 1027 A. D., and HOPKINSON reconstructed its model after GILES' translation.[4] E. H. PARKER, who, using the word compass for the "*Chih-nan-ch'ê*," translated extracts of the passages of the *Sung-shu* in the *China Review*,[5] asserts afterwards that it is evident this (*Chih-nan-ch'ê*) was no compass, although it is the result of his

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1) GILES, *op. cit.*, Vol. I, p. 221.
2) GILES, *op. cit.*, Vol. I, p. 222.
3) The *Times*, No. 1212109, January 22, 1909.
4) GILES, *op. cit.*, Vol. I, pp. 223–227.
5) The *China Review*, Vol. XVIII, pp. 197–198.

misunderstanding a Chinese text.[1] Yet, he accused GILES of having taken the credit of discovering the Chinese "Taxicab," which credit should properly be divided between (1) HIRTH, (2) himself, (3) CHAVANNES, and (4) the late CHALMERS. GILES retorts, however, in *In Self-defence*, indicating that HIRTH and CHAVANNES have no relation with this subject, as they asserted in their letters to GILES; that PARKER and CHALMERS give its name only in their treaties dealing with the south-pointing chariot; and then saying that CHALMERS' words, written in 1891, and therefore fifteen years before Professor PARKER makes his "discovery," do not seem to him to be very exhaustive of the subject, but if he considers that it is so, one naturally asks why he made acknowledgement of it in his own note of 1906. Moreover, GILES does not hesitate to assert conclusively that in the autumn of 1908 he ventured to make a full translation of the most important passages in Chinese history dealing with the "taxicab," which passages *had never been translated before by any one.*[2]

I do not hesitate to acknowledge the fact of his first having given a full translation of the passages. I have to protest, however, against this assertion, that the passages have never been translated before by any one, for KLAPROTH made a translation of the outline of these important passages just seventy four years earlier, or in the year 1834, though the translation was a sketch only in his treatise dealing with the "south-pointing chariot."[3] GILES later gave a full translation of them.

Nevertheless, KLAPROTH made his translation after the citation found in the commentary of the *T'ung-chien-kang-mu*, so that he was quite ignorant of the most important passages in regard to the "south-pointing chariot" along with the "taxicab" in the same historical record. It seems likely, however, that F. HIRTH was the first to read the text in the *Sung-shih*, and translated extracts of the passages dealing with the *chih-nan-ch'ê*, made 1027 A. D. and 1197 A. D., notwithstanding Giles self-confidence.[4] Yet, he could not believe the *chih-nan-ch'ê* in the earlier age as a mechanism based on a most complicated system of cog-wheels, even though he was acquainted with the text in the *Sung-shih* as GILES was. For HIRTH imagines that it would appear that as early as the fourth century B. C. some sort of a contrivance indicating a southern direction either existed or was believed to have existed in former times as we can find the word, *Ssŭ-nan* 司南, in the *Han-fei-tzŭ* 韓非子, a

1) PARKAR'S actual words are as follows: In 815 a new "southpointing chariot" 指南車 was constructed 新造 in order to mark the distance and time 記里鼓: it is evident this was no compass. But in 820 there is a second notice which seems to suggest two separate instruments 修指南車記里鼓車. *Vide* Adversaria Sinica, Vol. I, p. 274.

2) GILES, *op. cit.*, Vol. I, pp. 273–275.

3) KLAPROTH'S Schreiben, SS. 7–8.

4) F. HIRTH, The Ancient History of China, p. 131.

work of the philosopher Han-fei, who died in 233 B. C. He continues that in the later literature, the term "*Chih-nan*" is occasionally used metaphorically; for instance, in the "*History of the Three Kingdoms,*" from which it would appear that the term was known in the sense of "a Guide" about the year 200 A. D. And according to an account of the history of this invention contained in the *Sung-shu,* he believes it appears that the secret of the "south-pointing chariot" had been lost for many centuries, when the eminent astronomer Chang Hêng 張衡, who lived in 139 A. D., reconstructed it, but in the troubles causing the downfall of the eastern Han dynasty his model, too, was lost and consequently forgotten. He says also as follows:

From the third century A. D. renewed interest began to be taken in these mysterious allusions of the ancient literature, which led to repeated attempts to reconstruct what the would-be reconstructors apparently mistook as a mechanical contrivance; and it appears that all that was turned out was a machine consisting of certain wheels, possibly registering the movements of the axle of a chariot in such a manner as to cause an index to point in the same direction, whatever direction the chariot might take.....Subsequaint attempts are spoken of as having been more successful, but, as I understand the *Sung-shu,* the author of this account thinks of "machinery" and is not aware of the real agent, although he casually remarks that, during the Tsin dynasty (265–420), there was also a *chi-nan-ch'ou, i. e.* "a south-pointing ship." The Emperor Yan Hing's contrivance is more clearly described in the biography of its engineer, which says it had no machinery at all, but that, whenever it was put in motion, a man had to step inside to move the apparatus. Reading between the lines, I am inclined to assume that this remark strongly suggests the use of a compass, the man who had to step inside giving the chariot the direction assertained from it.[1]

And Leopold de Saussure quite falls in with Hirth's views[2]

Any of these views as mentioned above, however, I hesitate to accept as unquestionable. So far as I know, the earliest undoubted account in regard to the "south-pointing chariot" in Chinese literature appears in passages in the *Ku-chin-chu,* a work of Tsui Pao, who lived about the third to the fourth century A. D.[3] Nevertheless, Giles ignores this work, on the ground that its genuiness is not beyond dispute. Indeed, we can find a dispute against this work in the *Ssŭ-k'u-ch'üan-shu-tsung-mu-ti-yao* 四庫全書總目提要 which tells us that Ma Kao remarks in the preface to his work, the *Chung-Hua-ku-chin-chu* 中華古今注, that many parts of Ts'ui Pao's *Ku-chin-chu* being missing he made amends for them, though we can hardly find out any difference

1) F. Hirth, *op. cit.*, pp. 128–131.

2) L'origine de la rose des vents et l'invention de la boussole par Leopold de Saussure en *Archives des Sciences physiques et naturelles* (5me Période-vol. 5.)

3) The *Ssŭ-k'u-ch'üan-shu-tsung-mu-ti-yao,* Ch. CXVIII, p. 5.

between them with the exception of few points; that in the *T'ai-p'ing-yü-lan* 太平御覽, we can find Ts'ui Pao's work only, while in the *Wên-hsien-t'ung-k'ao* 文獻通考 there is recorded the name of MA KAO's work only, and therefore we can understand that Ts'ui Pao's work had been lost for a long time, while Ma Kao's work was written in the later age, and then the so-called *Ku-chin-chu*, as we see now, was forged after MA KAO's work by some one; that when we compare, however, Ma Kao's work with the *Su-shih-yen-i* 蘇氏演義, written by SU Ê 蘇鶚, we can see so many resemblances between them, that it is clear that the former was written after the latter.[1]

However, TS'UI PAO lived, as mentioned above, in the Chin dynasty, or about the third to the fourth century, while MA KAO, in the years 854–933 A. D.[2] and SU Ê, about the same time, for Ma Kao was 32 years old, when Su Ê recieved the degree of *Chin-shih* 進士 or "doctor."[3] Moreover, the TS'UI PAO's work, the *Ku-chin-chu*, is recorded in the *Catalogues of books* contained in the *Sui-shu* 隋書,[4] the *Chiu-t'ang-shu* 舊唐書,[5] the *T'ang-shu* 唐書,[6] and the *Sung-shih*,[7] or in the official histories of the successive dynasties since the Chin, while the *Su-shih-yen-i*, in the *T'ang-shu*[8] and the *Sung-shih*,[9] and the MA KAO's work, the *Chung-hua-ku-chin-chu*, in the *Sung-shih* only.[10]

The *T'ai-p'ing-yü-lan* was compiled in the year 977–983 A. D. and the *Wên-hsien-t'ung-k'ao*, about the end of the Sung dynasty or in the early part of the thirteenth century. In order that we may accept the opinion of the *Ssŭ-k'u-tsung-mu-ti-yao* as correct, we must allow that later in the tenth century MA KAO's work, written only about half a century before, was lost already, while TS'UI PAO's work has existed ever since for so long as six or seven centuries; and then the latter was lost till the early part of the thirteenth century, while the former made its appearance again; and afterwards, the latter was forged after the former by some one till the middle of the fourteenth century, when the *Sung-shih* was compiled. I can not accept, however, such a contradiction. And although the *Wên-hsien-t'ung-k'ao* is well known as a work which contains exhaustive knowledge, yet we must usually expect some errors and ommissions in it, as also asserted by the *Ssŭ-k'u-tsung-mu-ti-yao*.

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1) The *Ssu-k'u-tsung-mu-ti-yao*, Ch. CXVIII, pp. 4–5.
2) The *Chiu-wu-tai-shih* 舊五代史, Ch. LXXI, pp. 1–2, and the *Wu-tai-shih*, Ch. LV, pp. 2–3.
3) *Vide* the preface to the *Su-shih-yen-i*, written by LI TIAO-YÜEN 李調元.
4) The *Sui-shu*, Ch. XXXIV, p. 2.
5) The *Chiu-T'ang-shu*, Ch. XLVII, p. 2.
6) The *T'ang-shu*, Ch. LIX, p. 4.
7) The *Sung-shih*, Ch. CCV, p. 5.
8) The *T'ang-shu*, Ch. LIX, p. 5.
9) The *Sung-shih*, Ch. CCV, p. 6.
10) *Ibid.*

Moreover, in this encyclopædia, there is an account, the words of Ch'ên-shih 陳氏, quoted as the commentary of the *Chung-hua-ku-chin-chu*, which account states that this is MA KAO's work, which he compiled, in short, by enlarging TS'UI PAO's work only.[1] After this commentary we can suppose that MA TUAN-LIN 馬端臨, the author of the *Wên-hsien-t'ung-k'ao*, thought probably, MA KAO'S work was written after TS'UI PAO's work, or just the contrary of the opinion expressed by *Ssŭ-k'u-tsung-mo-ti-yao*.

I can not accept, too, that MA KAO's work was made after the *Su-shih-yen-i*, for MA KAO and SU Ê lived in the same age, as remarked above. Observing the contents of these three works, I can rather perceive their every feature, although they contain very similar passages in many points. Only, there is a slight shadow of doubt why SHÊN YO 沈約 the author of the *Sung-shu*, who lived 441–513 A. D. did not take the story of Huang-ti in his work, if the Ts'ui Pao's work had existed since the time of the Chin dynasty. But I can not allow such a doubt, because some cautious writers were accustomed to omit such a doubtful story, as, for instance, we can find out no account dealing with the "south-pointing chariots," made by Huang-ti or Chou-kung, in the *Chi-ku-lu* 稽古錄, written by SSŬ-MA KUANG 司馬光, who lived in the years 1019–1086 A. D., while the *T'ung-chien-wai-chi* 通鑑外記, worked by LUI SHU 劉恕, who lived 1032–1078 A. D., or just in the same age as SSŬ-MA KUANG, containes all such stories.

The fact is this, I think, that MA KAO's work was made after TS'UI PAO's work, and about the same time the *Su-shih-yen-i* was written after TS'UI PAO's work and others. It appears that some similar works as TS'UI PAO's *Ku-chin-chu* were written in the same age, for we can find the *Ku-chin-chu* by FU HOU 伏侯 in the *T'ang-shu*[2] and the *Hsü-ku-chin-chu* 續古今注 by CHOU MÊNG 周蒙 in the *Sung-shih*.[3]

In TS'UI PAO's work we can find not merely the story of Huang-ti and Ch'ih-yu 蚩尤, but also another legend, which states that in the reign of Ch'êng-wang 成王 of the Chou dynasty when Chou-kung's government brought peaceful times the Yüeh-shang-shih 越裳氏 despatched its envoys attended by interpreters and offered the king a white pheasant, a brave of black pheasants and some pieces of ivory; and that as the envoys might lose their way on the return journey, Chou-kung awarded them not only two rolls of gold brocade, but also five carriages which were all constructed as south-pointing ones; that also at the time of the fall of the Han dynasty, however, the process of its construction was entirely forgotten and Ma Chün 馬均, a scholar who lived in the Wei 魏 kingdom (220–265 A. D.), subsequently

1) The *Wen-hsien-t'ung-k'ao*, Ch. CCXIV, p. 46. The text is as follows: 陳氏曰, 後唐太學博士馬縞撰, 蓋惟廣崔豹之書也.

2) The *T'ang-shu*, Ch. LIX, p. 4.

3) The *Sung-shih*, Ch. CCV, p. 5.

reconstructed it, the plan of the vehicle which was manufactured at that time, in the fourth century A. D., being the same as the plan left by him.[1]

It is quite certain, therefore, that in the Chin dynasty (265–420 A. D.), there was manufactured the "south-pointing chariot." It is a matter of course, however, that no one can believe the statements which denote that the chariot was constructed by Huang-ti or Chou-kung, the legends being purely mythical, though I hesitate to decide whether the last account is right or not. Indeed, in the history of the Wei occurs an account which states that in the third year of *Ch'ing-lung* 青龍 (235 A. D.), the Emperor Ming 明 constructed several palaces in Lo-yang 洛陽 on a grand scale, and this having exceedingly embarrassed the peasants, his righteous subjects as Yang Fou 楊阜 and Kao T'ang-lung 高堂隆 expostulated with him repeatedly, but he would not listen to them, although he moderated his over-eagerness in some degree.[2] And in the same place we find a passage from the *Wei-liao* 魏略 as the annotation to this account, which was quoted by P'EI SUNG-CHIN 裴松之 as follow: "Some water which was led from the stream Ku 穀 flows in front of the palace Chiu-lung 九龍 and makes a fine well, fenced in by a line of sculptured parapet. There are statues of toads whose mouth recieve the falling water, and of a sacred dragon whose mouth vomits a stream. The Emperor made Dr. Ma Chün construct a "south-pointing chariot." The water played in various ways in the well. At the beginning of every year it was placed there. Several giant beasts, fishes and dragons played in various form, and also a circus horse galloped upside down. All these arrangements were the same as the provisions in the western capital of the Han dynasty.[3]

In these sentences, a passage, "the Emperor made Dr. Ma Chün construct a south-pointing chariot," has no connection with peceding or following part. The words, "the water played in various ways in the well," must be put necessarily next to the passage, "there are statues of toads whose mouths received the falling water, and of a sacred dragon whose mouth vomits a stream." If not in this manner it would be utter nonsense. Therefore we suspected for a time that the passage in regard to the south-pointing device had been later inserted into this place by some person. But after reconsideration, I am inclined to believe that if we remove the passage, we should also abolish the sentence, "At the beginning of every year it was placed there," for it is only a sentence connected with the passage relating to the *Ssŭ-nan-ch'ê;* and that if these two sentences had been inserted at a later time, they would not have been put into separate places. On that ground I understand for the present that these sentences were not inserted separately

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1) The *Ku-chin-chu,* Ch. I, p. 1.

2) The *Wei-chih* 魏志 Ch. III, p. 4.

3) The passage in the *Wei-liao* is as follows: 引穀水, 過九龍殿前, 爲玉井綺欄, 蟾蜍含受, 神龍吐出, 使博士馬均作指南車, 水轉百戲, 歲首建, 巨獸龍曼延, 弄馬倒騎, 備如漢西京之制.

by some person afterwards, but they were perhaps misplaced, the upper one with the lower, although it is highly doubtful that in any trustworthy records in the Han dynasty as the *Shih-chi* and the *Han-shu* 漢書 we should find no account of the "south-pointer," and that even in the original text of the *Wei-shu* 魏書 there occurs no statement on the vehicle and its reconstructor, Dr. Ma Chün. Moreover, as GILES quotes, in the biography of Hsü Ching 許靖 in the *Shu-chih*, written by CH'ÊN SHOU 陳壽 who lived 233–297 A. D., we can find a passage as follows: You (Wang Shang 王商) ought to take him (Hsü Ching) as a *chih-nan*, or a "Guide." "This figurative use of the term seems to presuppose the existence of something at any rate which was known to point invariably to the south," as GILES asserts, while this passage is a sentence in a letter to Wang Shang, written by SUNG CHUNG-TZŬ 宋仲子 about the years 200–210 A. D., before Hsü Ching went to Shu-chun 蜀郡 in the sixteenth year of *Chien-an* 建安, or in 211 A. D., though the history was compiled in the Chin dynasty. If that be the case, therefore, we can also say that the south-pointing instrument may have been already constructed in the third century A. D.

Can we believe, then, these accounts which indicate that the plan of the device was lost in the time of the Han dynasty's fall, or that all these arrangements in front of the palace of Ming-ti were the same as the provisions in the western capital of the Han dynasty? In the *Li-chih* 禮志, or the history of the rites, in the *Sung-shu* there occurs a minute account which was translated by GILES as mentioned above. The account states the circumstances of its transmission as follows: The "south-pointing chariot" was originally constructed by Chou-kung who bestowed it on the foreign envoy in order to show him the direction. Kuei-ku-tsŭ 鬼谷子 says that the people of the Chêng 鄭 carried with them a "south-pointing chariot," when sending for jade, in order not to be mislead. During the periods of the Ch'in and the Han, however, nothing more was heard of that system. In the eastern Han dynasty Chang Hêng 張衡 reconstructed it again. But at the time of the fall of the dynasty, it was lost once more. In the time of the Wei, Kao T'ang-lung and Ch'in Lang 秦朗 who were prominent as well-informed scholars, disputed this in the royal court, saying that there was no such device as the "south-pointing chariot" in existence, the writers having noted a false tradition. In the era of *Ch'ing-lung* 青龍 under Ming-ti, Dr. Ma Chün, being ordered to construct the vehicle, completed it anew. In the time of the disturbance of the Chin dynasty, however, it was lost again. In the age of the eastern Chin dynasty, Shih Hu 石虎 made Chieh Fei 解飛 construct it and also Yao Hsing 姚興 ordered Hu Shêng 狐生 to complete it. In the thirteenth year of *I-hsi* 義熙 (417 A. D.) in the reign of An-ti 安帝 when Wu-ti 武帝 of the Sung dynasty captured Chang-an 長安, he obtained the device for the first time. The plan of the device

was similar to a *ku-ch'ê* 鼓車, a vehicle which was equiped with a drum to be beaten every *li* 里, or chinese league. A wooden doll, which stretched its arm to the south, was put on the instrument and although it could be twined about in any way, the direction of the doll's pointing finger never changed. In an imperial cortége it was used as a van in the procession. This vehicle which was captured in Chang-an, however, having been constructed by a Jung-ti 戎狄, or a "tribesman," the machinery did not often show the right direction. Whenever it was turned or run about, it needed to be corrected. Tsu Ch'ung-chih 祖沖之 of Fan-yang 范陽, who was highly resourceful, maintained repeatedly, therefore, that its construction needed to be amended, and about the end of *Shêng-ming* 升明 (477–479 A. D.), Ch'i Yü 齊王, the chancellor of Shun-ti 順帝, made him construct it. The vehicle was completed by him, having been made accurately, and was not askew in any way. In the Chin dynasty there was also a *Chih-nan-chou* 指南舟, or a "south-pointing boat."[1]

The *Sung-shu* was worked by SHÊN YO 沈約 who lived 441–513, A. D. and in which, as cited above, we find the account which asserts without hesitation that in the dynasties of the Ch'in and Han there was no south-pointing device. According to the opinions of Kao T'ang-lung and Ch'in Lang, even up to the eastern Han dynasty it seems also that there was no such vehicle in existence. Yet, in the *Wei-liao*, as we saw, there occours the account which states that in the year 235 A. D. Dr. Ma Chün constructed a south-pointing instrument which was erected at the beginning of every year, and that all these arrangements were the same as the provisions in the western capital of the Han dynasty. The *Wei-liao* is an historical record on the Wei period written by YÜ HUAN 魚豢, a scholar who lived in Ching-chao 京兆, or the western capital of the Han, in the Wei dynasty. As an historical source for the time of the Wei, therefore, it should be comparatively reliable in these accounts. It thus seems likely that the "south-pointing device" was already known not only in the eastern Han, but also in the western Han dynasty, because the so-called western capital, which undoubtedly indicates Chang-an, was the capital of the western Han. Moreover, in the history of the rites in the *Sui-shu* we find an account which states that in the early time of the Han dynasty a "south-pointing chariot" was used along with a rider as the van of the imperial cortège, although it is of cource too late a source as evidence of the time of the Han.[2] And as mentioned above, in the letter written about the end of the eastern Han dynasty, the term "south-pointer" was used figuratively, as if it was very familiar in that age. This is a contradiction of the statement

1) The *Sung-shu*, Ch. XVIII, p. 1.

2) The *Sui-shu*, Ch. X. p. 1. The text: 指南車, 大駕出, 爲先啓之乘, 漢初置爺兒騎, 並爲先驅.

in the *Wei-liao* and that in the *Sung-shu*. Which opinion should we follow or what explanation can we find for this contradiction?

Indeed, as HIRTH says,[1] in the *Han-fei-tzŭ*, we can find a Chinese text on the "south-pointer" as follows: "The early Kings constructed the *Ssŭ-nan*, or the south-pointer, in order to fix the direction every morning and evening."[2] In the *Kuei-ku-tzŭ* 鬼谷子 which is alleged to be the work of the philosopher KUEI-KU-TZŬ who lived in the fourth century B. C., we also find a statement that refers to the people of the Chêng who carried with them a "south-pointing chariot" when sending for jade, as mentioned above.[3] However, we must warn the investigator not to take the whole contents of the current book of the *Han-fei-tzŭ* as the genuine text, although it is generally accepted as the work of the philosopher. As the *Ssŭ-k'u-ch'üan-shu-tsung-mu-ti-yao*, or the critics of the great Catalogue of the Imperial Library, states, it seems to have consisted of fifty-five parts since the Han dynasty (202 B. C—8 A. D.) and of twenty volumes since the Liang 梁 dynasty (502–556 A. D.), as we see it at present, but it has been already ascertained that there are many sentences which were lost, changed or mixed at later dates.[4] We should not, therefore, believe the whole to be the original text, which was written in the third century B. C. Nevertheless, since the passage of the *Wei-liao* is a more reliable source for historical facts in the time of the Wei dynasty, as stated above, it is certain at least that in the time of Wei, such a rumour was believed of the existence of the "south-pointing device" in the Han dynasty. And on the other hand, it may be supposed that the passage on the "south-pointer" in the *Han-hei-tzŭ* may have been written by an unknown writer in the time of the Wei or the Han dynasty, or by Han-fei himself about the end of the Chou dynasty. Futhermore, although we have only slight evidence to confirm the rumour of the existence of the "south-pointing instrument" in the Han dynasty in such a case as mentioned above we can not help but doubt whether the passage in the Han-fei-tzŭ has been written in the Han dynasty, or whether the device may have been already known in the Han dynasty, if it cannot be determined that the passage was written by Han-fei himself. There is no account, however, to induce us to conjecture that the vehicle has been known about the end of the Chou dynasty but the passage itself

1) HIRTH, *op. cit.*, p. 128.

2) The *Han-fei-tzu*, Ch. II. The text: 故先王立司南, 以端朝夕. HIRTH translated this passage as follows: "The early kings constructed the *ssi-nan*, *i. e.* 'the south-pointer' in order to fix the position of morning and evening." But this translation, I think, is perhaps an error, this passage indicating that the early Kings directed their government officials according to law in the same way as they fixed the directions according to a "south pointer" every morning and evening.

3) The *Kuei-ku-tzŭ*, Ch. X. The text: 故鄭人取玉也, 載司南之車, 爲其不惑也.

4) The *Ssu-k'u-ch'üan-shu-tsung-mu-ti-yao*, Ch. CXVII, p. 12.

in the *Han-fei-tzŭ*, which is too doubtful to be accepted as the genuine text. Much more doubtful is the case with the *Kuei-ku-tzŭ*. As the *Ku-chin-wei-shu-k'ao* 古今僞書考 which is a work of YAO SHOU-YÜAN 姚首源, a scholar in the Ch'ing 清 dynasty, states,[1] and as we see also in the introduction to the *Kuei-ku-tzŭ*, which was written by PI YÜAN 畢沅, a scholar in the same dynasty, this book's name is found for the first time in the *Sui-shu*, the history of the Sui dynasty (590–618 A. D.).[2] Even Kuei-ku-tzŭ himself is a very obscure person, and it is not known whether he really existed, although it is told generally that he lived at the end of the Chou dynasty. Therefore, the account of the *Kuei-ku-tzŭ* we should not take as a source to confirm the present question.

In short, the first sound record in regard to the "south-pointing device" was that which we find in the *Ku-chin-chu*, and there is no doubt of the fact that in the fourth century A. D. such an instrument was manufactured in China. Yet, we are inclined to believe the fact that Dr. Ma Chün constructed it in the Wei dynasty, although we can not be sure of it, the account of the *Wei-liao* being somewhat questionable. In the time of the western and eastern Han dynasties, such a device may have been constructed also, if the accounts of the *Wei-liao* and the *Sui-shu* may be taken to suggest it and if the passages in the biography of Hsü Ching and in the *Han-fei-tzŭ* may be taken to presuppose the existence of a "south-pointer." However, we must warn the investigator not to decide as to this, as the accounts are much more doubtful. About the end of the Chou dynasty, whether the vehicle was already known we can not ascertain, since the passage in the *Han-fei-tzŭ* cannot be confirmed. All similar accounts credited to the older ages, I am sure, are quite false.

Of what construction it was is my next question. In all the accounts mentioned above, we can find no statement about the inner plan but only that of the outward. For the first time, a description of the inner part occurs in the biography of Tsu Ch'ung-chih, a mechanic, which is inserted in the *Nan-ch'i-shu* 南齊書. It states that the Emperor Yao Hsing's Chih-nan-ch'ê, which Wu-ti of the Sung dynasty captured in Kuan-chung 關中, had no inner machinery at all, but whenever it was put in motion, a man had to move the apparatus from the inside; that in the era of *Shêng-ming*, an Emperor of the Sung period, made Tsu Ch'ung-chih construct it after the ancient method; that he constructed a machine of copper which moved smoothly, always pointing to the south without deviation.[3] Hirth says in regard to the Yau Hsing's chih-nan-ch'ê that he is inclined to assume that this remark strongly suggests the use of a compass, the man who had to step

1) The *Ku-chin-wei-shu-k'ao*, in the *Tzu-lei* 子類, pp. 19–20.
2) The *Sui-shu*, Ch. XXXIV, p. 2.
3) The *Nan-ch'i-shu*, Ch. LII. p. 4.

inside giving the chariot the direction ascertained from it. Indeed, his remark may be quite reasonable. I think, however, it was not necessary to use a compass to correct it, since there was no need to fix the direction precisely as a van of the Imperial cortège. Moreover, we can find much more detailed descriptions of its inner plan in the *Yü-fu-chih* 輿服志 of the *Sung-shih,* which occur in the year of *T'ien-shêng* 天聖 (1027 A. D.) in the reign of the Emperor Jen-tsung 仁宗 and in the first year of *Ta-kuan* 大觀 (1107 A. D.) in the reign of the Emperor Hui-tsung 徽宗. According to these statements, the south-pointing vehicle made in the reign of Jên-tsung was constructed in complicated system of five cogged and four non-cogged wheels; one of which, being put in the center, was the largest wheel, 4 *ch'ih* 尺 8 *ts'un* 寸 in diameter; and on either side of the wheel two amaller cogged wheels 1 *ch'ih* 2 *ts'un* in diameter, and two others 2 *ch'ih* 4 *ts'un* in diameter were put respectively; the last two or four smallest non-cogged wheels of only 3 *ts'un* in diameter in the lower places, another two non-cogged wheels being the wheels of the vehicle.[1] In the reign of the Emperor Hui-tsung, the vehicle was constructed in a much more complicated system of twenty four cogged and four non-cogged wheels. It is quite certain, therefore, that at least in the Sung dynasty the south-pointing vehicle had no relation to a magnetic needle. In the time before the Sung dynasty, however, we can not ascertain how the inner part was constructed. Yet, from its outward form, which was almost the same as that in the *Sung-shih,* we presume that it also may have possessed similar device inside, although it is a matter of cource that the similarity of its outward appearance does not necessarily signify resemblance of the inside. Above all, the account in the *Nan-ch'i-shu* indicates that the vehicle in that period was of a similar kind of machinery as those in the Sung dynasty.[2] Moreover, the account with regard to it does not occur by itself in most cases, but is generally accompanied by an account of a *chi-li-ku-ch'ê* 記里鼓車, or a "taxicab," an instrument equipped with a drum in order to announce every Chinese league travelled. According to the minute description in the *Sung-shih,* we can also learn of its machinery which was constructed in a similar complicated system of several cogged wheels.[3] In a word, it is quite clear that the chih-nan-ch'ê accompanied by a *Chi-li-ku-ch'ê* was used as a van of the Imperial cortège, both being of similar construction.

Hirth already indicated, as mentioned above, both of the passages dealing with the *chih-nan-ch'ê* in the *Yü-fu-chih* of the *Sung-shih.* Afterwards, Giles first gives a full translation of the former passages, but he does not

1) The *Sung-shih,* Ch. CXLIX. p. 4.

2) The *Nan-ch'i-shu,* Ch. LII, p. 4. The text: 昇明中, 太祖輔政, 使沖之修古法, 沖之改造銅機, 圓轉不窮, 而司方如一.

3) The *Sung-shih,* Ch. CXLIX. p. 4.

mention the latter at all. On the other hand, Hopkinson tells us that he found, after consideration of the details of the "compass chariot," it was rather difficult to reconstruct from the description translated by Giles, regretting the general vagueness of the statements. Therefore, GILES asserts that the "south-pointing chariot" can not be made to work, and the *Times* reports that it was doubtful if this chariot was ever made to work at all.

Nevertheless, I can not believe the detailed description of the mechanical vehicle as a fanciful statement while the "taxicab" was successfully set up. As in ancient times, in oriental states as Japan and China, there was a custom of keeping secret important points of all inventions, so it is not uncommon that one meets with difficulty to reproduce it. When HOPKINSON wrote, therefore, a letter to GILES, telling him that it is rather difficult to reconstruct from the description, I wonder why Giles did not give a full translation of the latter one in the *Sung-shih*? The latter detailed description being much more complicated is quite different in several points from the former. I made, therefore, a full translation of the latter detailed description in the *Sung-shih*. Afterwards I found a full translation of the same by A. C. MOULE, who indicated GILES' mistranslations of the former description in the *Sung-shih*, saying that Professor HOPKINSON would have been able to speak quite differently, if it had not been for the accidental omission of one clause, and misunderstanding of one word, and if two important gaps in the specification itself had been filled in from the second more detailed specification which Professor GILES does not translate or even mention. He also translated the firat specification more accurately and gave a plan illustrating on the construction of the vehicle, while he made a full translation of the second specification.[1] There is no doubt, therefore, that the south-pointing vehicle was constructed on mechanism in the Sung dynasty, and my translation of the latter now is needless.[2]

There is one other question left to be settled, however, *i. e.* whether the sketch of a chih-nan-ch'ê which we find in the *San-ts'ai-t'u-hui* 三才圖繪 is in such a form, as to indicate that it was constructed to work by magnetic force. It is identical with that which Giles found in the *T'u-shu-chi-ch'êng* 圖書集成, for the latter is the reproduction of the former. Even if it is accepted as a fact, the description of it states that it was found in the era of *Yen-yu* 延祐 (1314–1320 A. D.).[3] *Yen-yu* is the name of the era of Jên-tsung, an emperor of the Yüan 元 dynasty and *San-ts'ai-t'u-hui* has been compiled in the Ming dynasty. On the other hand, as I shall show later,

1) *T'oung Pao*, Vol XXIII, pp. 83–98.

2) GILES and MOULE translated the Chinese measure, a *ts'un* 寸, into an inch of the English measure, but it is an error, for a Chinese foot or a *ch'ih* 尺 contains ten *ts'un* while a foot is composed of twelve inches.

3) The *San-ts'ai-t'u-hui*, in the *Ch'i-yung*, 器用 section, Ch, V.

it is quite certain that the magnetic needle was already known in those periods in China. Therefore, it is not impossible that it was made by the application of magnetic force. I may add in passing that a "south-pointing boat," an account of which occurs in the *Sung-shu*, was perhaps only dreamed of fancifully in connection with the "south-pointing vehicle," for this is a single isolated account in all Chinese texts.

Now, it is an important question for us to decide when the magnetic needle was invented in China. The earliest account of the lodestone in Chinese literature, as far as I know, occurs in the *Lü-shih-ch'un-ch'iu* 呂氏春秋, a work which was compiled under the superintendence of Lü-pu-wei 呂布韋, a prime minister of the Ch'in about the end of the Chou dynasty, where it is defind as follows; "The lodestone calls the iron or attracts it."[1]

Besides, we can find also similar accounts in the *Shan-hai-ching* 山海經,[2] the *Kuan-tzŭ* 管子,[3] the *Kuan-yin-tzŭ* 關尹子,[4] and the *Huai-nan-tzŭ* 淮南子.[5] The *Shan-hai-ching* and the *Kuan-tzŭ*, however, are both generally believed to have been works in the later age, although, it is contended that the former is the earliest geographical record in China, and the latter, the work written by KUAN-YIN-TZŬ in the Ch'un-ch'iu period, or in the middle period of the Chou dynasty. The *Kuan-yin-tzŭ* is beliebed to have been a work of a scholar named YIN-HSI 尹喜, Kuan-ling 關令 or a chief of a barrier, who was a contemporary of Lao-tzu 老子. In the *I-wên-chih* 藝文志 or the bibliography in the *Han-shu*, there is recorded the *Kuan-yin-tzŭ*. We can not, however, find the name of this book in the bibliographies in the *Sui-suh* and the *T'ang-shu*, but it is said that this book was again in the house of Sun Ting 孫定 at the *Yung-chia* 永嘉 in the southern Sung dynasty. It is supposed, therefore, that the original book was lost early, and the latter, as we see now, was produced spuriously in the T'ang or the Wu-tai period as the *Tsung-mu-t'i-yao* asserts. The *Huai-nan-tsŭ* was compiled in the Han dynasty. Therefore, it may be assumed that since about the end of the Chou dynasty the power of the lodestone was already known in China. Yet, there is no evidence that in those days also the polarity of a lodestone or a magnetic needle was known. Although in the *K'ang-hsi-tzŭ-tien* 康熙字典, a Chinese dictionary compiled in the reign of the Emperor Shêng-tsu 聖祖 in the Ch'ing dynasty, a passage is quoted which states that the *Tz'ŭ* 磁 is the name of a stone with which may attract a needle as the description tells of a Chinese character 磁 which is to be found in the *Shuo-*

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1) The *Lü-shih-ch'un-ch'iu*, Ch. IX. The text: 慈石召鐵, 或引之也.

2) The *Shan-hai-ching*, Ch. III. The text: 灌題之山, 匠韓之水出焉, 卽西流注于泑澤, 其中多磁石.

3) The *Kuan-tzŭ*, Ch. LXXVII. The text: 上有慈石者, 下有銅金, ...此山之見榮者也.

4) The *Kuan-yin-tzŭ*, Ch. VI. The text: 磁石無我, 能見大力.

5) The *Wei* (or *Huai*)*-nan-tzu*, Ch. XVI. The text: 磁石能引鐵.

wên 說文, a Chinese dictionary compiled in 121 A. D., I am very surprised, however, to see that we can not find such a character in the dictionary *Shou-wên*. KLAPROTH also fell into an error in consequence of this false statement. We can find, however, the statement "a lodestone attracts a needle" in the *Lun-hêng* 論衡, written by a scholar WAN CH'UNG 王充, who lived about the years 30–100 A. D. in the period of the eastern Han dynasty.[1] Although we have a passage in the *Kuei-ku-tzŭ* as follows:[2] "A lodestone takes a needle, as a tongue takes a roast bone," the account in the *Lun-hêng* is the first Chinese text referring to the attractive power of a lodestone for a needle, as far as I know, for the *Kuei-ku-tzŭ* is a later work as mentioned above. In the *P'êi-wên-yün-fu* 佩文韻府, just the same sentence with that which is found in the *Lun-hêng* is quoted as an account in the *Yen-t'ieh-lun* 鹽鐵論 written about 81 B. C.; however I can not find such a sentence in the latter book at all.[3] I have found with interest a passage in the *Wa-myô-rui-jû-sho* 和名類聚抄 compiled in Japan about the years 923–930 A. D., which states that a lodestone attracts a needle.[4] These descriptions which indicate that a needle is attracted by a lodestone give us a gentle hint to doubt whether a magnetic needle was already known in those periods. It is a matter of course, however, that we should not be sure of it. Therefore, so far as I know, the earliest obvious Chinese account of the magnetic needle is that which occurs in the *Mêng-ch'i-pi-t'an* 夢溪筆談, a work written by SHEN KUA 沈括 who lived in the years 1021–1085 A. D. It states that a *fang-chia* 方家, or a geomancer, rubs the point of a needle with a lodestone to make it point to the south, but it will always deviate a little to the east and not show due south; that to use the needle it may be put on water, but it would not be steady, and also it may be put on the nail of a finger or on the lip of a bowl, but it is too apt to drop, although its motion is very brisk; that the best method is to hang it by a thread, and to prepare the contrivance one had to single out a fine thread from a new skein of silk floss and fix it with a bit of bees' wax on the middle of the needle, the latter to be hung up where there was no wind; that the needle would then always point to the south; that on rubbing a needle with a lodestone, however, it may happen by chance to point to the north, and he, the author, owned needles of both sorts; and that no one could as yet find out the principle of it.[5] We can find also a similar account in the *Mêng-ch'i-pu-pi-t'an* 夢溪補筆談, or the supplement of the *Mêng-ch'i-pi-t'an*.[6]

1) The *Lun-heng*, Ch. XVI. The text: 頓牟掇芥, 磁石引針.
2) The *Kuei-ku-tzŭ*, Ch. II, 若磁石之取鍼, 舌之取燔骨.
3) The *P'êi-wên-yün-fu*, Ch. XXVII.
4) The *Wa-myô-rui-ju-shô*, Ch. II. The text: 慈石吸針.
5) The *Mêng-k'i-pi-t'an*, Ch. XXIV.
6) The *Meng-k'i-pu-pi-t'an*, Ch. III.

Next to it, a similar mention occurs in the *Pên-ts'ao-yen-i* 本草衍義, a work compiled by K'OU TSUNG-SHIH 寇宗奭 about the year 1116 A. D. The only other mention from the account of the *Mêng-ch'i-pi-t'an* is that which gives a description stating that on sticking the needle through a piece of lamp wick or pith, and then floating it on water it would also point to the south with a slight deviation.[1] It is very strange, indeed, that in the same period, (SHEN KUA being a scholar in the reign of the Emperor Jên-tsung 仁宗 and K'ou Tsung-shih, a botanist in the reign of the Emperor Hui-tsung in the Sung dynasty) the so-called "south-pointing vehicle" mentioned above was constructed with the machinery based on a system of some cogged and non-cogged wheels. It is too clear to overlook that even in this period when the magnetic needle was well known no one hit upon the idea to apply it for the "south-pointer." When we consider this fact, how can we suppose its application in the early ages? Furthermore, it is particulary interesting to see that the account of the "south-pointing vehicle" are found successively in the authentic Chinese histories from Chin dynasty to the Kin 金, while in the records of the period—since the Yüan or the Ming—when accounts on the magnetic needle may be found frequently, we can perceive no evidence that the so-called *Chih-nan-ch'ê* was in practical use. Indeed, we can distinctly note, therefore, that there was no connection between the *Chih-nan-ch'ê* and the compass.

Nevertheless, HIRTH imagines that as early as the fourth century B. C. some sort of a contrivance indicating a south direction existed or was believed to have existed in former times and it appears that the secret of the chariot had been lost for many centuries, when the eminent astronomer Chang Hêng reconstructed it, but in the troubles causing the downfall of the eastern Han dynasty his model, too, was lost and consequently forgotten. As for the times of the Han dynasty, it may be imagined, as asserted above, that some sort of a contrivance indicating the south existed or was believed to have existed, if we take the passage in the *Han-fei-tzŭ* as the text in the period of the Han dynasty, and if the passage in the *Shu-chih* may be taken to presuppose the existence of a "south-pointer," and also if the accounts of the *Wei-liao* and the *Sui-shu* may be taken to suggest it. As to such an early age as the fourth century B. C., however, we can say nothing at all, for we have no evidence in Chinese texts. We have to conclude too, the word, *ssŭ-nan* or *chih-nan* may have happened to be used fancifully in the meaning of a "Guide," if the story of Huang-ti or Chou-kung existed, though the "South-pointer" did not exist in reality.

HIRTH says, moreover, that the *Ch'ao-yeh-ch'ien-tsai* 朝野僉載 compiled by CHANG TSU 張鷟, who lived in the T'ang dynasty, states that in 692

1) The *Pên-ts'au-yen-i*, Ch V.

A. D. a mechanic was sent to the court from Hai-chou 海州, who had constructed a "chariot showing the twelve hours of the day" (*shih-êrh-ch'ên-ch'ê* 十二辰車); and that it looks very much as though the magnetic needle had something to do with it.[1] But I can not find that the chariot had any relation to the magnetic needle, for any one who reads properly the Chinese text as "when the shaft points to the south rightly the front gate of the imperial palace is opened....."[2] would understand it certainly as a mechanism. Hirth states also that Dr. EDKINS, in his paper "*On Chinese Names for Boats*," quotes WYLIE in showing that the Buddhist priest and imperial astronomer I-hsing 一行 knew not only the south-pointing qualities of the magnetic needle but also its eastern deviation at the beginning of the eight century; but that since no references are given he is not able to confirm the fact.[3] The ground on which Wylie depends to back this argument is as follows: "On comparing the needle with the north pole, I-hsing found the former pointed between the constellations Hü 虛 and Wei 危. The pole was just in 6 degrees of Hü, from which the needle declined to the right (east) 2°95′. As it declined to the right of the north pole, it was necessarily to the left of the south pole." Edkins adds that he has not succeeded in finding this passage in the lives of the priest I-hsing he was able to consult, but takes it for granted, on the excellent authority of the late Mr. WYLIE, that it is contained in some other Chinese text.[4] I have failed also to find such a passage, not only in the lives of I-hsing, but also in the astronomical record in the *T'ang-shu*, which contains mainly a mention of the deeds of I-hsing. I can not be certain of course whether it may be found in a certain record or not, but a passage in the astronomical record in the *T'ang-shu*, which resembles it, I think, has no connection to the magnetic needle. For I question whether the Chinese text is quoted properly by WYLIE. In the first place, he assures us that the account which he quoted indicates that the needle points between the constellations Hü and Wei, and the pole was just in 6 degrees of Hü. However, the constellations being the asterisms along the ecliptic, they are situated at a good distance from the pole. The astronomical record in the *T'ang-shu* states that the pole is situated within a distance of 104 degrees from Hü and of 97 degrees from Wei; that the north star of Hü was situated within the constellation Hü in the old table, but now observing the heavens it is within 9 degrees of Hsü-nü 須女, and the north star of Wei, within the constellation Wei in the old table, but now within 6 degrees and a half

1) HIRTH, *op. cit.*, p. 132.
2) The text: 海州一匠, 造十二辰車, 廻轅正南, 則午門開.
3) HIRTH, *op. cit.*, p. 131.
4) HIRTH, *op. cit.* pp. 135–136.

of Hü.[1] I suppose Wylie's description which states that the pole was just in 6 degrees of Hü, may have been a similar error to the statement which means that on observing the heavens, the north star of Wei is just within 6 degrees and a half of Hü. The north star of Wei, I think, does not mean the pole in such a case, but it means the star which is situated in such a case, but it means the star which is situated in the north of the constellation Wei; and this sentence means that the star which was situated in the north of constellation Wei in the old table, now is just within 6 degrees and a half of Hü.

So far as I know, the earliest unmistakable Chinese account of the use of a magnetic needle as a guide to mariners, as Hirth remarks, occurs in a work of the twelfth century, entitled *P'ing-chou-k'o-t'an* 萍洲可談 and compiled by Chu Yü 朱彧, a native of Hu-chou 湖州 in Chê-kiang 浙江.[2] Also, as Hirth states, in the second chapter of this work the author has inserted a series of notes on the foreign trade at Canton, which previous to the arrival of the Portuguese in Eastern waters had been in the hands of Arab and Persian navigators. Since he himself never lived at Canton, whereas his father, Chu Fu 朱服, had held office there at the end of the eleventh century, his information about the foreign trade in Canton is based on accounts of the father, and it therefore dates from the latter part of the eleventh century. This view is supported by the fact that the years 1086 and 1099 are mentioned in Chu Yü's paragraphs referring to Canton in other connections.

Besides, in the *Tung-hua-lu* 同話錄, written by Ts'êng San-i 曾三異 about the end of the twelfth century, we can find an account with regard to the *Tzŭ-wu-chên* 子午針, or a compass, which account states distinctly the deviation of a magnetic needle.[3] After Parker, by the way, Dr. Edkins says that the use of the compass by the Chinese envoy to Corea in 1122 is the oldest known record of its employment in the literature of any country,[4] but I failed to find such a passage in Chinese texts. Even if it may be found hereafter, it is not the oldest record even in China, as I have asserted above.

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1) The *T'ang-shu*, Ch. XXXI, in the *T'ien-wên-chih* 天文志. The text: 其所測宿度, 與古異者, 舊經, 角距星去極九十一度, (中略) 虛百四度, 危九十七度; 虛北星, 舊圖入虛, 今測, 在須女九度, 危北星, 舊圖入危, 今測, 在虛六度半. The *Chiu-t'ang-shu*, Ch. XXXV, in the *T'ien-wên-chih*. The text: 虛二星十度, 舊去極百四度, 今一百一度, 北星舊圖入虛宿, 今測, 在須女九度; 危三星十七度, 舊去極九十七度, 今九十七度, 北星舊圖入危宿, 今測, 在虛六度半.

2) Hirth, *op. cit.*, pp. 133–134. The text in the *P'ing-chou-ko-t'an* is as follows: 舟師識地理, 夜則觀星, 晝則觀日, 陰晦觀指南針, 或以十丈繩鉤, 取海底泥嗅之, 便知所至, 海中無雨, 凡有雨則近山矣.

3) The *T'ung-hua lu* in the *T'ao-shih-chi-shu* 陶氏輯書, Ch. XXIII; or in the *Shuo-fu* 說郛, Section XXIII. The text: 子午針, 地螺或有子午正針, 或用子正丙壬間縫針, 天地南北之正, 當用子午, 或謂江南地偏, 難用子午之正, 故以丙壬參之.

4) The *China Review*, Vol. XVIII, p. 197.

In short, there is no definite Chinese record of a magnetic needle or a compass till the middle of the eleventh century. Yet in this first reliable text we can already perceive not only the remark on its eastern deviation, but also some steps of its development. We may assert, therefore, that the invention of the magnetic needle must have been made in a preceding age.

We have the last question as to where it was first invented in the world. In Europe, according to KLAPROTH, a vague idea of the attraction of a lodestone to iron had already been known to the philosopher THALES (639–548 B. C.) and to the Athenian scholar THEOPHRASTOS (371–286 B. C.), its evidence, for instance, being such an account as THEOPHRATOS' *On the Stone.*[1] The earliest reliable account in Chinese literature, as above mentioned, being that in the *Lü-tzŭ-ch'un-ch'iu* compiled about the years from 249 to 237 B. C., it occurs earlier in the Grecian literature than in the Chinese. If in those ages, therefore, it may be perceived that China communicated directly or indirectly with the western countries, the knowledge of the power of the lodestone also may have been introduced from the West. Or it may have been separately discovered in the East and the West. However, KLAPROTH assures us that in the ages of Greece and Rome the polarity of the lodestone or the magnetic needle was not yet entirely known; that so-called ARISTOTOLE's *Of the Stone* in which the polarity of the lodestone is mentioned is crearly a false work which was forged in a later age. So far as I know it seems to be quite certain that in Europe the earliest reliable record of the magnetic needle is the satirical poem entitled *La Bible,* which was written by GUYOT DE PROVINCE about the year 1190.[2] But the *Encyclopædia Britannica* states that the earliest definite mention as yet known of the use of the mariner's compass in the Middle Ages occurs in a treaties entitled *De Utensilibus,* written by Alexander NECKAM in the twelfth century where he speaks of a needle carried on board ship which, being placed on a pivot, shows mariners their course when the polar star is hidden; that the magnetical needle, and its suspension on a stick or straw in water, are clearly described in *La Bible Guiot,* a poem probably of the thirteenth century, by GUIOT DE PROVINCE. *The International Encyclopædia* also gives well-high the same description as that in the *Britannica.* The *Lexicon* agrees with KLAPROTH's view, maintaining *La Bible* which was written about the year 1190 as the earliest definite mention; and *Nouveau Larousse Illustré* also states the same opinion as the view of MEYER's *Lexicon,* except the date of the poem which is mentioned to have been written in the year 1180. However, the *Britannica's* description is quite untenable, because it is not reasonable to take it that the use of a magnetic needle placed on a pivot

1) KLAPROTH's Schreiben, SS. 25–26.
2) *Ibid.,* SS. 25–44.

was discovered earlier than the use of it placed on a stick or straw in water. Anyway, we can assert that it should not go back more than the twelfth century in Europe. As for the deviation of a magnetic needle, after KLAPROTH's research, we for the present should follow the view which indicates that it was discovered about the middle of the fifteenth century.[1] Granting that these conclusions are errorless, the first allusion to the magnetic needle in Chinese literature is earlier by about a century or more than that in Europe, and also the knowledge of its deviation is found in Chinese records about three centuries or more earlier.

In regard to Arabia I have been not able to investigate but only a few original works which have given me no clue to settle the present question, so that I have had mainly to depend on the quotations of others. Therefore I have not such good grounds as to assert decisively when and how the magnetic needle was known and used there for the first time. So far as I know, however, it may be assumed that the polarity of the lodestone or the magnetic needle may have been first used in Arabia about the twelfth or the thirteenth century. According to KLAPROTH's opinion, provided that BAILAK's *Schatz der Kaufleute zur Kentniss der Stein* is the earliest reliable account on the polarity of a lodestone used by Arabs, and that this first unquestionable date is about the year 1242, the record in Europe is earlier by about half a century, and the Chinese record, by about a century and a half.[2] On the one hand, however, the surviving Arabian records are very scarce, and on the other, all the accounts in Europe not only do not claim a European origin, but also indicate the introduction from the East. In such a case we may be inclined to believe that it originated in China at first, and then was introduced to Europe through the intermediation of Arabs. KLAPROTH asserts, therefore, that the Europeans introduced the compass through Arabians from China.[3] Hirth states also on citing an account in SHÊN KUA's *Mêng-k'i-pi-t'an* that, since SHÊN KUA was a native of Hang-chou, where in those days a lively traffic existed with Arab and Persian traders, it seems quite possible that the latter had seen the needle used for geomantic purposes somewhere in that neighbourhood, if not in Chinchew or Canton, learned the secret of its preparation from the Chinese, and discovered its further use in navigation. Quoting a passage in CHU YÜ's *P'ing-chou-k'o-t'an*, which states that in clear weather the captain ascertains the ship's position at night by looking at the stars, in the daytime by looking at the sun, but in dull weather he looks at the south-pointing needle, HIRTH concludes that he is inclined to think that attempts to use the needle on ships must have been made in China about as early as it was known

1) *Ibid.*, SS. 45–49.
2) *Ibid.*, SS. 21–25.
3) *Ibid.*, S. 12.

there to geomancers, but that it was abandoned as a useless luxury by the conservative junk masters; that the magnetic needle was seen by Arab traders on the coast of China in the hands of geomancers, was applied by them to navigation, and was then brought back to China as the "mariner's compass."[1] Whether his assumption proves correct or not, however, is a grave and difficult question. The passage written by BAILAK, which KLAPROTH quoted as the earliest account on the polarity of lodestane in regard to Arabs, states that in the Sea of Syria, Arab steersmen used the porality of a lodestone to ascertain the ship's position, when at night, the weather was too dull to see the stars; that for this purpose one put in the inside of the ship in order to keep it away from the wind a vessel filled with water, on which a needle struck in crossform through a piece of block or halm was floated, and then approaching a plam-sized or a little smaller lodestone over the needle he slewed it round to the right, so that the needle also moved round along with it, and suddenly withdrawing his hand, the needle indeed pointed to the north and south. BAILAK also says that he saw such a scene on a voyage from Tripolis to Alexandria in Egypt in the year 640 (1242–1243 A. D.), and moreover, he heard from others that in the Indian Sea sailors used a hollow iron fish which, being put on the water, floated to point to the north and south.[2] As above mentioned, it is quite plain that in China the permanent magnetic needle and even its deviation were know already about the middle of the eleventh century and also such a needle was used in ships to ascertain their position about the end of the century. In spite of these facts in China, the Arab sailors, as above stated, used the temporary magnetic needle even in 1242. If Arab sailors learned the use of the magnetic needle from China, it is very strange to see such a point of difference. Whether the hollow iron fish which is said to have been used in the Indian Sea was a temporary or permanent one we can not ascertain decisively, but it seems more likely that it was the former, because there is no particular description about the latter. There is no reason to believe that they learned its deviation. Moreover, if Arab sailor learned the use of the magnetic needle from China, I think it is more reasonable to suppose that they learned its application to navigation as well, for Chinese sailors already applied it for that purpose even in the eleventh century.[3] Or, granting

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1) HIRTH, *op. cit.*, pp. 133–134.

2) KLAPROTH'S Schreiben, SS. 22–23.

3) We can find another definite evidence which indicates that Chinese sailor used the magnetic needle for navigation in the introduction of the *Chin-la-fêng-t'u-chi* 眞臘風土記 written by CHOU TA-KUAN 周達觀 about 1297, although it is not the earliest account of the use of the magnetic needle for navigation. The text: 眞臘風土記序云, 自溫州開洋, 行丁未針, 歷閩廣海外諸州港口, 過七洲洋, 經交趾洋, 到占城, 又自占城, 順風可半月, 到眞蒲, 乃其境, 又自眞蒲, 行坤申針, 過崑崙洋入港, 港凡數十, 惟第四港可入, 其餘悉以沙淺故,不通巨舟.

that in the period of the eastern Han the attraction of a lodestone to a needle being already known, there will be a little probability to suppose that in the time of the T'ang dynasty Arab sailors learned the use of the polarity of a lodestone from there. This conclusion, however, is too uncertain a supposition to be proposed even as a hypothesis, in such a case as we can also suppose that in Arabia it may have been discovered without connection to China, and as we have no clear evidence to assert it. Unless a more positive proof can be discovered, therefore, we can not decide whether its relation is unquestionable, even if we have just to be certain for the present that the magnetic needle, its application to navigation and its deviation were first discovered in China. As for Europe I have also no authority to decide the relation to Arabia, but I have a little inclination to doubt whether the invention of the magnetic needle in Europe owed anything to the Arabs, as a great part of the western civilization did. Turks, Indians, Persians, Finns and so on have all claimed to be the originators of the magnetic needle. But there is hardly any evidence for this contention except to depend upon the uncertain linguistic comparison, and of course we can not give it a strong support. Moreover, the opinion advocated by GILBERT and COLCHESTER that Marco Polo first brought it from the East to Italy in the year 1260 seems to have been proposed only to persist in the view of its Italian origin. By the way, MEYER'S *Konversation-Lexicon* states that in the year 1260 the knowledge of the compass was brought by *Paulus* VENETUS from China to Japan. This view, however, is a great mistake. In Japan the lodestone was clearly known since the beginning of the eighth century, and as above mentioned, an account of the attraction of a lodestone to a needle occurs first in the *Wa-myô-rui-ju-shô*, but records of the compass or the magnetic needle we can not find, so far as I know, up to the middle of the Tokugawa period.

To sum up, we may say that the "south-pointing vehicle," or the *chîh-nan-ch'ê*, has no relation to the polarity of a lodestone or the magnetic needle, and even if it seems likely that the lodestone may have been known separately in the West and the East, the magnetic needle, its deviation, and perhaps their application to navigation were discovered in China for the first time; that however, we have no reliable evidence to decide whether the knowledge in China had some relation to that in Arabia and in Europe. At any rate, it seems certain that Arab sailors made use of the polarity of a lodestone or a magnetic needle for a long time to ascertain their ship's position. At last in Europe it developed into the perfect mariner's compass, while in China we cannot perceive any improvement of it, untill the mariner's compass was introduced there from the West.