

The Morris CollectionCatalog No.Description

C174

Korean breech-loading bronze cannon with iron chamber

Markings: Extensive Chinese inscription on lower right side of breech, not translated at this writing. Former owner states that in part it means "cannon number 147. a Ferenghi cannon of the fourth class. Weight-97 catties" etc., and that it was made in mainland China about 1550 A.D. (this I doubt).

Measurements: Length: 41"
Weight: about 130 pounds
Bore: 1 3/8 "

The cannon came from the estate of a retired Navy or Marine Corps officer named Rowan(?), near Mount Holly, N.J. about 1950. Originally, it must have been among those captured during the Marine amphibious landing in Korea in 1871. The Naval Historical Foundation publication Marine Amphibious Landing in Korea, 1871, compiled by Miss Carolyn A. Tyson, Historical Branch, G-3 Division, HQ, USMC, consists of letters of Captain McLane Tilton, USMC, who commanded the Marine detachment in the action. In several places Capt. Tilton refers to these weapons, which were being used to defend the Korean forts. In one passage he calls them "insignificant breech-loading brass cannon." There is an identical cannon on display at the Marine Corps Historical Center in the Washington Navy Yard.

This cannon is in the style of 16th. Century bronze breech-loaders with removable cast iron chambers, which were popular throughout Europe for use as shipboard anti-personnel weapons. Several chambers could be loaded and placed near a piece, thus enabling fairly rapid fire by merely changing chambers to load. The cannon has very unique and distinctive lines leaving no doubt that it is of the same origin as its twin at the USMC Historical Center.

Whole No.	Plain		Whole No.	Plain	
	copies	Bound copies.		copies	Bound copies.
1.....	197	...	31.....	31	...
2.....	199	...	32.....	1	...
3.....	58	...	33.....	13	...
4.....	148	...	34.....	105	...
5.....	120	...	35.....	104	...
6.....	3	...	36.....	259	...
7.....	8	...	37.....	165	...
8.....	33	...	38.....	245	...
9.....	40	...	39.....	140	...
10.....	8	...	40.....	627	...
11.....	211	...	41.....	253	...
12.....	54	...	42.....	127	...
13.....	4	...	43.....	290	...
14.....	5	...	44.....	279	...
15.....	3	...	45.....	214	...
16.....	218	...	46.....	221	...
17.....	1	...	47.....	197	...
18.....	89	...	48.....	168	...
19.....	108	...	49.....	217	...
20.....	124	...	50.....	175	...
21.....	228	...	51.....	229	...
22.....	272	...	52.....	195	...
23.....	172	...	53.....	547	...
24.....	196	...	54.....	210	...
25.....	1137	...	55.....	222	...
26.....	200	...	56.....	592	...
27.....	288	...	57.....	165	...
28.....	3	...	58.....	204	...
29.....	220	...	59.....	169	...
30.....	250	...	60.....	1126	...

Very respectfully,

H. G. DRESSEL,

Secretary and Treasurer.

ANNAPOLIS, MD., Jan. 1, 1891.

Vol. XVIII., No. 2. 1892. Whole No. 62.

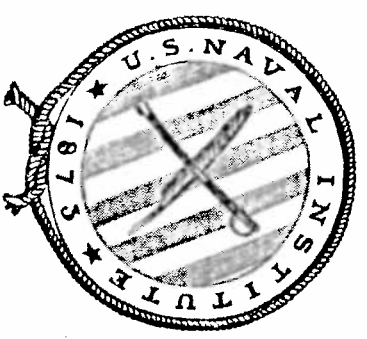
PROCEEDINGS

OF THE

UNITED STATES

NAVAL INSTITUTE.

VOLUME XVIII.



EDITED BY H. G. DRESSEL.

PUBLISHED QUARTERLY BY THE INSTITUTE.

ANNAPOLIS, MD.

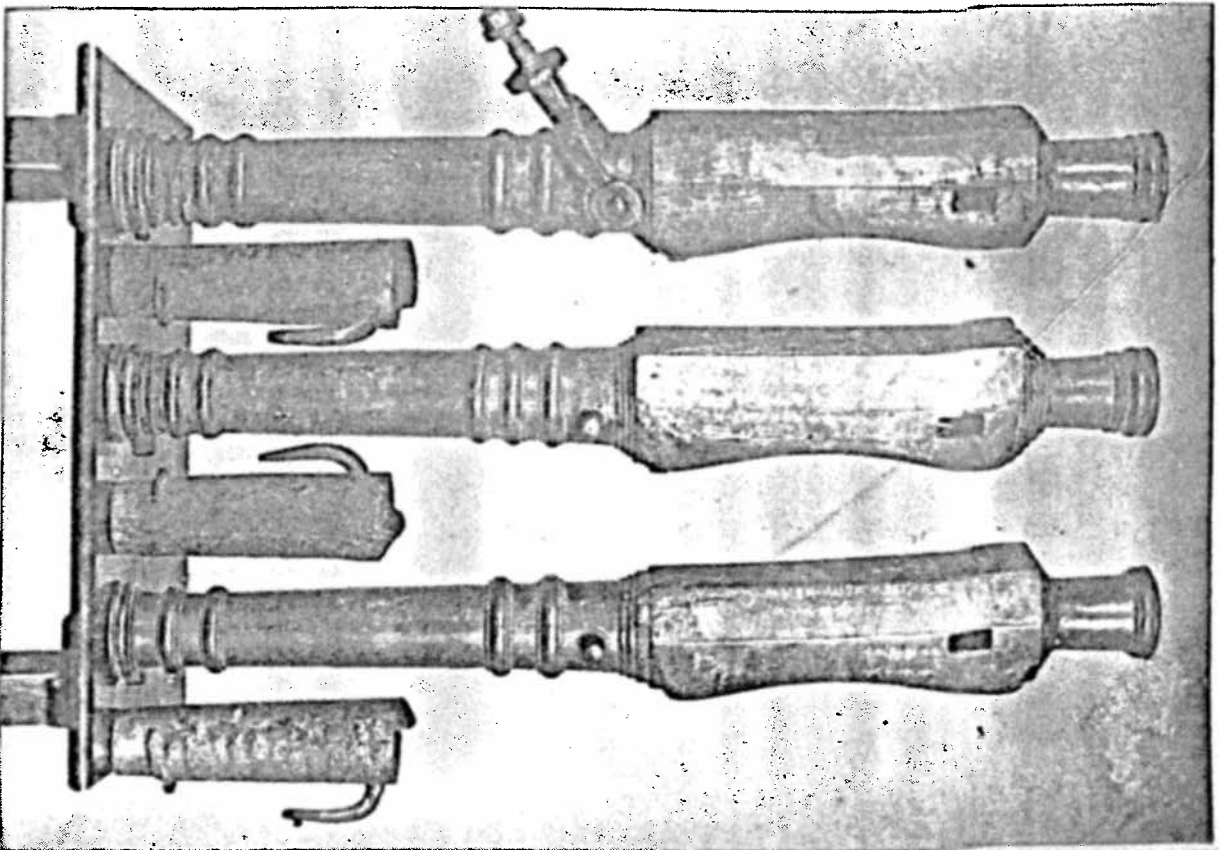
The writers only are responsible for the contents of their respective articles.

CONTENTS.

THE ESSAY FOR 1892: TORPEDO-BOATS: THEIR ORGANIZATION AND CONDUCT. By Wm. Laird Clowes,	181
CALIBRE AND ITS APPLICATION AS A PROTECTION TO VESSELS. By J. M. Cheneau,	221
OFFICIAL REPORT ON THE BEHAVIOR OF THE U. S. S. BALTIMORE. By Captain W. S. Schley, U. S. Navy, Commanding U. S. S. Baltimore,	235
ELECTRIC WELDED PROJECTILES. By Hiram Percy Maxim,	251
THE INFLUENCE OF RANGE-FINDERS UPON MODERN ORDNANCE, GUN-BATTERY, AND WAR-SHIP CONSTRUCTION. By Lieutenant Albert Clowes, U. S. Navy,	259
NOTES ON THE DATE OF MANUFACTURE OF THE THREE GUNS AT THE U. S. NAVAL ACADEMY, CAPTURED IN COREA BY REAR-ADMIRAL JOHN RODGERS. By Thomas Wm. Clarke,	265
INSTITUTIONAL NOTES,	305
The Screw Ferry-Boat.—The First-Class Cruiser Edgar.—The Frigate Electric Position Finder.—Engine and Helm Control.—The Harvey Patents,	319
PHOTOGRAPHIC NOTES,	319
ADVERTISEMENTS,	

*Copyright, 1892, by H. G. DRESSEL,
Sec'y and Treas., U. S. Naval Institute.*

PRESS OF THE FRIEDENWALD CO.
BALTIMORE, MD.



U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON THE DATE OF MANUFACTURE OF THE
THREE GUNS AT THE U. S. NAVAL ACADEMY,
CAPTURED IN COREA BY REAR-ADMIRAL JOHN
RODGERS, U. S. N.

By THOMAS W. CLARKE.

One of these three guns is of a slightly ruder type than the other two. Both the others contain a mechanical feature which this ruder gun lacks, the ratchet on the under-side of the bottom of the boxing of the breech-cavity for engaging the point of an elevating pawl when in battery. A convenient mechanical contrivance like this could not have been introduced into ordnance and then omitted from professional work without providing a substitute, unless the traditions and models of former work had been lost.

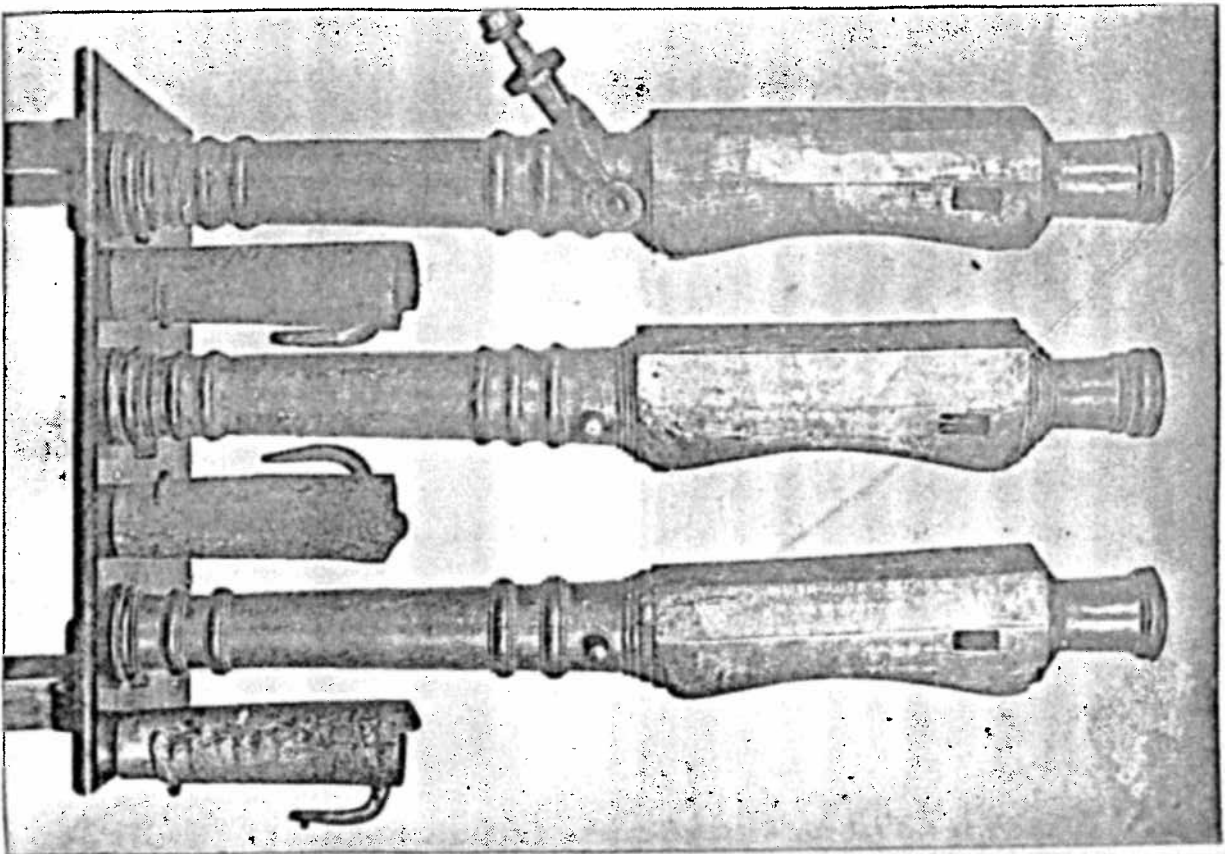
Chinese practice, still more than European, would respect the ancient and approved ways, and anybody would leave the better structure alone.

We may then, at this stage of the inquiry, and simply to settle the order of reading from latest to earliest, regard the gun without the ratchet as of earlier date than the guns with ratchets.

THE GUN OF 1680.*

All three guns bear inscriptions which have been translated by the accomplished scholar Wong-Chin-Foo, of New York. One of those with ratchets presents the longest inscription—55 characters. This reads:

* In the cut opposite, the left-hand gun, with swivel and nut, is the gun of 1680, the middle one is the gun of 1313, and the one on the right is the gun of 1665. The cartridge blocks are of cast iron and much honeycombed.



U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON THE DATE OF MANUFACTURE OF THE
THREE GUNS AT THE U. S. NAVAL ACADEMY,
CAPTURED IN COREA BY REAR-ADMIRAL JOHN
RODGERS, U. S. N.

By THOMAS W. CLARKE.

One of these three guns is of a slightly ruder type than the other two. Both the others contain a mechanical feature which this ruder gun lacks, the ratchet on the under-side of the bottom of the boxing of the breech-cavity for engaging the point of an elevating pawl when in battery. A convenient mechanical contrivance like this could not have been introduced into ordnance and then omitted from professional work without providing a substitute, unless the traditions and models of former work had been lost.

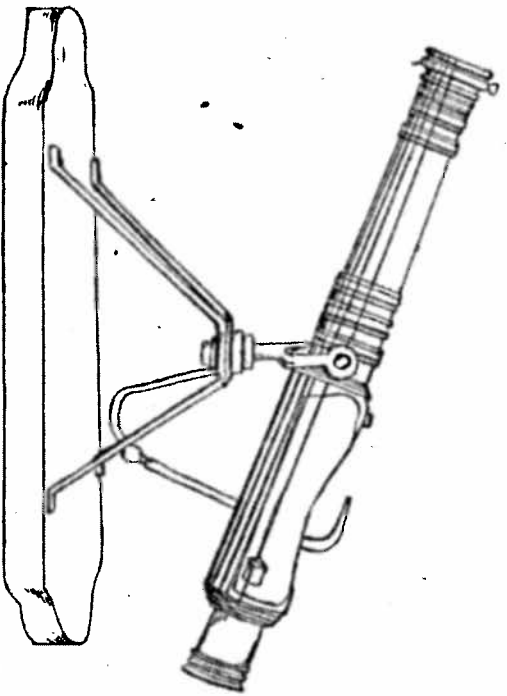
Chinese practice, still more than European, would respect the ancient and approved ways, and anybody would leave the better structure alone.

We may then, at this stage of the inquiry, and simply to settle the order of reading from latest to earliest, regard the gun without the ratchet as of earlier date than the guns with ratchets.

THE GUN OF 1680.*

All three guns bear inscriptions which have been translated by the accomplished scholar Wong-Chin-Foo, of New York. One of those with ratchets presents the longest inscription—55 characters. This reads:

* In the cut opposite, the left-hand gun, with swivel and nut, is the gun of 1680, the middle one is the gun of 1813, and the one on the right is the gun of 1665. The cartridge blocks are of cast iron and much honeycombed.



(Col. 1 at right) K'ang-Hi, 19 year 2 month day. (Col. 2) Tung-Chi-Shi whole company built for Kiang-do-dun its metal top, Fuhangkhi number 24 weight one hundred and one catty. (Col. 3) Gien-Chi-Gwen-Gwan-Ja (The casting General, superintendent acting) Chung Shin Ching. (Col. 4) Chief managing official Chow-Yi-Ho. (Col. 5) General of division Kiang-Chun. (Col. 6) Master workman Yu-Shun-jen.

K'ang-Hi was the regnal title employed by the second Emperor of the present dynasty. This title is indicated in this inscription as an imperial regnal title by having its first character slightly above the rest of the inscription; a curious etiquette which prevails in inscriptions, in proclamations, and in formal official documents, but not always in printed books. It is shown, however, in a page of a printed book which illustrates this article. There are now

spacing in the elevations. The present rules are recent and of this century. They are analogous to the black and red ink formalities of army papers in the United States.

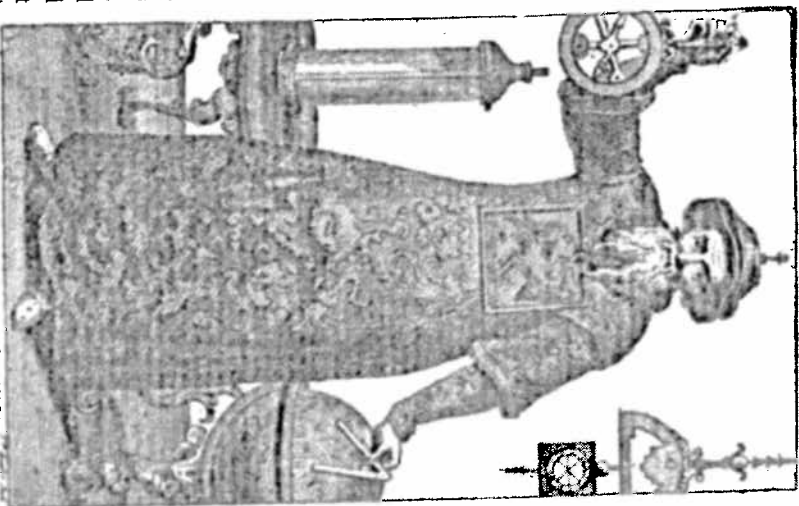
This Emperor came to the throne in 1662, when eight years old. His nineteenth year would begin in February, 1680. He reigned over sixty years, and

on his decease received the temple name of Shen-Tsujen-Hwang-Ti, by which he is spoken of in books written after his death.

He was educated in part by Father Adam Schaal, a Jesuit missionary who had been his father's tutor, and who held, on the demise of the crown, official position in the board of mathematicians.

Under the regency which ensued, and which lasted about four years, there was a religious, perhaps a national reaction.

The missionaries fell into disgrace and were imprisoned, but were released and restored to favor in or soon after A. D. well as to reign.

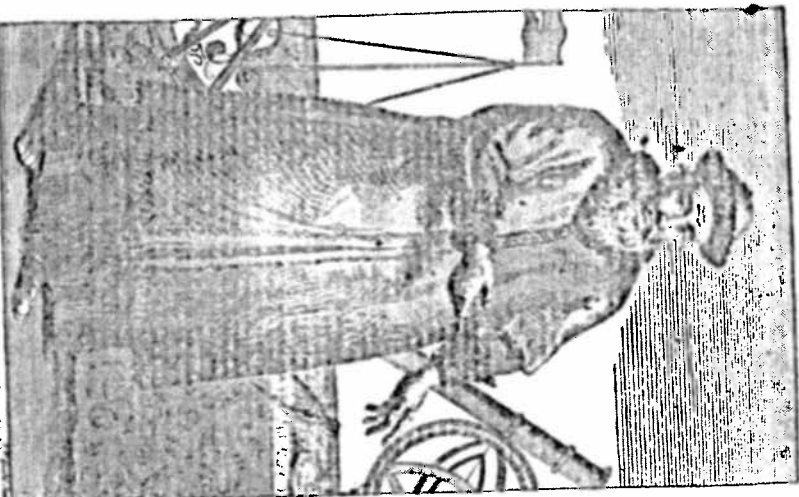


Isidor Adam Schaal, (Rings Missionary

or soon after A. D. 1666, when the Emperor began to govern as well as to reign.

For a century and a half the one undisputed Chinese fact among Europeans has been, that at this period the autochthonous skill of the Chinaman in ordnance and artillery was very limited, if not quite lacking. Nothing less than most convincing proofs can shake this conclusion. This proof is at Annapolis.

Father Duhalde relates that there were during his residence in China, somewhat later than this date, some bombardments at the gates of Nanking and some "Pattereroes" in the buildings on the sea-coast, but not skill enough in China to make use of them. In 1621 the city of Macao gave the emperor, Tien-Ki, three guns; to manage



Father Ferdinand Verbiest, Chinese Missionary.

which, Portuguese engineers were taken into Chinese service. These Macao guns proved terrifying to Tartars, so that in A. D. 1636, under the last Ming Emperor, during the Tartar invasion, at a time when there was a persecution of Christians for the purification of the empire, and to appease the divine wrath, Father Schaal was entrapped into admitting that he knew the European method of casting guns, and was ordered by the Emperor, Tsung Cheng, to instruct workmen in the art, and was assigned a proper place near the palace and allowed assistants from the imperial retinue.

Though not directly stated by contemporary European writers, it is believed by Williams and others that some guns were produced by Father Schaal. Duhalde says: "Use was made of this Means to introduce into the Empire a great number of Evangelical Workmen." Whatever was inaugurated by Father Schaal was but temporary, and his laboratory, if any was formed, had been broken up before 1670.

In 1665, Fathers Schaal and Verbiest were imprisoned in fetters, and Father Schaal was tried for his life and convicted, but he was released, pardoned, and died of a good old age, August 15, 1666.

While in prison, a controversy arose as to the accuracy of the official almanac, and the Jesuits, excepting Father Schaal, were taken out of prison, brought before the Emperor, and ordered to make a series of instrumental tests of the accuracy of its calculations. The date of this is not given, but it must have been before August, 1666. On proving the error of the official astronomers, Verbiest was ordered to find out the errors and correct the work, and another series of observations was made, the result of which was that in A. D. 1669 Father Verbiest became President of the Board of Mathematics. After this he caused to be made several altitude, azimuth, equinoctial and other measuring instruments, quadrants, sextants, and a celestial globe of great weight and size, from cast brass, with fine modeling and with very decorative features in the Chinese style.

After this work had been done, its mechanical excellence attracted the attention of the Board of War, probably about 1678, because about that time he finished his work on the calendar and presented his book of calculations to the Emperor, and was promoted in rank and awarded a title.

The Board of War obtained an order on Verbiest to instruct workmen in the art of cannon-casting, and "he cast 130 pieces with great success."

After this the Board obtained another order on Verbiest, by his Chinese title of Nan-hoi-jin, given him in 1678, ordering the casting of 320 pieces of various calibers and of the European fashion, and that he should oversee the work. On February 11, 1681, he delivered the models, which were approved, and the Board of Works was ordered to furnish all that was necessary for the work. The job took over a year. Many difficulties were encountered, attributed to the jealousy of courtiers. One of these troubles enables us to say that these guns were muzzle-loaders. An attempt was made to disable a gun by wedging a shot in the bore. Father Verbiest removed it by the now well-known scheme of loading with powder at the touch-hole and firing out the shot. All of Verbiest's guns were blessed and engraved with saints' names in the foundry, and were engraved with proper characters traced by the Father's own hand.

The proof of these guns was made in 1682, and twenty-three thousand practice-shots were fired from them. Father Verbiest was

again promoted in official rank to a position equivalent to that of "Viceroys who have deserved well in their government."

On this occasion the Emperor said to Father Verbiest, "The cannons that you made the last year were very serviceable against

the rebels, and I am well satisfied with your services," and he gave the Father his furred vest and gown.

This dates Father Verbiest's gun-founding work in A. D. 1680 to 1682. It was done in Verbiest's own foundry near the palace. It was muzzle-loading work, and was marked with saints' names.

Neither of our three breech-loaders is so marked, hence neither can be a Jesuit gun of Verbiest's time. They present a special variety of the familiar type of *pedrero*, of which the Cortes gun now at Annapolis, made probably as early as 1474, is another variety. They are what is called by the English writers of the Tudor and Stuart and early Georgian periods "petereoes," a word which is spelt with a great variety of combinations of t's, c's, r's and a's. Such swivels were familiar to Europeans in the sixteenth and seventeenth centuries, as shown by the numerous illustrations of them collected by Favé for the late Emperor Napoleon's work on Artillery. Duhaide does not claim that they were introduced by the missionaries, but on the contrary concedes them to have had a more ancient origin.*



KANG HI.

* As Duhaide is not divided into numbered chapters, and as there are several editions, some in two and some in four volumes, and of various dimensions of page, it has not been practicable to refer to this authority at each citation, but a compilation of the dates given in the section on "Kang Hi," in the chapters on "Military Government," etc., "Of the Nobility," and "Of their Astronomy," shows that the dates given above are substantially accurate. The copy consulted was *Howken's* translation, 3d edition, London, 1741, 4 vols. 12mo.

Duhaide also in his chapter on the History of Corea relates that in the 26th year of Wan-Li (A. D. 1598) the Chinese commander had a cannon shot off as a signal for springing a treacherous ambushade contrived against the Japanese general, Hing-Chang. Griffiths' "Mikado's Empire," p. 246, speaks of a breech-loading Japanese cannon of this period—the Japanese invasion of Corea—still preserved at Kioto. Even earlier than this, one of the generals in Corea had his horse killed by a "cannon shot."

We are now prepared to analyze this inscription. The gun was made about March, 1680, for the Chinese year began in February. Its destination was the metal top of the fort (Dun) at Kiang-Tu (the river capital). It will not be too hazardous a conjecture to say this was a barbette battery at Ngan Kiang Fu, now capital of Ngan-Hwei, then the western capital of Kiang-Nan. There was a large garrison there, a strong and notable fort, and the times required this point to be vigorously maintained. Twice before in the history of China had the control of Poyang Lake and of the river-bend close by seemed decisive of the fate of a dynasty,—when the Mongols obtained and when they lost the empire. In 1680, to the south and southwest of this pass, the organized armies of a Chinese revolted vassal who had assumed the yellow vestments were in full force and concentration, and the Tartar generals had got control of the sea-coast and were pushing inland along the southern frontier towards Yunnan, in order to isolate the revolt in an uncultivated mining country, where lack of supplies would in the end compel the rebel chief to risk an engagement on the field of his adversaries' choice or lose his army by famine or desertion. The fort at the Poyang Lake pass is a likely, but not certain, original destination of this piece.

The personages who were responsible for the enterprise were Tung Chi Shui T sien Zhe. The last two characters clearly signify the whole body or company. Shi is a character which implies civil magistracy. Tung Chi is to-day, as Mr. Mayers' manual of Chinese Governmental Titles informs us, the colloquial designation of the chief military officer of a single province or the second military officer of a vicereignty. The second column can then be paraphrased in English thus: "The provincial general-in-chief and the whole body of civil magistrates (of the western government of Kiang Nan) built (for) the barbette battery at Ngan-Kiang-Fu, Fulangkhi Number 24, weight one hundred and one catics."

The next notable thing is the height of the succeeding columns.

The third column begins abreast of the seventh character of the second. The fourth and fifth begin abreast of the eleventh character of the second column and the fourth of the third. The third, fourth and fifth columns end about even. The sixth has its top two characters lower down than the top of the fifth column and ends a character lower. These are signatory columns, and show that one functionary was of considerably higher rank than all the others, and one of considerably lower rank.

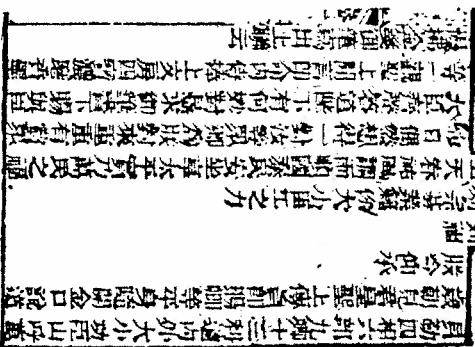
The workman who practically did the work was Ju-Shun-jen (Col. 6). The principal supervisor was a military mandarin, acting as superintendent, named Chung-Shen-Ching (Col. 3). The next in authority was a Tseng-Twan-Gwan (chief managing magistrate). He was probably subordinate to the Board of Works and may be called the principal director, Chow-Yi-Ho (Col. 4). The third inspector was entitled Tseng-Wan-Hu, and was named Kiang-Zin. This title translates chief of 10,000 families. One must not, however, in Chinese, any more than in English, over-analyze syllabic constituents of a word or phrase. By itself the word "sloop" signifies a fore-and-aft rigged vessel with one mast and a bowsprit, which has her head-gail in one piece, with its tack made fast to the outer end of the bowsprit. "Sloop-of-war" designates a vessel which has none of these characteristics. The English Major-General corresponds to the French General of Brigade. The American Major-General corresponds to the French General of Division. In gunnery we find mentioned in English about a century ago "murderers" and "murdering pieces," as well as "peterees." They refer to the same sort of gun, a light swivel. Just as the French *perrier* and the Spanish *padrero* have lost their relation with stone shot and now signify only the swivel mounting of the piece, so the coupling by the Spaniard of a pair of swivels into the masculine and feminine or fatherly and motherly relation of *padrero* and *madrero* (mothering or pet) gave Jack Barnacle a chance to convert a Spanish jest into an English special noun of appropriate sense for its retained sound, and Diego's mother's darling was transformed, by the English mouth struggling with a Spanish word, into a truculent assassin.

Thus, while the title Wan-Hu recalls the Mongol national organization on a plan of decimal family groups, which forms the basis of the early Hussar or hundredth-man levy of Hungary, and of the Cossack contingent of Russia of to-day, so the families which averaged a soldier apiece have ceased in this title to be an exact description,

the myriad has become numerically vague, and the Wan-Hu chief signifies in a society, which has passed from the nomad to the sedentary stage of civilization, such a military officer as would command a force equal to that furnished by 10,000 nomad families. It will not be unsafe to consider this title as that of a Tartar General of Division, or chief of a banner.

This gun is number 24, and its weight is 101 catties (about 135 pounds). The sort of weapon is Fulangkhi. Fulang is now used colloquially to designate the French. It is also used for foreigners generally, as Frank has been used in the Levant for centuries. The selection of characters to form this word would always suggest to the educated Chinaman the ideas of barbarian, spadassin, and beast, while the syllable *Khi* is so formed as to suggest manufacture, well contrived and weapon.

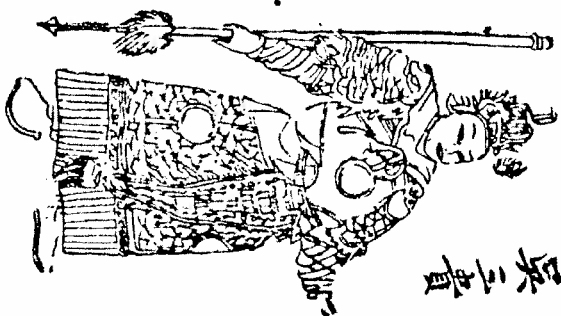
When the reign K'ang Hi began, the boy Emperor had by no means a well-established throne, far less a prospect of the grandeur and power which he attained. While his court exercised direct sway over part of the provinces north of the Yang-tze and over one or two south of that river, three Chinese vassal-kings, who owed him little more than homage for investiture, maintained large independent armies, held most of the provinces south of the Yang-tze and west of the Yellow river, and controlled the tea crop, most of the silk crop, a large part of the rice crop, and all the foreign commerce. Each was only less powerful than the Emperor. The three, and probably either two—the other neutral—could overmatch him. The famous Cheng-Chang-Kung was established at Formosa as a sea king, and ravaged the coasts of the imperial provinces so that they were depopulated for three leagues inland and the sea fishery broken up. The Emperor's court was seamed with gentle and sectarian dissensions. The calendar was disgracefully erroneous,



PAGE OF BOOK TO ILLUSTRATE ELEVATION OF CHARACTERS.
(See p. 266.)

and was proved so in 1666 in the presence of the Emperor, with improvised instruments got up over night by men just out of prison. After four years of regency this boy of twelve dismissed his tutors and guardians and took the scepter himself.

He had been born to good luck. The great Formosa prince had died the year of K'ang Hsi's accession. Cheng King-Mai, with less warlike tastes than his father, kept the peace of the sea for ten years. In 1673 an attempt was made to organize a great gentle movement of China for the Chinese. Wu-San-Gwei, who had a powerful



WU-SAR-GRAT J97643 to 1668.
from a Chinese print

their own respective precedence. Cheng-King-Mai failed to be received at Fokien as an equal and independent prince. Shang-Ko-Ho of Kwang-Tung preferred a vassalage which had known limits to an undefined and vague future, and refused to change his allegiance prematurely.

The Prince of Formosa, stung by the affront to the past of his family, by force of arms drove Keng-Tsing-Chung to submit to the Tartar and then retired to his island to milk and die. The armies of Kwang-Tung and of Fokien were soon arrayed under imperial

generals against the Prince of Western Peace, and that aged Chinese patriot died in 1679. Two years later the rebellion was entirely suppressed. The son of Wu-San-Gwei, who had been proclaimed Emperor, committed suicide. Shang-Chi-Sin, who had succeeded his father on the latter's suicide in 1676, in 1680 received the imperial sentence of death, which was mitigated by the imperial present of a red silk cord and a sign-manual permitting suicide, for thus his royalty was acknowledged while his treason was punished. He obeyed the sentence and hanged himself in red silk like a king. Keng-Ting-Chung, of Fokien, who had been too strong to punish in 1674 when the dynasty was in danger, was executed with ignominy in 1681 and his brothers were beheaded. Conflicting ambitions had swamped a conspiracy which if combined had been stronger than the empire.

From this date on, to the end of his almost unequaled reign of sixty years in 1722, the Emperor showed himself a vigorous, enterprising and intelligent prince. He was athletic in person and proud of his strength and skill as an archer. He was a bold huntsman and did not hesitate to encounter the tiger with sword and spear. He studied and promoted the arts and sciences. He was versed in the literature of his empire, and personally and almost daily supervised the compilation of the great Chinese dictionary, a work unrivaled in western nations till the publication of the encyclopedic dictionaries of the present day. He instituted an elaborate topographical survey of the empire, and caused to be collected statistics of its resources and requirements. He re-established, revised and regulated a system of posts, post-roads and signal-stations for visual telegraphy, managed by squads of soldiers always on duty. He repelled from the borders of the empire the dangerous tribes of barbarians, and established the bounds and limits of the nomads across the frontier, so that friendly clans and tribes attached to the fortunes of China by similarity of race, by family relations, by social rites, by ties of hospitality, and by the ambition or interests of chiefs, should range along the boundary and the jealous and ill-disposed be kept at a distance. Corea, Tonquin and Annam sent him tribute. Thibet yielded to his arms and received his frontier garrisons. He negotiated with foreign powers, had treaty relations with Holland, Russia, Portugal and the Pope, and had a correspondence with France. He pacified the empire, readjusted the boundaries of the provinces, and fixed the present administrative system with its all-pervading dual



Double Barrel Machine Gun. Built by the Korean Government in 1916. It is a very good example of the Korean gun.

CHARLESTOWN REPEATER.

1573 to 1620 of an emperor in whose reign the Japanese invaded Korea. History records that in this war, in 1593, a general's horse was killed by a cannon shot, and in 1598 a cannon shot was used as a signal. Griffiths' "Mikado's Empire" states that a breech-loading cannon is still preserved in Japan as a relic of this invasion.

This curious early repeater fully illustrates the furious firing spear with its nest of seeds and its bamboo barrel of the Sung period, and we are no longer obliged to reject the evidence of the writers of the Sung, Kin and Yuan histories because we do not understand it.

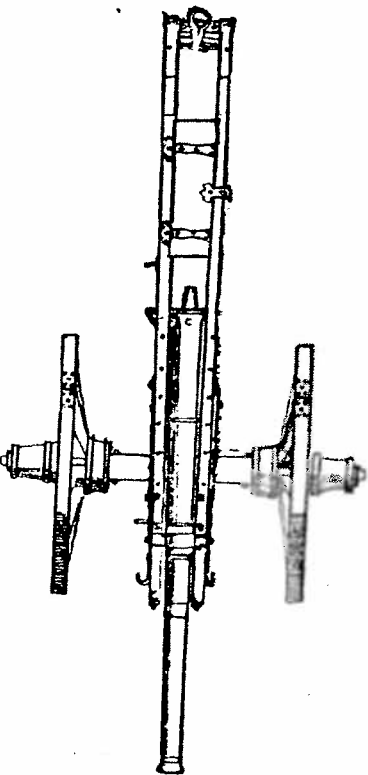
We have also discovered another thing, that some scion of the Shen Khi family of 1313 must have remained in China, because we find one of that name in 1663 at work manufacturing guns, and it is possible that the Shen Khi brigade may have been originally named for one of them before it got its literary form. This, however, is mere conjecture.

All these breech-loading guns were called by the founders by the special name Fulangkhi. Mr. Mayers cites a Chinese author who wrote about 1517 concerning the Portuguese. He spoke of their guns by this name, and said that this name was rightly a name of a country and not of cannon. Mr. Mayers conjectured that the Portuguese had been called Franks by some person, and the name had been transferred to the guns. No evidence is found anywhere that the Portuguese were ever called Fulangkhi's, and Mr. Mayers apparently did not know that the term continued to be an official term for guns as late as 1680. The Portuguese guns are said to have been of iron, jacketed with wood and strongly hooped. This hardly was the model from which to make a brass gun like these of this museum.

Again, these Chinese Fulangkhi differ from the pedreros of Europe by having hollow instead of solid cascabels, which seems to imply a different course of development. Undoubtedly Fulangkhi might mean French. As undoubtedly, in some of the treaty ports to-day, Fulang is taken for France, and for foreign generally. Probably when the set of characters were devised to designate the machine it

was believed to have come from abroad with some barbarian invader from the West. When an Arab calls the rocket the Arrow of Cathay, and the breech-loading cannon Mad-la, he goes far to admit an early use of gunpowder in China wars; and when the Chinaman speaks of Western and of Mohammedan cannon and of Fulangkhi, he goes far towards calling the instrument an imported article. We are not called upon to settle the place of origin of this class of weapon exactly, but only to date one gun.

Our date for that has been fixed at A. D. 1313, and the only catalogued gun older than this is the Fulangkhi of Fort Monroe, made in the same month.



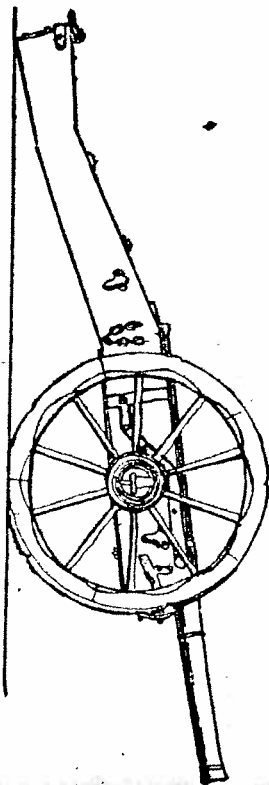
BURGUNDIAN GUN. PLAN AFTER FAYÉ.

It is pretty clear from some old bills and accounts that gunpowder artillery was used in European war before 1300. It is not disputed that the hand-grenade was used in China as early as 1233. We have no drawings of any gun except the "madia" earlier than the fifteenth century.

Some ancient guns are preserved in Europe and Asia, and the Royal Artillery Institute have published a series of papers by Lieut. Brackenbury which describe and illustrate some of the most curious of them. They date as follows:

- 1318. Bombard at Amberg, Bavaria.
- 1379. Wooden-cased gun at Venice.
- 14th century. Tower guns, London.
- 1423. The Micheletes at St. Michel.
- 1430. La Dritte Geriete of Chent.

- 1460. Mons Meg at Edinburgh.
- 1464. Turkish guns at Constantinople.
- 1475. Captured in 1476 and 1477. Guns of Charles of Burgundy at Morat and Neustadt.
- 1478. A gun of Louis XI. in the Paris Museum of Artillery (structure not described.)
- 1535-1539. Two sakers at Woolwich.
- 1542. The Mary Rose guns at Woolwich. All by Arcano de Arcani.
- 1546. Czar Pooschka at Moscow.
- 16th century. Malik y Mydan at Benares.



BURGUNDIAN GUN AT NEUSTADT, AFTER FAYE.

Besides these is the double-barreled draconcello cast at Liege in 1503, now at Madrid, and the Bartemy de Pins gun of 1490 at Paris, and the banded gun in the Tower, about 1545.

Probably the above list contains more than half of all the guns now extant made before 1500. There may be fifty guns now extant made in the sixteenth century.

De Saulcy declared that the most important improvement in field artillery was the introduction of trunnions and the flask or bracket trail system of mounting, and that the origin of the improvement is unknown.

One gun of Charles of Burgundy, a cast-iron piece, may fairly be said to have this improvement. The Bartemy gun was doubtless so mounted.

Both these guns, however, were preceded in Europe by the swivel system, illustrated by the Cortes guns at Annapolis and Washington, which are undoubtedly older than 1474, when Isabella acceded to the throne of Castile. By her marriage contract it was provided,

in 1469, that after her access the arms of Aragon should always be associated with those of Castile and Leon, and, as these guns were marked with Castile and Leon only, this fact dates them earlier than 1474.

The pedigree of the Bartemy gun and of most European artillery is traced to the wooden-stocked guns of Burgundy by the adjustment of their trunnions lower than the axis of the piece, while the independent origin of the Cortes swivel, of the Madrid draconcello and of the Fulangkh's appears by the emplacement of their trunnions abreast of their bores.

Without attempting to account for the origin of the name Fulangkh, it is worth remembering that the earliest illustration we have of the landing of St. Louis at Damietta represents his army as provided with cannon.



DE MOLAY.



TAMARLANE.

THE HISTORICAL PERSPECTIVE OF THE FULANGKHI OF 1313.

The war of Cortes in Mexico is a remote American event. It began twenty-six years after the first voyage of Columbus, nearly three and three-quarters centuries ago. The oldest Fulangkh was then as old as the Cortes swivel was in the reign of Queen Anne. The year of Hwang King, called Kwei Chow, was at a notable period in the history of the world.

The Crusades were over. The modern period had begun. Robert Bruce was King of Scotland, and in another year he would win the independency of his kingdom at Bannockburn and strike down before both armies Sir Henry Bohun, the English champion, break-

ing his axe in the blow. Edward II. was then King of England, and English people were still discussing the recent fall and execution of Gaveston. Henry VII. of Luxemburg was Emperor, Dante was in his prime, and Petrarch was a schoolboy. Clement V. was Pope, and the Papacy was settled at Avignon under the protection of Philip the Fair. The order of the Temple had just been dissolved. De Molay was to mount the scaffold in a year, and to summon Philip in judgment at a year and a day of essoin, and Philip would be laid in his coffin in two years' time. The Polish mortgage to



SEAL OF ROBERT BRUCE—OBVERSE.

Brandenburg, never redeemed, had just laid the foundation of Prussian power. Russia then paid tribute to the posterity of Zenghis. The Arabic caliphates of Cordova and Grenada survived in Spain, and the last sigh of the Moor would not breathe farewell to the Alhambra for a century and a half, leaving its name to the overhanging hill. The grandsons of Rudolph held petty principalities in Germany, but the Hapsburgs were not a reigning family. Charles of Anjou ruled Hungary. Venice was sovereign over most of the Greek Empire, and Athens was an independent principality of a French duke. Tamerlane would be born in a quarter of a century,

but a hundred and forty years would elapse before the cannon of Mahommed II. should batter the walls of Constantinople.

Pope Sylvester had invented a mechanical clock, but a child born in this year 1313 would be over sixty years old before any French church would have one on its tower. It was two centuries before Europe knew of printing by movable types. Paper had been invented, was made in Spain, but France and Germany would not make it for a year, nor England for a century. Coal was only in use in the districts where it could be quarried. The use of water-



SEAL OF ROBERT BRUCE—REVERSE.

power was confined to the blowing engine called the *trempe*, and to driving the wipers of small trip-hammers. Road-making was a lost art. Wheel-carriages were unknown or of the rudest sort, and transportation in Europe per ton per mile was paid at the rate of thirty cents of our money. The impossibility of an internal commerce made local dearths and famines severe and frequent. No postal service existed, no common carriers of freight or passengers. Floors were strewn with rushes and walls hung with carpets. Sugar was a confection, and two centuries would elapse before it would be a food. No forks were used at table. Every guest brought his own

knife. Many European nations would not arrive at the accomplishment of making soap for centuries.

Of the things quite unknown in those days, but quite usual to-day, were alpaca, coca, coffee, cacao, and chocolate, cochineal, jalap, logwood, maize, manila or sisal hemp, Peruvian bark and the cinchona and guinine alkaloids, potatoes and yams, tea, tobacco and tapioca. Among those quite rare were cotton cloth and indigo. Canned meats and vegetables were quite unknown, and more than three-fourths of all the food was heavily salted or smoked, often both. It was before the days of the whale fishery. Street lamps were unknown, and houses imperfectly lighted. There was no window-glass, almost no drainage, and chimneys were very poor.

To reduce the commonest and plainest people of to-day to the supplies of the luxurious of 1313 would be to deprive them of many of the necessities of life.

What shall we say of the metallurgic skill, of the mechanical advances which had been made, as shown by the gun itself? Drills, files, gravers, modeling in sand, coring, dry distillation, winning of sulphur from the volcano and of niter from the earth, a selection among charcoals for special properties, all must have been contrived, learned and practised before this gun was made.

Why, with this great advance thus early, has the Chinese development of firearms been so slow and apparently retrograde?

First. The national policy did not permit the use of firearms to the people, or to any but a limited part of the army.

Second. The soldier till quite recently was required to purchase the materials of his powder and to make it himself. We learn from Barrow that as late as 1793 a formula was in use which was deficient in saltpeter and called for an excess of sulphur and of charcoal. Moreover, the purification of the niter was defective. Granulation has not been thought important.

Third. Mechanical improvements have been neglected, and no attempt made to get a more modern type of gun than the match-lock. Small-arms of inconvenient weight have been preferred, and the cartridge was never thought desirable.

Fourth. Candidates for commissions or promotion have been deterred from attempting improvement by the rigid formalism which required adherence to the ways of the past at the age of acquisition, as a condition of success in the schools.

Fifth. A preference of provincial authorities for local economy

rather than for national efficiency and power. This again is but another name for the unsympathetic selfishness which Kudlai meant to correct.

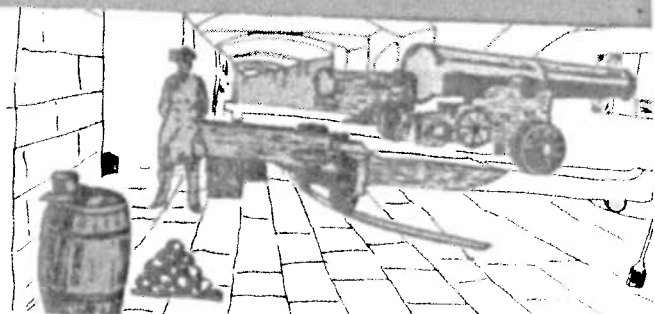
Sixth. The peaceful relations of China with the rest of the world other than Asiatic nations unskilled in mechanics have made the situation of comparatively small consequence till recently.

The tributary relation of Corea to China accounts for the presence of these weapons in that kingdom.

It is, however, strange that an American naval force should have captured in one day five guns, all of them older than the time when white men first occupied the great Mississippi River system, the cotton and corn field of the world.

Two of these guns were far older than the time when America was first brought to the knowledge of Europe; a third, the Charles-town repeater, was made in the very year in which Virginia was planted; a fourth, in the year when arbitrary government was threatened to Massachusetts by the appointment of the Carr-Maverick commissioners; and the fifth, in the year the first royal government was established by the charter of New Hampshire, and the only feudal government ever set up in the old United States territory was established in the Massachusetts province of Maine. It is strange that this force from the New World should have brought them from that Far Cathay, whose fame was the cause of the expedition of Columbus, and it is stranger still that men should be living to-day, still in active service, who can say they have heard the hostile roar and have been exposed to the peril of shot projected from the oldest extant pieces of artillery of the world.

The
Casemate
Museum



22 Jul 86

Mr. Morris—

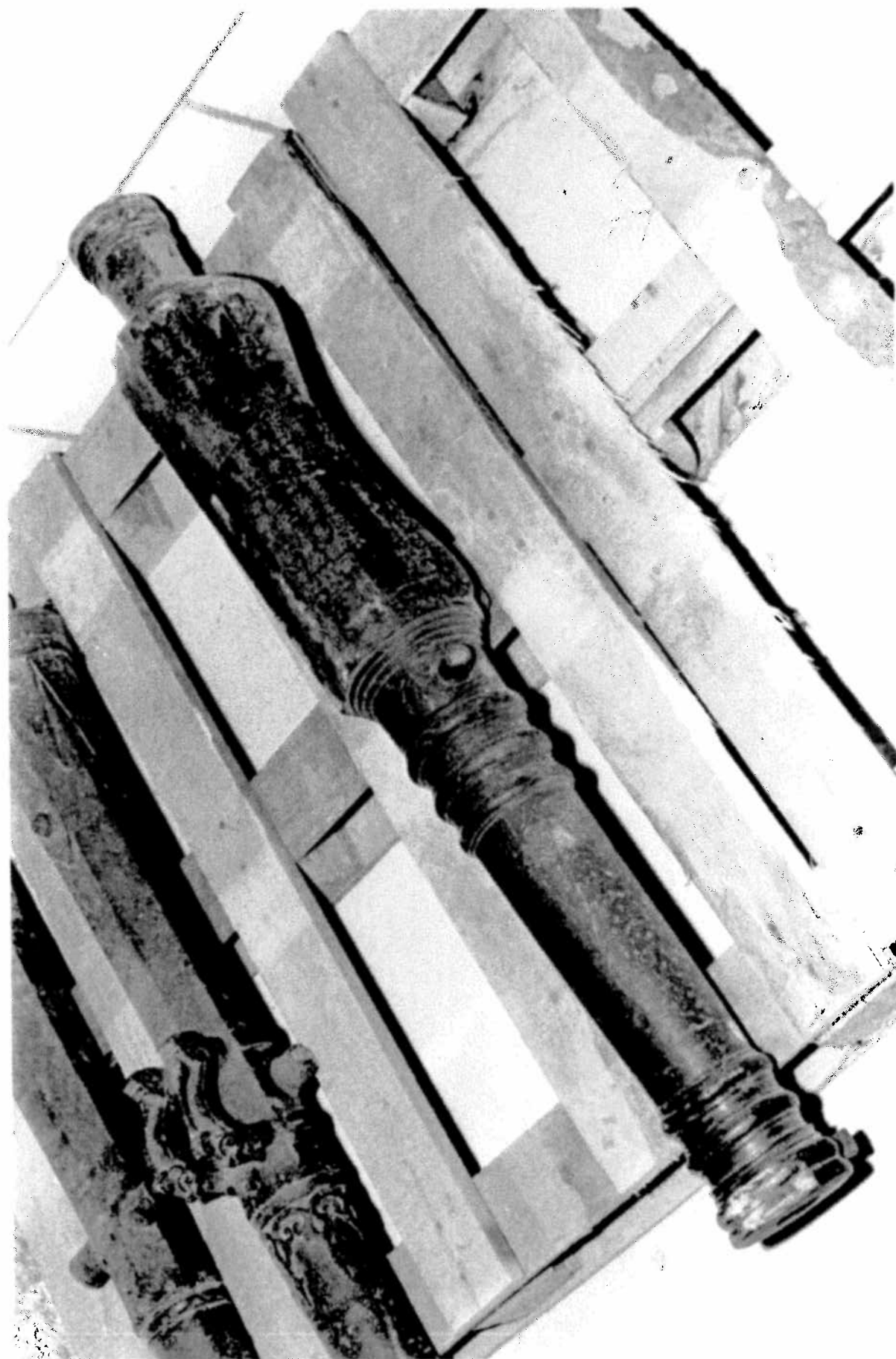
Here are the new pictures of
the Chinese lettering we
discussed. I hope its clear enough
for you. Some of the information
we have states the translation of the
inscription as "19th Moon, of the Chinese
Emperor, King Hi, A.D. 1681."

Good luck on your research.

Kathy Rothrock

called to check on
the

Home of the U.S. ARMY'S COAST ARTILLERY MUSEUM



三
卷
三
十
四
五
六
七
八
九
十
十一
十二
十三
十四
十五
十六
十七
十八
十九
二十
二十一
二十二
二十三
二十四
二十五
二十六
二十七
二十八
二十九
三十
三十一
三十二
三十三
三十四
三十五
三十六
三十七
三十八
三十九
四十
四十一
四十二
四十三
四十四
四十五
四十六
四十七
四十八
四十九
五十
五十一
五十二
五十三
五十四
五十五
五十六
五十七
五十八
五十九
六十
六十一
六十二
六十三
六十四
六十五
六十六
六十七
六十八
六十九
七十
七十一
七十二
七十三
七十四
七十五
七十六
七十七
七十八
七十九
八十
八十一
八十二
八十三
八十四
八十五
八十六
八十七
八十八
八十九
九十
九十一
九十二
九十三
九十四
九十五
九十六
九十七
九十八
九十九
一百

Chinese Chaucer on canon

(60 year cycle)

no. ~~146~~ 147

August

Official
(Rank of person)

(Name)

Mr. Skin

Gen No. _____

重
(Weight)

97 - (九
+
七)

一
百
四
十
七
||

147

(last line) Headquarters Officer

Officer
miller

宋之廣
金榮立

Kim AE Yip.

(Ming Wen) Conclusion Inscription is the
first

5/14/87 some on the other

picture ("1313") per except
for the weight (97) and the number
(147). Even the words are the same.

10 May 1987

TRANSLATION OF CHINESE CHARACTERS ON BREECHLOADING CANNON
CAPTURED IN KOREA BY U.S. NAVY IN 1871

This translation was based on an article in vol. XVIII No. 2, U.S. Naval Institute Proceedings, "Notes on the date of Manufacture of the Three Guns at the U.S. Naval Academy, Captured in Korea by Rear-Admiral John Rodgers, U.S.N., " by Thomas Wm. Clarke (1892). The differences between the gun in the Morris Collection and the "gun of 1313" described on p. 279 of the article were determined by a friend of Kwong Sin of Springfield, VA. today.

The characters are arranged in six columns, engraved on the right of the breech of the bronze gun. Two characters of the Hia Tse series (cycle of sixty) date it in the Kwei Chow, or fiftieth year of the cycle. It has no regnal title at the head of the date column.

The inscription reads: (Col. 1) Kwei Chow, 8 month day, made cast. (Col. 2) 4 class Fulangkhi number one hundred forty seven, weight ninety-seven catties. (Col. 3) Make cast superintendent Tseng-Tsien Shi (Chief Assistant Privy Councillor) Shen Khi Lik. (Col. 4.) Pen Fu Gwen Gwan (General of Ordnance superintending), Chief Assistant Privy Councillor Kin Tack Yuan. (Col. 5) District Magistrate Sung Si Lien. (Col. 6) Master Workman Kin Gai Lik.

The Morris Collection piece has an inscription very similar to the "gun of 1313" at the U.S. Naval Academy, and also very similar to a piece at Fort Monroe in Hampton, VA. The USNA piece is 4 class Fulangkhi number 229, weight 100 catties. The Fort Monroe piece is number 194. Pictures and marks of these two guns are in Morris collection records.

Other known examples of these guns are at the U.S. Marine Corps Historical Center, Washington, DC, and aboard a ship museum in San Francisco, CA.

Despite the article mentioned above attempting to establish very early dates for these pieces, I believe them to have been cast in a later Kwei Chow year, either 1793 or 1853. My primary reason for holding this belief is the integrally-cast sights (both front and rear) on the weapons. The caption for the Fort Monroe piece, contained in a catalogue of the 1893 Columbian Exhibition, published by the Army, also casts doubt on the weapon being of as early an origin as the Proceedings article states.

MEMO: To Mr. Ashley Halsey
I Owe You
\$500, to complete
\$2500 purchase
price of 1
B/L Cannon, Paid
\$2000. cash 25 per
cent.

11/10/84

John Z. Moore



ASHLEY HALSEY, JR.

NAVAL HISTORICAL FOUNDATION PUBLICATION



MARINE AMPHIBIOUS LANDING IN KOREA, 1871



Compiled By
Miss Carolyn A. Tyson
Historical Branch, G-3 Division
Headquarters, U. S. Marine Corps.

At anchor, near Boiséé I'd, Salee River, Korea
4th of June 1871

My dear Nan,

We are still anchored where my last immense letter was finished, and as I have an hour before the steamer leaves for Chefoo, China, (across the Yellow Sea,) will enclose a few more lines, to say we are all as hearty as bucks, and full of having a bang at the Koreans before very long. On June 1st we started our Gunboats "Palos" and "Monocacy", with four little steam launches, to make soundings higher up the River Salee, and when they reached a mud fort on a point of the River, the Koreans opened on them without a moments warning, when we returned the fire passed the point, and after anchoring shelled the Koreans out; after which the "Monocacy" having struck a rock, which made her leak, the little fleet repassed the fort, and rejoined our Fleet six miles below. The Koreans were not able to fire upon us on our returning, having been cleared out by our big shells. Their guns are very rude, seemed to be lashed to logs, and cannot be trained except on a point beforehand, which, when the vessel nears, they touch them off! The vessels were not struck at all, by large shot, and only by one or two rude balls from a small-arm called "jing-galls" which two men carry on their shoulders & touch off with a match! Only three of our men were touched, and only slightly wounded; you can judge then, how unable they are to cope with us, armed as we are with the latest improvements. The slight damage to the "Monocacy" was repaired before midnight, by allowing her stern to rest on a soft mud bank, the tide receding lifting her out the water, and the little hole patched as good as new. I was not with the party, but you may be sure we all will be, when we make our next advance up the river, which we probably will very soon, and give them a good drubbing too, for firing upon our little vessels, without giving any warning. Indeed the people we have communicated with, altho' they did not say they would not fire upon us, should we continue up the River, let us infer they wouldn't, and we were obliged to return their fire to maintain a dignified position. The little steamer "Palos" goes to night to sea, taking our mail to Chefoo, on Shantung Promitory, in China, right across the Yellow Sea from where we are, about 300 miles, and gets our mail from home, which has been sent there from Yokohama. Today we got a communication from the Head Man at the fort referred to,⁵ who stated that when Capt. Febinger of our Navy came up here, he did not make war on them, and didn't see why we wanted to come so far to make a treaty. They had been living 4000 years they said, without any treaty with us, and of course they couldn't see why they shouldn't continue to live as they do! Now I hope and trust my precious you wont go and get anxious, as we are quite able to do all with safety that the Admiral desires to-do,

and the next letter will tell you how we shelled them out and kicked their mud forts down the hill! This is the entire history so far, of the whole matter, but no doubt the papers will be filled with all sorts of stuff and nonsense, as they always are. No communication will be possible with San Francisco for two months after this date, so you can be on your guard for yarns. Our little vessels returned to the fleet after the shelling of the fort, merely to report the circumstances to the commander-in-chief, otherwise they could have demolished it, but the senior officer (Capt. Homer Blake) did not feel authorized to continue the firing, after shelling them out, without communicating with the Admiral in view of our peculiar instructions from the government. Capt. Blake commands the "Alaska" but went up to make the survey . . . Most affectionately Your husband
McLane Tilton

No. 14 USShip "Colorado" off Isle Boiséé, Corea, Asia
June 21st 1871

My dearest Nannie,

My last letter, No. 13, gave you an account of the firing upon our launches from the Korean forts in the Salée River, whilst engaged in making soundings. I suppose you have all been very anxious about us since, as no doubt the papers have been filled with all sorts of dreadful prophecies in regard to the affair. I am glad to say I am alive still and kicking, although at one time I never expected to see my Wife and baby any more, and if it hadn't been that the Koreans cant shoot true, I never should. It is all over now, and as I expected, we have failed to make any treaty with the Koreans. The local authorities near us return all our communications sent on shore to be forwarded to their King, and our Expedition so far as a treaty goes has turned out to be fruitless. We have not force enough to go to their Capital in the interior even if our government directed us to do so. The Country is beautiful; filled with lovely hills & valleys running in every direction and cultivated with grain of all kinds which even now is turning to the colors indicating ripening. Everything is pretty and green, and the little thatched villages are snugly built in little nooks, surrounded by pines & other evergreens. We had a dreadful time on our Expedition, landed six hundred and eighty⁶ in all upon a muddy beach 1/4 mile wide, mud knee deep, but the guns of the Monocacy protected us shelling the first fortification where we landed and drove the Koreans out who retired firing at us, but didn't hurt anyone. This was Saturday the 10th of June. We all camped that night, the Marines being in advance of the main body about 1/2 or 3/4 a mile. Early Sunday morning we started for the next fort, and took it without any opposition but found the guns in the fort, (brass breech loaders) all loaded. We knocked the ram-parts down and proceeded to the great work of the Koreans a redoubt

⁵Hear Admiral John Rodgers's report, 5 July 1871, numbers the landing force at 651 men. In *Annual Report . . . 1871, op. cit.*, p. 280.

⁶Published in *Papers Relating to the Foreign Relations of the United States, Transmitted to Congress with the Annual Message of the President* (Washington: GPO, 1871), pp. 130, 131.

The report of Captain McLane Tilton, dated June 16, 1871, and the General Order issued on June 5, 1871 by Rear Admiral John Rodgers, Commanding, United States Asiatic Squadron, are printed here as documentary information. They have been reproduced from the "Annual Report of the Secretary of the Navy on the Operations of the Department, for the year 1871". The Secretary of the Navy at that time was The Honorable George M. Robeson.

Report of Captain McLane Tilton, commanding United States Marines.

UNITED STATES FLAG-SHIP COLORADO,
At anchor off Isle Boisé, Corea, June 16, 1871.

SIR: In conformity with your directions, I have the honor to make the following report of the part taken by the marines of the Asiatic fleet in the late expedition against the Koreans:

On Saturday, the 10th instant, the guards of the Colorado, Alaska, and Benicia, numbering one hundred and five, rank and file, and four officers, equipped in light marching order, with one hundred rounds ammunition and two days' cooked rations, were embarked from their respective ships and towed up the Salée River by the United States ship Palos. Upon nearing the first of a line of fortifications, extending up the river on the Kang-Hoa Island side, the Palos anchored, and by order of the commanding officer all the boats cast off and pulled away for the shore, where we landed on a wide sloping beach, two hundred yards from high-water mark, with the mud over the knees of the tallest men, and crossed by deep sluicers filled with softer and still deeper mud. After getting out of the boats a line of skirmishers was extended across the muddy beach, and parallel to a tongue of land jutting through it to the river, fortified on the point by a square redoubt in the right, and a crenulated wall extending a hundred yards to the left, along the river, with fields of grain and a small village immediately in its rear. The fortification had been silenced by the cannonade from the United States ship Monocacy and the steam-launches, and the garrison fled through the brush and fields, firing a few shots as they retired at a distance. The marines, by order, then advanced on the place, sweeping through the grain-fields and village, meeting no opposition, and remained in possession until the main body came up, when we were again ordered to push forward, which we did, scouring the fields as far as practicable from the left of the line of march, the river being on our right, and took a position on a wooded knoll, covered with hemispherical mounds, and commanding a fine view of the beautiful hills and inundated rice-fields immediately around us, and distant about half a mile from the main body. A reconnaissance was then made toward the next fort—a square work of hewn granite foundation, with a split rock, mud, and mortar rampart, crenulated on each face, with a front of about thirty paces—and a messenger dispatched to headquarters with the information that the road was clear and passable for artillery. Pickets were posted on the flanks of our little position, five hundred yards to the right and left—a rice-field inundated being in front—and a Dahlgren 12-pounder planted

so as to command the junction of the only two approaches, which the commanding officer had ordered up to us as a support.

An order having been sent to hold our position till morning, we bivouacked with our arms by our sides, dividing our force in three reliefs, one of which was continually on the alert. No incident occurred during the night except rapid firing of small-arms and howling from a hill inland from us, and about a third of a mile distant. Two or three shots from the artillery with the main body were fired across the left of our picket, in the direction of the noise, which presently ceased.

Sunday morning, the 11th of June, the main body came up, and we received orders to push forward, which we did, and after reaching the fields in the rear of the next line of fortifications, we threw a line of skirmishers across the peninsula of hills on which the fort stood, and after the main body came up we advanced toward the rear face, with two-thirds of our guards in reserve. We entered this second place, after reconnoitering it, without opposition, and dismantled the battlements by throwing over the fifty or sixty insignificant breech-loading brass cannon, all being loaded, and tore down the ramparts on the front and right face of the work to the level of the tread of the banquettes.

The ramparts consisted of a pierced wall of chipped granite, with a filling of earth in the interstices and coated over with mortar, giving it the appearance of being more solid than it really was. The cannon were rolled over the cliff into the water by Bugler English, without much trouble, who climbed down for this purpose. I cannot give the weight, but the bore was not over two inches diameter. A photographer came on shore from the Monocacy and succeeded in taking a negative picture of the place. We were then ordered by the commanding officer to push forward and find the road leading to our objective point, and to cover the flanks of the main body, which we did with two-thirds of the marines deployed, the remainder in reserve.

We scoured the scrubby woods and fields of grain, stirring up two or three unarmed native refugees from the village we had just passed, who were not, however, molested; and, after progressing half a mile, down deep ravines and the steepest sort of hills, were fired upon from a high ridge a little to the left of us, up which our skirmish line cautiously wheeled, and upon reaching the summit saw the enemy on a parallel ridge opposite, who blazed away at us with their gingalls or matchlocks, their black heads popping up and down the while from the grass, but only one spent bullet struck us, without any injury. A piece of artillery was here brought up from the valley beneath us, by direction of Lieutenant Commander Cassel, by superhuman exertions on the part of his men, and several shells landed among the enemy grouped on a knoll, scattering the party, when our skirmish line pushed on down the narrow range leading to the circular redoubt—our objective point, and known to us as the citadel, being the third work of the line of fortifications—the main body following in column of fours.

Upon reaching a point a third of a mile from this work, a general halt was ordered to rest the men, who were greatly fatigued after their comparatively short, although extremely steep, march; the topography of the country being indescribable, resembling a sort of "chopped sea," of immense hills and deep ravines lying in every conceivable position. We then advanced cautiously, with our line of skirmishers parallel to the right face of the redoubt, which was our point of attack, concealed from view from the enemy, and took position along the crest of a hill one hundred and fifty yards from him, closing intervals to one pace on the right skirmisher; the line extending along the ridge, our right

A
SHLEY | | ALSEY

P.O. Box 264

Spotsylvania



Virginia

22553

DEAR JOHN:

Here is the available information per
your request.

A thorough search of files fails to reveal
anything more.

As I told you, the original translation
disappeared years ago.

My misty recollection is that somebody
borrowed it for reference. Possibly it never
was returned.

Cordially,

Ashley

11/27

SIXTEENTH-CENTURY BRONZE BREECH-LOADING CANNON.

This cannon turned up in an estate near Mount Holly, N.J., and was among several antique cannon owned there prior to 1950 by a retired Navy or Marine officer. His name was given as Rown or Rowan. The other pieces were iron, pitted, whereabouts now unknown. No history of any of them was available.

A curator in the Far East Wing of the Metropolitan Museum of Art, New York City, translated the four-row inscription on the left side of the frame of this cannon to mean the following:

It was manufactured in mainland China about 1550 A.D. It was designated a Ferenghi (term for Portuguese or Spanish, i.e., "Frankish" or Western World) cannon of the fourth class. The serial is #147. The data includes place, year and month of manufacture.

The original translation is not at hand nor available from a search of files. No doubt a rubbing can be translated.

Provenance of the cannon is assumed to include capture by U.S. forces in the Korean conflict of the 1870's and shipment to the U.S. as a war trophy. This belief is borne out by the existence of an identical cannon, minus iron chamber, in the USMC Museum, Washington Navy Yard, and another in the San Francisco area. A third is reported to be in a museum in the Norfolk area.

-0-

(The weight was given as 97 catties or 129½ pounds. Whether this was with or without iron chamber and yoke is unknown.)

10 May 1987

TRANSLATION OF CHINESE CHARACTERS ON BREECHLOADING CANNON
CAPTURED IN KOREA BY U.S. NAVY IN 1871

This translation was based on an article in vol. XVIII No. 2, U.S. Naval Institute Proceedings, "Notes on the date of Manufacture of the Three Guns at the U.S. Naval Academy, Captured in Corea by Rear-Admiral John Rodgers, U.S.N.," by Thomas Wm. Clarke (1892). The differences between the gun in the Morris Collection and the "gun of 1313" described on p. 279 of the article were determined by a friend of Kwong Sin of Springfield, VA. today.

The characters are arranged in six columns, engraved on the right of the breech of the bronze gun. Two characters of the Hia Tse series (cycle of sixty) date it in the Kwei Chow, or fiftieth year of the cycle. It has no regnal title at the head of the date column.

The inscription reads: (Col. 1) Kwei Chow, 8 month day, made cast. (Col. 2) 4 class Fulangkhi number one hundred forty seven, weight ninety-seven catties. (Col. 3) Make cast superintendent Tseng-Tsien Shi (Chief Assistant Privy Councillor) Shen Khi Lik. (Col. 4.) Pen Fu Gwen Gwan (General of Ordnance superintending), Chief Assistant Privy Councillor Kin Tack Yuan. (Col. 5) District Magistrate Sung Si Lien. (Col. 6) Master Workman Kin Gai Lik.

The Morris Collection piece has an inscription very similar to the "gun of 1313" at the U.S. Naval Academy, and also very similar to a piece at Fort Monroe in Hampton, VA. The USNA piece is 4 class Fulangkhi number 229, weight 100 catties. The Fort Monroe piece is number 194. Pictures and marks of these two guns are in Morris collection records.

Other known examples of these guns are at the U.S. Marine Corps Historical Center, Washington, DC, and aboard a ship museum in San Francisco, CA.

Despite the article mentioned above attempting to establish very early dates for these pieces, I believe them to have been cast in a later Kwei Chow year, either 1793 or 1853. My primary reason for holding this belief is the integrally-cast sights (both front and rear) on the weapons. The caption for the Fort Monroe piece, contained in a catalogue of the 1893 Columbian Exhibition, published by the Army, also casts doubt on the weapon being of as early an origin as the Proceedings article states.

中國科學技術史

李約瑟著

CIVILISATION IN
CHINA

BY

JOSEPH NEEDHAM, F.R.S., F.B.A.

SOME TIME MASTER OF DONSTABLE AND CHINESE COLLEGE, CAMBRIDGE. DIRECTOR OF THE UNIVERSITY
HISTORY OF SCIENCE LIBRARY, CAMBRIDGE. HONORARY PROFESSOR OF SCIENCE SINCE 1958.

With the collaboration of

HO PING-YÜ (HO PENG YOKE), Ph.D.

PROFESSOR OF CHINESE IN THE UNIVERSITY OF HONGKONG

LU GWEI-DJEN, Ph.D.

FELLOW OF ROBINSON COLLEGE, CAMBRIDGE

ASSOCIATE DIRECTOR OF THE EAST ASIAN HISTORY OF SCIENCE LIBRARY

and

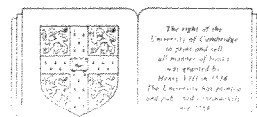
WANG LING, Ph.D.

EMERITUS PROFESSORIAL FELLOW, DEPARTMENT OF FAR EASTERN HISTORY, INSTITUTE OF
ADVANCED STUDIES, AUSTRALIAN NATIONAL UNIVERSITY, CANBERRA

VOLUME 5

CHEMISTRY AND CHEMICAL
TECHNOLOGY

Part 7: MILITARY TECHNOLOGY;
THE GUNPOWDER EPIC



CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE

LONDON NEW YORK NEW ROCHELLE

MELBOURNE SYDNEY

For more information, contact: 2700 Street, Cambridge, MA 02142, USA
127 East 27th Street, New York, NY 10012, USA
10 Stamford Road, 408000, Melbourne 1906, Australia

© Cambridge University Press 1986

First published 1986

Printed in Great Britain at
the University Press, Cambridge

Private libraries cataloguing in publication data

Neetham, Joseph

Science and civilization in China

Vol. 3. Chemistry and chemical technology

pt. 2. Military technology: the gunpowder era

1. Science—China—History. 2. Technology—

China—History

I. Title. II. Ho Ping-Yu. III. Lu, Tsiang-Pan

IV. Wang, Ling

959.31. Q1-27.55

Library of Congress cataloguing in publication data

(Revised for volume 3, part 2)

Neetham, Joseph, 1900-

Science and civilization in China.

Includes bibliographies.

Contents: v. 1. Introductory orientations - v. 2.

History of scientific thought - [etc.] - v. 3. Chemistry

and chemical technology - [etc.] - pt. 2. Military

technology, with the collaboration of Ho Ping-Yu.

1. China - Civilization - Collected works.

2. Science - China - History - Collected works.

3. Technology - China - History - Collected works.

4. Science and civilization - Collected works.

I. Wang, Ling. II. Title.

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

DS721.839. 509.51. 54-4723

To

the memory of
FENG SHU-NIEN

renowned scholar of history and philology,
born at Tientsin in Szechuan, and most graciously
welcomed to war-time China,
who led a discussion one evening while we were
in the history of gunpowder in China.

and to
YU TA-WEI

physicist, then

Ping-Kung-shu Shu-chang (Intendant-General of Arsenal)

1942-1946

whose 'bird coffee' I used to drink with him in his
office, and with whom we had a happy reunion in 1984.

this volume is dedicated.



Table 1. Early Chinese hand-guns and cannon (to approximately the end of the Yung-Lao reign-period, 1424)

Year	Provenance and where preserved	Length overall cm.	Dimensions muzzle bore diameter cm.	Weight kg.	Metal	Inscription ^b	References
1433	Pan-lao-chih-hung-tzu in A-chih-hung Hsien, Heilungkiang, Provincial Museum	34	2.6	3.35	bronze		Wei Kuo Chung (1), Fig. B1
1447	National Histor. Mus. Peking	39.3	10.5	6.94	bronze	1	Wang Jung (1); Goodrich (2); Needham (B2); Arima (1), p. 154; Figs. B5, B6, B7, B8; Chou Wei (1), p. 270, pl. B3; Chao Hui-shan (1)
1452	Thayuan Provincial Museum						H. Blackmore (p.c.); Fig. B9
1474	Nan, Shensi	26.5	2.3	1.78	bronze		Arima (1), pp. 153 ff.
1475	Rotunda Museum, Woolwich	47.5	10.5		bronze		Arima (1), pp. 153 ff.
1475	Ta-ming (Yuan capital)	32	2.2		bronze		Arima (1), pp. 153 ff.
1475	Ta-ming (Yuan capital)	21.5	2.6		bronze		Arima (1), pp. 153 ff.
1475	Arima Collection	31.5	2.6		bronze		Arima (1), pp. 153 ff.
1475	Shantung Nat. Milit. Museum, Peking	43.5	3	1.75	bronze	1	Wang Jung (1); Goodrich (2); Needham (B2); Figs. 90a, b, 91
1475	Thayuan Provincial Museum						Chou Wei (1), p. 270, pl. B3
1475	Nandung Museum, Chiangsu	several hundred bombards made for Chang Shih-chih's 'Chou' dynasty		302.7 ^d 211.8	cast iron	1	Wang Jung (priv. comm.); Goodrich (24); Han Kuo-chun (1)
1475	Nat. Milit. Museum, Peking	39.5	11	15.75	bronze	1	Wang Jung (1); Goodrich (2); Figs. 92, 93
1475	Harvard-Yenching Inst. Mus. Peking	45.7	2.54		cast iron		Goodrich (25)
1475	Huhehot Museum, Inner Mongolia						Anon. (21)
1475	Thayuan Provincial Museum						Chou Wei (1), p. 270, pl. B3
1475	Arima Collection of Kuroda Genji	43	2		bronze	1	Arima (1), pp. 110-1, 147
1475	Thayuan Provincial Museum	44.6	3.9	2.04	bronze	1	Chou Wei (1), p. 270, pl. B3; Goodrich (13), who saw another in the grounds of Academia Sinica; Needham (B23)
1477	Tho-kho-tho, Inner Mongolia	42	2.2		bronze		Li F.-Yu (1) ^e
1477	Tho-kho-tho, Inner Mongolia	44.3	1.9	2.1	bronze	1	Li F.-Yu (1)
1477	Tho-kho-tho, Inner Mongolia	44	2.1	2.14	bronze	1	Li F.-Yu (1)
1477	Tho-kho-tho, Inner Mongolia	42	2.1	1.95	bronze	1	Li F.-Yu (1)
1477	Tho-kho-tho, Inner Mongolia	36	1.9		bronze		Li F.-Yu (1)
1477	Tho-kho-tho, Inner Mongolia	27	2.3		bronze		Li F.-Yu (1)
1477	Tho-kho-tho, Inner Mongolia	38.5	1.9		bronze ^f		Li F.-Yu (1)
1477	Arima Collection	32.2	2.1	2.2	bronze	1	Arima & Kuroda (1); Arima (1), pp. 142, 147, 141
1477	Military Weapons Museum, Berlin	44	2		bronze	1	Arima & Kuroda (1); Arima (1), pp. 142-143, 147, 141
1477	Thayuan Provincial Library	44	2		bronze	1	Arima & Kuroda (1); Arima (1), pp. 143-14, 145
1477	Thayuan Provincial Museum	101.6	21.6	>150	cast iron ^g	1	Arima (1), pp. 144-145, 147; Sartori (14); Bishop (14); Goodrich (24); Read (4); Needham (B6); Chou Wei (1), p. 270, pl. B3; Figs. 94a, B1
1477	Huhehot Museum, Inner Mongolia	44	2	2.1	bronze		Tshui Hsuan (1)
1477	Huhehot Museum, Inner Mongolia	43.5	2	2.1	bronze		Tshui Hsuan (1)
1477	Collection of Lo Chen-Yü	barrel broken off		3.5	bronze	1	Arima & Kuroda (1); Arima (1), pp. 145-16, 147
1477	Kuangtung Provincial Mus. (from Kao-yao Hsien)	36	2.3	1.1	bronze	1	Ku Yun-chihuan (1)
1477	National Histor. Mus. Peking	39	2	1	bronze		
1477	National Histor. Mus. Peking	26.5	2	1	cast iron		
1477	National Histor. Mus. Peking	25.4			bronze	1	Arima (1), pp. 146, 147, 147; Goodrich (14)
1477	Huhehot Museum, Inner Mongolia	44.5	2	1.9	bronze		Tshui Hsuan (1)
1477	Tho-kho-tho, Inner Mongolia	41.2	2.1	2.1	bronze	1	Li F.-Yu (1)
1477	Sin-yuan Museum	43.2		2.1	bronze	1	Goodrich, in Goodrich & Feng Chia-sheng (1), p. 142 ^h
1477	Collection of Prince Chichibu	35	1.5	2.27	bronze	1	Kuroda (1); Arima (1), pp. 146, 147
1477	Collection of Fujiwara Teiki	43.5	1.5	2.5	bronze	1	Kuroda (1); Arima (1), pp. 146, 147
1477	Rotunda Museum, Woolwich	61			bronze	1	H. Blackmore (p.c.); Figs. 94, 95
1477	Rotunda Museum, Woolwich				brass or bronze	1	Okada Noboru (p.c.), but date is hard to be sure of
1477	Kuroda Collection	36	1.4	2.2	bronze	1	Kuroda (1); Arima (1), pp. 146, 147

the famous author of the *Hu Pi Chih* which we so often quote. It is entitled *Huo Yao Fa*¹ (Practical Dissertation on Gunpowder) and would be well worth a translation in full, epitomising as it does the traditional thinking about the mechanism of the explosive mixture. The nature of saltpetre is to expand vertically (*shang*) while sulphur expands horizontally; saltpetre is the prince, with sulphur and charcoal as the ministers, and even poisonous substances are brought in as adjuncts. It could show very clearly how Chinese technologists thought of explosive phenomena in the early years of the 17th century.

It remains only to say a few words about the time of the Opium Wars, when the Chinese were busy catching up with the gunnery developments, modern for that day, which had been made by the European nations. Thus in 1843 Chihien Chieh-Ping², Admiral of Fukien, memorialised that the remaining gunpowder-mills (*mu*)³ worked by man-power should be done away with, and animal-power or water-power, seven times more effective, universally substituted.⁴ He also had something to say on the preparation and purification of saltpetre (cf. p. 94 above), recommending oxide glue for the clearing. Rondot (2) knew this text when he visited some Chinese arsenals in 1849; there he found that the nitrate percentage of the powder made was equivalent to that of the best French product (75.5 %). Ting Kung-Chien⁵, who was one of the leading gunnery and powder experts of the time, observed this too.⁶ Rondot found, rather to his surprise, a large Chinese chemical laboratory and works organised and equipped by Phan Shih-Chheng,⁷ where saltpetre was prepared and recrystallised in bulk, and alcohol and nitric acid distilled. Some of this was used for making silver fulminate detonator caps, which had been produced in China since 1842.⁸

Perhaps the nearest Western parallel to Mao Yuan's essay would be the pages which Sir Thomas Browne conserved to the nature of gunpowder in his *Pseudodoxia Epidemica* (commonly called 'Vulgar Errors') of 1646. They occur in bk. 2, ch. 5, part 5 (Bask. ed., vol. 1, pp. 271 ff.). Now all these (common) errors, says Browne, although they bear a share in the discharge, yet they have distinct intentions and different offices in the composition. From Brimstone proceedeth the percing and powerful firing. ... From Sulfur cometh the black colour and quick accretion. ... From Saltpetre proceedeth the force and the impetus and the great noise and the great heat, and the great fire, and the great smoke, and the great sort of Powder the very best and comesth most Saltpetre ...

The memorial by Chieh-Ping is to be found in *Hu Kuo Tzu Chih*, ch. 91, pp. 88-116. He appears in from p. 88 or 89. The memorial is also recommended the use of vine charcoal instead of that made from pine or fir.
¹ *HKT*, ch. 91, pp. 116-156. On him, see Chihien Chieh-Thien (1), *Huang Thien-chu, T'shai Chiang-Chih* & Liao Yuan-ch'uan (1).
² *Paoan Sze-ch'ing* for Tientsin in European (cf. Chihien Chieh-Thien (1), pp. 36 ff., pp. 40 ff., 56 ff., (2), pp. 8-9, and p. 205 above, where we discussed the attention he gave to sea-mines, and his employment of an American expert to assist in their construction).
³ See Hsiao (1), pp. 100 ff., pp. 112. *S'ien-t'ien-shan* had first been prepared in 1738, but it was not until 1740 that the Chinese began to use it in their arsenals. It was used to replace the use of gunpowder in the world as it was known to this species. (Chinese Administration, 11, p. 71, above).
⁴ 7, 36.
⁵ 7, 37.
⁶ 4, 17.
⁷ 4, 17.
⁸ 4, 17.

The memorials of Chieh and Ting both urged that lessons should be learnt from European methods of powder manufacture. Then after the foundation of the famous Kuangnan Arsenal (Chuang Xian Chih-Chih Chieh-Tsao Chai) near Shanghai in 1865, and the establishment of a Translation Bureau (Fan I Kuan) within it two years later, an American book by Watt on powder-making was translated into Chinese by John Fryer (Fu Lan-Ya) with the title *Chih Hsu Yao Fa*¹ (Procedures in Gunpowder Manufacture).² But it is probable that neither Chieh nor Ting, nor Fryer and his associates, had any idea of how old gunpowder really was in Chinese history, nor that China had been the land of its birth. And now we must retrace our steps to the last years of the 17th century in order to follow the later development of artillery and musketry.

(17) THE LATER DEVELOPMENT OF ARTILLERY

From this point onwards we find ourselves in the presence of a great wave of influence back from Europe upon China. If Chinese culture had been left entirely to itself it is possible that the same developments would have occurred, according to that slow and steady progress which the whole of its history had manifested.³ But now the new economic system of capitalism was arising in Europe in strength and innovation as well as invention⁴ was getting full rein; thus it came about that superior forms of light cannon originating in the West spread rapidly everywhere over the Old World.⁵ We deal with them now (and their heavier congeners too) because improved hand-guns such as the arquebus and the musket reached China only some forty or fifty years later.

Here the key invention was that of breech-loading. Rather than waste a lot of time ramming the charge and the projectile down the muzzle, and probably a wasted as well, it was much more convenient to have a separate container for all these, shaped rather like a beer-mug with an appropriate handle, and placed in position in a cavity arranged to receive it at the breech of the cannon, then wedged into place with a transverse wooden bullet. This replaceable cylinder was known as the chamber or culasse. A drawing of the whole system is given in Fig. 129.⁶

¹ Cf. Bennett (1), p. 118. ² Cf. Needham (59), (66), p. 414.
³ See Schumpeier (1), 21. It was not only a matter of the new, but of the adoption and mass application of the old.
⁴ This was what vitiated the otherwise meritorious book of Cipolla (1). To show that the full-rigged ship (1700 model) of Vol. 4, pt. 3, pp. 512, 594-5, 606, 611, 662-71, with its brocade of up-to-date guns, sailing applications of the new sailing junk was one thing. To require completely that the former was based upon artistic realisation as its background and scientific knowledge, while the latter still had rote traditional bureau rule.
⁵ The spread of European artillery pieces among all the States of Eastern South-western and South Asia has been well-documented by Hsiao (1), pp. 110-11, and (2) pp. 111-112. This was greatly owing to the fact that the sulphur and saltpetre from China (to be used in Japan, as Hsiao (1) says, since the 16th century) was known as the 'chamber' or 'culasse'.
⁶ This invention was completely imported from Europe, where it was used in the 17th century, and was known as the 'chamber' or 'culasse'.



Fig. 131. Another part of the same fresco showing the field guns of the Turks, which are made out significantly larger than the guns of the defenders, here two, painted from the battlements. All the pieces are clearly painted with dragon scales, in accordance with the appellation so often given to artillery pieces.

records these breech-loaders are described variously as 'bases', 'port-pieces' or 'serpentines'. By the early +17th century they are generally called 'slings' or 'Portuguese bases'. The trouble with 'culverin' is that, like 'saker', 'minion' and 'falconet', it referred primarily to the length and bore of the gun, but so did 'base', which became the one with the smallest calibre. So perhaps culverin or caliver may pass, so long as one realises its inadequacy, since it meant only any long and narrow cannon.²

To add reality to what we are talking about, we may take a look at a few pictures of the breech-loaders in question. An early type, dating from about +1475, is shown in Fig. 132. Of Spanish origin, its barrel is made of four staves welded together and bound with iron hoops; the chamber is still in place, and the tiller may originally have been straight.³ Next (Fig. 133) is a Portuguese sling of c. +1520, cast in bronze, with tiller broken off, and chamber-cavity empty.⁴ The third (Fig. 134) was taken in Benin, and may be a Nigerian copy of

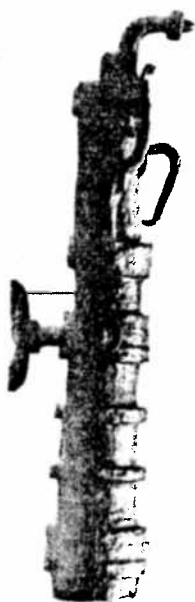


Fig. 132. Example of the fo-lang-chi, a sling or base, loosely called 'culverin' or 'caliver' from a Spanish word, c. +1475. Photo: Metropolitan Museum of Art, New York City, where it is numbered 17.100.100 (from the collection of the Museum of Art, New York City). This piece was developed up near Seville; it has its chamber in position, and a barrel (under the barrel) of four staves welded together and surrounded by hoops. Length 1' 10", bore at muzzle 1 1/2", bore at muzzle 1 1/2", at breech 5/8", wt. 100 lb.

a Portuguese sling; its chamber is missing but it retains its long tiller.⁵ These are the types of weapon which were called fo-lang-chi.⁶

(i) The fo-lang-chi (Frankish breech-loader)

In +1523 the Chinese captured two Western ships in which they found Portuguese culverins. These weapons were presented to the emperor and given the name fo-lang-chi, following the Chinese appellation for these foreigners, then in +1529 these guns were copied in China.⁷ So runs the conventional wisdom, but the story is a good deal more complicated, as Pelliot showed in a remarkable monograph [53] on the Hoja and the Said Husain of Ming texts.⁸ Actually, the standard statement is the gist of the account in the Ming Shih,⁹ which adds that Wang Hung¹⁰ was the one who presented the cannon at court.¹¹

The official historians were basing their account on two books, the Shu Yu Chou Tzu Lu¹² (Record of Despatches concerning the different Countries) of Yen

² Tower of London Armouries, Blackmore (2), p. 170, no. 399. Barrel length 5 ft 2 in. Other breech-loaders chamber, p. 151, no. 106, pl. 39 A (Portuguese of c. +1525); (Dutch of +1670) which keeps an original 192 and p. 168, no. 394 (Malay or Filipino).

³ Merle Peterson (1) describes a reproduction of a natural archery made by Edin and Fokker and Edin in the kind.

⁴ He was really trying to identify these characters and cleared up the horn-blower problem on the way.

There was at some point a Chinese-speaking minor named Ho Chou-Hsiao, a descendant of Muslim origin, from Malacca, or one of the interpreters of the undergrowth. From Pelliot (53) on the Hoja and the Said Husain of Ming texts.

⁵ He was the son of a Portuguese merchant, who was in the service of the Chinese. The other Muslim merchant was Hsiao Hsiao, and he was the son of a Portuguese merchant.

⁶ The fact that a gun of this kind was found in Benin, and may be a Nigerian copy of a Portuguese sling, is a good deal more complicated, as Pelliot showed in a remarkable monograph [53] on the Hoja and the Said Husain of Ming texts.

⁷ Wang Hung was the one who presented the cannon at court.

⁸ The official historians were basing their account on two books, the Shu Yu Chou Tzu Lu (Record of Despatches concerning the different Countries) of Yen

¹ For the information of the reader in this connection, see the book by A. V. H. Smith, *The History of the Tower of London*, p. 151, no. 106, pl. 39 A (Portuguese of c. +1525); (Dutch of +1670) which keeps an original 192 and p. 168, no. 394 (Malay or Filipino).

² Merle Peterson (1) describes a reproduction of a natural archery made by Edin and Fokker and Edin in the kind.

³ He was really trying to identify these characters and cleared up the horn-blower problem on the way.

There was at some point a Chinese-speaking minor named Ho Chou-Hsiao, a descendant of Muslim origin, from Malacca, or one of the interpreters of the undergrowth. From Pelliot (53) on the Hoja and the Said Husain of Ming texts.

⁴ He was the son of a Portuguese merchant, who was in the service of the Chinese. The other Muslim merchant was Hsiao Hsiao, and he was the son of a Portuguese merchant.

⁵ The fact that a gun of this kind was found in Benin, and may be a Nigerian copy of a Portuguese sling, is a good deal more complicated, as Pelliot showed in a remarkable monograph [53] on the Hoja and the Said Husain of Ming texts.

⁶ Wang Hung was the one who presented the cannon at court.

⁷ The official historians were basing their account on two books, the Shu Yu Chou Tzu Lu (Record of Despatches concerning the different Countries) of Yen

⁸ Pelliot (53) on the Hoja and the Said Husain of Ming texts.

⁹ Wang Hung was the one who presented the cannon at court.

¹⁰ The official historians were basing their account on two books, the Shu Yu Chou Tzu Lu (Record of Despatches concerning the different Countries) of Yen

¹¹ Pelliot (53) on the Hoja and the Said Husain of Ming texts.

¹² Wang Hung was the one who presented the cannon at court.

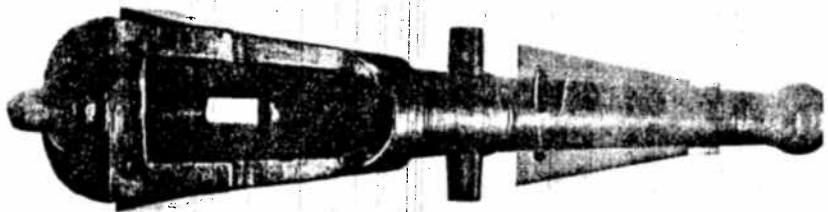


Fig. 1. A long, slender, tapering object, possibly a pipe or a small sculpture, with a decorative, bulbous base and a small, rounded finial at the top.



Fig. 2. A long, slender, tapering object, similar to the one in Fig. 1, but with a different base and finial design.

(Encyclopaedia) of Ch'ien Jen-Hsi¹ (+1690), but both of these say that it was a lower War Ministry official, Ho Yu², who got hold of the guns in +1522, and that later on copies were cast at the capital by two Westerners, Yang San³ (Pelto) and Tai Ming⁴. However, when in +1519 the famous philosopher Wang Yang-Ming⁵ (d. +1529), then Governor of Changsi, was putting down the revolt of a prince named Ch'ü Ch'ien-Hao⁶, he used, or intended to use, his friend Lin Ch'ün⁷, army commander against the prince, had his bronze founders cast *fo-lang-chi ch'ung*⁸ at this time—consequently the weapon was known in China, at least in Fukien and Chiangsi, before +1522. Moreover, there had been another rebellion in the same province twelve years earlier, when Huang Kuan⁹ was prefect, and it had been put down largely by a volunteer officer named Wei Sh'eng¹⁰, who attacked the brigands with more than a hundred *fo-lang-chi*, and destroyed them.¹¹ Therefore the Frankish breech-loaders were a fairly familiar weapon in the south as early as +1510.

If this is the case, it cannot have reached China directly from the Portuguese, because Malacca did not fall until +1511.¹² Pelliot thought it most probable that the guns came up from Malaya before Chinese people had ever met anyone from Portugal, in which case the word *ch'ing* really meant 'machine' from the first, i.e. transliteration of the name for the people.¹³ As Pelliot put it: 'on avait connu les canons *fo-lang-chi* avant les étrangers *fo-lang-chi*'. At all events there was a pervasive association of *fo-lang-chi* breech-loaders with southern regions, as witness

¹ Ch. 9, p. 96.

² Dates of +1520 (6th month) and +1538 (8th month) are both given for this in *Ming Shih* 12.

³ See Goodrich & Yang *Chao-Yung* (1), pp. 142-2-15.

⁴ *Huang Cheng Ch'ang Kang* (Ch'ien Shu, ch. 24, p. 122).

⁵ The reference for this comes, it is true, from the *Fukien Thung Ch'ü* (1), p. 127, to (1841), ch. 205, p. 102, which was compiled long afterwards, but the word *fo-lang-chi* is there for no reason for doubting the account.

⁶ The first Portuguese ship to touch at a Chinese haven was commanded by Jorge Alvarez and the year was +1514. The first Portuguese diplomatic contact was that of Tome Pires and began in +1517. See Vol. 4, p. 3, pp. 307, 334.

⁷ If so, things must have happened rather quickly, as the first Portuguese visit to Malacca was only in +1519. One wonders whether other sources ought not to be looked for—Sinhalese, or even English? On the talking of Frankistan, for example, the *Yuan Shih* (6th, 40, p. 62) already uses the phrase *Fu-lang-shih* for the Marignoli embassy (cf. Vol. 1, p. 180), and this was easily assimilated to the old *Thang* term for Byzantium—*Rum* (New Rome) → *Fu-lang*? (cf. Vol. 2, pp. 100, 105). The *Fang* also generated the name for *fo-lang-chi* breech-loaders comes from the fact that *Shih* (for *Shih* Sheng emperor, cf. +1525 to +1530) used the name *Shih* for the cannon of Frankish *fo-lang-chi* through made in India (P'ing-tung, Vol. 1, pp. 210, 211).

⁸ This designation of European weapons appeared all over Asia at the time, derived, no doubt, from Arabic *Manegoli* (cf. Vol. 1, p. 180), and this was easily assimilated to the old *Thang* term for Byzantium—*Rum* (New Rome) → *Fu-lang*? (cf. Vol. 2, pp. 100, 105). The *Fang* also generated the name for *fo-lang-chi* breech-loaders comes from the fact that *Shih* (for *Shih* Sheng emperor, cf. +1525 to +1530) used the name *Shih* for the cannon of Frankish *fo-lang-chi* through made in India (P'ing-tung, Vol. 1, pp. 210, 211).

⁹ This designation of European weapons appeared all over Asia at the time, derived, no doubt, from Arabic *Manegoli* (cf. Vol. 1, p. 180), and this was easily assimilated to the old *Thang* term for Byzantium—*Rum* (New Rome) → *Fu-lang*? (cf. Vol. 2, pp. 100, 105). The *Fang* also generated the name for *fo-lang-chi* breech-loaders comes from the fact that *Shih* (for *Shih* Sheng emperor, cf. +1525 to +1530) used the name *Shih* for the cannon of Frankish *fo-lang-chi* through made in India (P'ing-tung, Vol. 1, pp. 210, 211).

¹⁰ This designation of European weapons appeared all over Asia at the time, derived, no doubt, from Arabic *Manegoli* (cf. Vol. 1, p. 180), and this was easily assimilated to the old *Thang* term for Byzantium—*Rum* (New Rome) → *Fu-lang*? (cf. Vol. 2, pp. 100, 105). The *Fang* also generated the name for *fo-lang-chi* breech-loaders comes from the fact that *Shih* (for *Shih* Sheng emperor, cf. +1525 to +1530) used the name *Shih* for the cannon of Frankish *fo-lang-chi* through made in India (P'ing-tung, Vol. 1, pp. 210, 211).

¹¹ This designation of European weapons appeared all over Asia at the time, derived, no doubt, from Arabic *Manegoli* (cf. Vol. 1, p. 180), and this was easily assimilated to the old *Thang* term for Byzantium—*Rum* (New Rome) → *Fu-lang*? (cf. Vol. 2, pp. 100, 105). The *Fang* also generated the name for *fo-lang-chi* breech-loaders comes from the fact that *Shih* (for *Shih* Sheng emperor, cf. +1525 to +1530) used the name *Shih* for the cannon of Frankish *fo-lang-chi* through made in India (P'ing-tung, Vol. 1, pp. 210, 211).

¹² This designation of European weapons appeared all over Asia at the time, derived, no doubt, from Arabic *Manegoli* (cf. Vol. 1, p. 180), and this was easily assimilated to the old *Thang* term for Byzantium—*Rum* (New Rome) → *Fu-lang*? (cf. Vol. 2, pp. 100, 105). The *Fang* also generated the name for *fo-lang-chi* breech-loaders comes from the fact that *Shih* (for *Shih* Sheng emperor, cf. +1525 to +1530) used the name *Shih* for the cannon of Frankish *fo-lang-chi* through made in India (P'ing-tung, Vol. 1, pp. 210, 211).

¹³ This designation of European weapons appeared all over Asia at the time, derived, no doubt, from Arabic *Manegoli* (cf. Vol. 1, p. 180), and this was easily assimilated to the old *Thang* term for Byzantium—*Rum* (New Rome) → *Fu-lang*? (cf. Vol. 2, pp. 100, 105). The *Fang* also generated the name for *fo-lang-chi* breech-loaders comes from the fact that *Shih* (for *Shih* Sheng emperor, cf. +1525 to +1530) used the name *Shih* for the cannon of Frankish *fo-lang-chi* through made in India (P'ing-tung, Vol. 1, pp. 210, 211).

the *Yueh Shun Thung Thun* (Collected Discourses of Mr. Moon-Moumian), i.e. Li Wen-Feng¹, who was writing about +1435. In the course of this book of memorabilia, he notes that the design came originally from abroad, and in his time only the Cantonese gun-founders could make them as well as the foreigners could.² It is often said that the earliest Chinese description of the *fo-lang-chi* breech-loader occurs in the *Ch'ou Hai Tai Pien* of +1562, and this may be true, but when one takes a closer look one finds that Ch'eng Jo-T'eng was quoting a much earlier memorandum, written in fact by Ku Ying-Hsiang³, the scholar we met with long ago as a distinguished mathematician.⁴ When Ku was Acting Superintendant of Foreign Trade at Canton in +1517 he became an eye-witness of the arrival of a fleet under Fernão Peres de Andrade, which brought the first Portuguese ambassador to China, the ill-fated Tome Pires.⁵ What he said about the breech-loading cannon must therefore have been written long before, probably about +1525 or +1530.

The report, which Ch'eng Jo-T'eng says did not get into the *Ming Hui T'ung*, is given in his *Ch'ou Hai Tai Pien*,⁶ it speaks of two Portuguese vessels carrying the *Capitão-mor* (Ch'ü-pi-tan-mo), i.e. the ambassador, Pires, surrounded by tall men with prominent noses and deep-set eyes wearing white head-cloths like Muslims. The victory of the two Kuang provinces, Ch'ien Hsi-Hsien⁷, came to examine them, and the party was sent up to the capital, where it stayed in the Hostel for Foreign Tribute Missions (Hui Thung Kuan⁸) for a year, but the Chinese were upset because the Westerners did not know the proper customs of civilised intercourse, and the embassy ended in failure. Actually, what was much more significant were the depredations of other Portuguese captains, and the bitter complaints of the ousted Rajah of Malacca. Then follows the passage about the guns (Figs. 135, 136):⁹

This cannon (*ch'ung*) is made of iron,¹⁰ and measures five or six feet in length. It has a large belly and a long barrel. At the bulge there is a long cavity, into which five smaller chambers (*ch'ung*)¹¹ can be inserted in rotation, and these contain the gunpowder for firing.¹² The gun is wrapped on the outside with wooden staves and fastened with iron hoops to ensure that it does not split.¹³ Four or five of these cannons are concealed behind a ship's bulwarks on each side, and if an opposing ship comes near, one single shot,

¹ This text was first noted by Parker (7).

² Vol. 3, pp. 34-2.

³ Vol. 4, pp. 3, pp. 334-5. The full details are in Carrasco (2), Pelliot (57) and Chang Thien-T'ie (1), pp. 428.

⁴ Ch. 13, pp. 312, 6, 324.

⁵ *Ming Shih* later on took up, p. 110, says however,

⁶ 'Noble there is the failure to invent a new form for what was already a new thing. We have no arrows, no machine before, as in Vol. 1, p. 10, p. 105, (1) *Shou-hsin* 25, pp. 415, 46, 47. It was said that the

⁷ And the people the next, he would have said, 'This is the first time that we have seen of this'.

⁸ This is the first time that we have seen of this.

⁹ Vol. 10, the *Shou-hsin*, a former historical

¹⁰ Vol. 10, the *Shou-hsin*, a former historical

¹¹ Vol. 10, the *Shou-hsin*, a former historical

¹² Vol. 10, the *Shou-hsin*, a former historical

¹³ Vol. 10, the *Shou-hsin*, a former historical

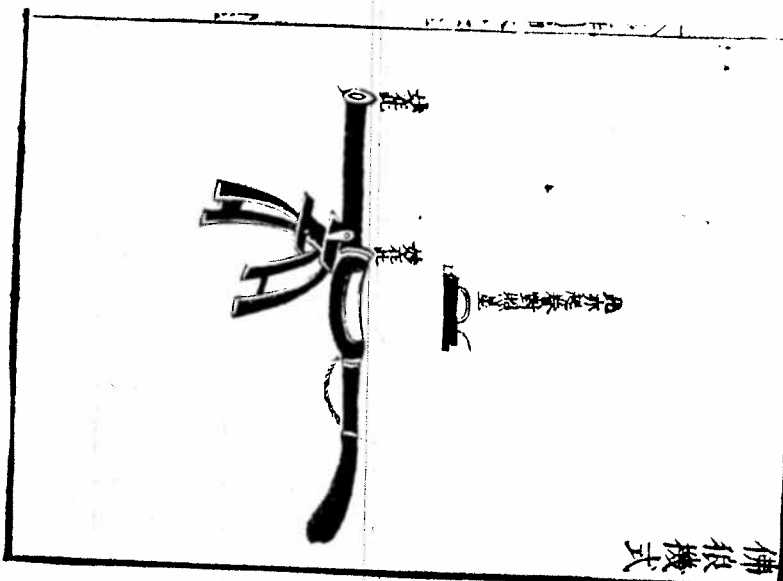


Fig. 15. The first Chinese illustration of a Farakshi vulcani 'fo-lan-ki-shang' from *CHP* ch. 13, p. 312. One's barrel or culvert is also shown. This book came out in 1902, but the relevant quotation came from a report of 1901 or so. The small arrow is motion of which is various supported on a swiveling base.

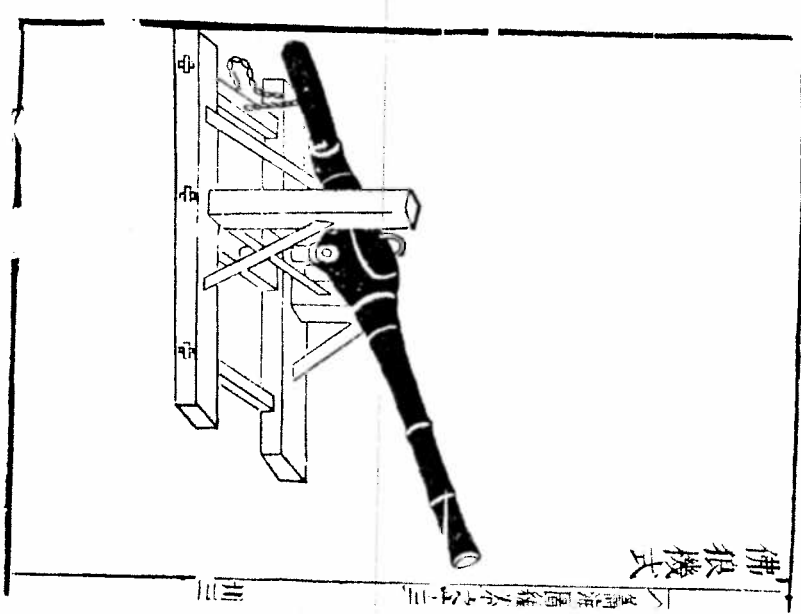


Fig. 16. Another illustration from the same work ch. 13, p. 312. The mounting is more elaborate than the earlier proposal of two things in separate positions.

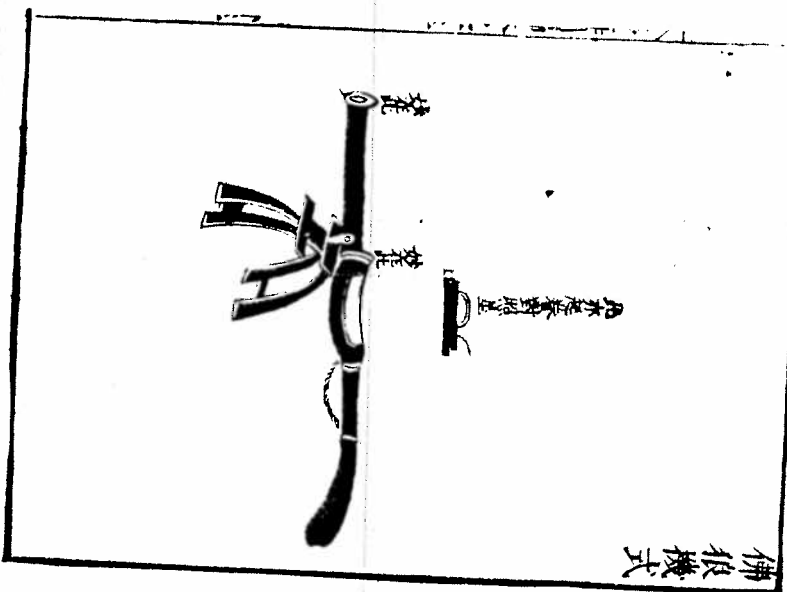


Fig. 115. The first Chinese illustration of a Folangji (steam) pump, from *Si-yang-shi shu-shu*, from 1777, ch. 1, p. 133. The chamber or cylinder is also shown. This book came out in 1792, but the invention (piston, etc.) came from a report of 1734 or so. The small piston is mounted with a spring to support it on a valve when it is

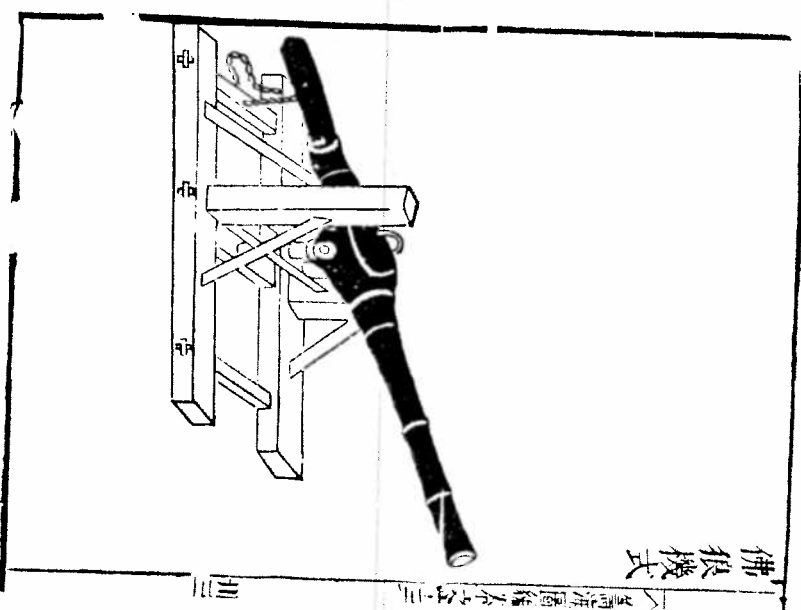


Fig. 116. Another illustration from the same work, ch. 1, p. 133. The mounting is more elaborate but the same principle of working is obvious.

When a cannon of this type, and its gunpowder formula, was submitted (to the throne) by an officer from the campaign against the sea-pirates, was submitted (to the parade-ground, and its range was found to be only about 100 paces.³⁹ But it was admittedly an effective weapon on shipboard, and it could also be used in the defence of city walls. However, it was not much good for carrying about on open battlefields. Later on, when Wang Chiheng-Chai⁴⁰ (i.e. Wang Hung) became Minister of War, he sought permission to cast more than a thousand of such cannon for issue to (defence posts on) the three frontiers. One type was mounted on a wooden stand, so that it could be lowered and raised, or turned to the left and to the right (for accurate aiming). This method of mounting guns was originally developed in China, and did not come in with the Portuguese.

Each (breach-loading) cannon weighs about 200 catties,⁴¹ and its three chambers weigh about 30 catties each. The single lead shot which each one contains weighs about 10 ounces.⁴²

The passage then concludes with a few lines which to some extent repeat what has already been said, extolling the universal mounting and recommending it for rampart defence, if not for attack. Although the smaller guns at sea let the force of the fire partly escape when they go off, and fill the vessel with thunderous noise, there is no wooden ship that can withstand a direct hit. They can also be mounted on rafts for coastal defence.

(ii) Field-guns, siege guns, and garrison artillery

After this, illustrations and descriptions of breach-loading cannon are not rare in the Chinese military literature. A cannon with a bulbous belly and replaceable chambers like the *fo-lang-chi* and called the 'flying-over-the-mountains Chhi Chi-Kuang' in his *Lien Ping Shih Chi* of +1568. There is no text to accompany the drawing (Fig. 137) but the caption says that the cannon measures 2 ft 7 in. long and weighs 280 catties. The *fo-lang-chi* itself, with nine replaceable

³⁹ On p. 14 of the same chapter, Ching Jo-Tung was not quite so optimistic. Although the large Kuang-breach-loader cannon, he said, 'yet as they rise and fall in the trough of the waves they are dashed about, fired by it. If you are not hit the mark—but I must say if it does there is no ship which will not be pulled down.' (This was the usual 5 ft double-piece, it would mean about 50 ft, but Wang Shih-chi, p. 114) says more than twice as much.

⁴⁰ Wang Shih-chi, p. 114, says from 1550 to 1560, 1560 to 1570, 1570 to 1580, 1580 to 1590, 1590 to 1600, 1600 to 1610, 1610 to 1620, 1620 to 1630, 1630 to 1640, 1640 to 1650, 1650 to 1660, 1660 to 1670, 1670 to 1680, 1680 to 1690, 1690 to 1700, 1700 to 1710, 1710 to 1720, 1720 to 1730, 1730 to 1740, 1740 to 1750, 1750 to 1760, 1760 to 1770, 1770 to 1780, 1780 to 1790, 1790 to 1800, 1800 to 1810, 1810 to 1820, 1820 to 1830, 1830 to 1840, 1840 to 1850, 1850 to 1860, 1860 to 1870, 1870 to 1880, 1880 to 1890, 1890 to 1900, 1900 to 1910, 1910 to 1920, 1920 to 1930, 1930 to 1940, 1940 to 1950, 1950 to 1960, 1960 to 1970, 1970 to 1980, 1980 to 1990, 1990 to 2000, 2000 to 2010, 2010 to 2020, 2020 to 2030, 2030 to 2040, 2040 to 2050, 2050 to 2060, 2060 to 2070, 2070 to 2080, 2080 to 2090, 2090 to 2100, 2100 to 2110, 2110 to 2120, 2120 to 2130, 2130 to 2140, 2140 to 2150, 2150 to 2160, 2160 to 2170, 2170 to 2180, 2180 to 2190, 2190 to 2200, 2200 to 2210, 2210 to 2220, 2220 to 2230, 2230 to 2240, 2240 to 2250, 2250 to 2260, 2260 to 2270, 2270 to 2280, 2280 to 2290, 2290 to 2300, 2300 to 2310, 2310 to 2320, 2320 to 2330, 2330 to 2340, 2340 to 2350, 2350 to 2360, 2360 to 2370, 2370 to 2380, 2380 to 2390, 2390 to 2400, 2400 to 2410, 2410 to 2420, 2420 to 2430, 2430 to 2440, 2440 to 2450, 2450 to 2460, 2460 to 2470, 2470 to 2480, 2480 to 2490, 2490 to 2500, 2500 to 2510, 2510 to 2520, 2520 to 2530, 2530 to 2540, 2540 to 2550, 2550 to 2560, 2560 to 2570, 2570 to 2580, 2580 to 2590, 2590 to 2600, 2600 to 2610, 2610 to 2620, 2620 to 2630, 2630 to 2640, 2640 to 2650, 2650 to 2660, 2660 to 2670, 2670 to 2680, 2680 to 2690, 2690 to 2700, 2700 to 2710, 2710 to 2720, 2720 to 2730, 2730 to 2740, 2740 to 2750, 2750 to 2760, 2760 to 2770, 2770 to 2780, 2780 to 2790, 2790 to 2800, 2800 to 2810, 2810 to 2820, 2820 to 2830, 2830 to 2840, 2840 to 2850, 2850 to 2860, 2860 to 2870, 2870 to 2880, 2880 to 2890, 2890 to 2900, 2900 to 2910, 2910 to 2920, 2920 to 2930, 2930 to 2940, 2940 to 2950, 2950 to 2960, 2960 to 2970, 2970 to 2980, 2980 to 2990, 2990 to 3000, 3000 to 3010, 3010 to 3020, 3020 to 3030, 3030 to 3040, 3040 to 3050, 3050 to 3060, 3060 to 3070, 3070 to 3080, 3080 to 3090, 3090 to 3100, 3100 to 3110, 3110 to 3120, 3120 to 3130, 3130 to 3140, 3140 to 3150, 3150 to 3160, 3160 to 3170, 3170 to 3180, 3180 to 3190, 3190 to 3200, 3200 to 3210, 3210 to 3220, 3220 to 3230, 3230 to 3240, 3240 to 3250, 3250 to 3260, 3260 to 3270, 3270 to 3280, 3280 to 3290, 3290 to 3300, 3300 to 3310, 3310 to 3320, 3320 to 3330, 3330 to 3340, 3340 to 3350, 3350 to 3360, 3360 to 3370, 3370 to 3380, 3380 to 3390, 3390 to 3400, 3400 to 3410, 3410 to 3420, 3420 to 3430, 3430 to 3440, 3440 to 3450, 3450 to 3460, 3460 to 3470, 3470 to 3480, 3480 to 3490, 3490 to 3500, 3500 to 3510, 3510 to 3520, 3520 to 3530, 3530 to 3540, 3540 to 3550, 3550 to 3560, 3560 to 3570, 3570 to 3580, 3580 to 3590, 3590 to 3600, 3600 to 3610, 3610 to 3620, 3620 to 3630, 3630 to 3640, 3640 to 3650, 3650 to 3660, 3660 to 3670, 3670 to 3680, 3680 to 3690, 3690 to 3700, 3700 to 3710, 3710 to 3720, 3720 to 3730, 3730 to 3740, 3740 to 3750, 3750 to 3760, 3760 to 3770, 3770 to 3780, 3780 to 3790, 3790 to 3800, 3800 to 3810, 3810 to 3820, 3820 to 3830, 3830 to 3840, 3840 to 3850, 3850 to 3860, 3860 to 3870, 3870 to 3880, 3880 to 3890, 3890 to 3900, 3900 to 3910, 3910 to 3920, 3920 to 3930, 3930 to 3940, 3940 to 3950, 3950 to 3960, 3960 to 3970, 3970 to 3980, 3980 to 3990, 3990 to 4000, 4000 to 4010, 4010 to 4020, 4020 to 4030, 4030 to 4040, 4040 to 4050, 4050 to 4060, 4060 to 4070, 4070 to 4080, 4080 to 4090, 4090 to 4100, 4100 to 4110, 4110 to 4120, 4120 to 4130, 4130 to 4140, 4140 to 4150, 4150 to 4160, 4160 to 4170, 4170 to 4180, 4180 to 4190, 4190 to 4200, 4200 to 4210, 4210 to 4220, 4220 to 4230, 4230 to 4240, 4240 to 4250, 4250 to 4260, 4260 to 4270, 4270 to 4280, 4280 to 4290, 4290 to 4300, 4300 to 4310, 4310 to 4320, 4320 to 4330, 4330 to 4340, 4340 to 4350, 4350 to 4360, 4360 to 4370, 4370 to 4380, 4380 to 4390, 4390 to 4400, 4400 to 4410, 4410 to 4420, 4420 to 4430, 4430 to 4440, 4440 to 4450, 4450 to 4460, 4460 to 4470, 4470 to 4480, 4480 to 4490, 4490 to 4500, 4500 to 4510, 4510 to 4520, 4520 to 4530, 4530 to 4540, 4540 to 4550, 4550 to 4560, 4560 to 4570, 4570 to 4580, 4580 to 4590, 4590 to 4600, 4600 to 4610, 4610 to 4620, 4620 to 4630, 4630 to 4640, 4640 to 4650, 4650 to 4660, 4660 to 4670, 4670 to 4680, 4680 to 4690, 4690 to 4700, 4700 to 4710, 4710 to 4720, 4720 to 4730, 4730 to 4740, 4740 to 4750, 4750 to 4760, 4760 to 4770, 4770 to 4780, 4780 to 4790, 4790 to 4800, 4800 to 4810, 4810 to 4820, 4820 to 4830, 4830 to 4840, 4840 to 4850, 4850 to 4860, 4860 to 4870, 4870 to 4880, 4880 to 4890, 4890 to 4900, 4900 to 4910, 4910 to 4920, 4920 to 4930, 4930 to 4940, 4940 to 4950, 4950 to 4960, 4960 to 4970, 4970 to 4980, 4980 to 4990, 4990 to 5000, 5000 to 5010, 5010 to 5020, 5020 to 5030, 5030 to 5040, 5040 to 5050, 5050 to 5060, 5060 to 5070, 5070 to 5080, 5080 to 5090, 5090 to 5100, 5100 to 5110, 5110 to 5120, 5120 to 5130, 5130 to 5140, 5140 to 5150, 5150 to 5160, 5160 to 5170, 5170 to 5180, 5180 to 5190, 5190 to 5200, 5200 to 5210, 5210 to 5220, 5220 to 5230, 5230 to 5240, 5240 to 5250, 5250 to 5260, 5260 to 5270, 5270 to 5280, 5280 to 5290, 5290 to 5300, 5300 to 5310, 5310 to 5320, 5320 to 5330, 5330 to 5340, 5340 to 5350, 5350 to 5360, 5360 to 5370, 5370 to 5380, 5380 to 5390, 5390 to 5400, 5400 to 5410, 5410 to 5420, 5420 to 5430, 5430 to 5440, 5440 to 5450, 5450 to 5460, 5460 to 5470, 5470 to 5480, 5480 to 5490, 5490 to 5500, 5500 to 5510, 5510 to 5520, 5520 to 5530, 5530 to 5540, 5540 to 5550, 5550 to 5560, 5560 to 5570, 5570 to 5580, 5580 to 5590, 5590 to 5600, 5600 to 5610, 5610 to 5620, 5620 to 5630, 5630 to 5640, 5640 to 5650, 5650 to 5660, 5660 to 5670, 5670 to 5680, 5680 to 5690, 5690 to 5700, 5700 to 5710, 5710 to 5720, 5720 to 5730, 5730 to 5740, 5740 to 5750, 5750 to 5760, 5760 to 5770, 5770 to 5780, 5780 to 5790, 5790 to 5800, 5800 to 5810, 5810 to 5820, 5820 to 5830, 5830 to 5840, 5840 to 5850, 5850 to 5860, 5860 to 5870, 5870 to 5880, 5880 to 5890, 5890 to 5900, 5900 to 5910, 5910 to 5920, 5920 to 5930, 5930 to 5940, 5940 to 5950, 5950 to 5960, 5960 to 5970, 5970 to 5980, 5980 to 5990, 5990 to 6000, 6000 to 6010, 6010 to 6020, 6020 to 6030, 6030 to 6040, 6040 to 6050, 6050 to 6060, 6060 to 6070, 6070 to 6080, 6080 to 6090, 6090 to 6100, 6100 to 6110, 6110 to 6120, 6120 to 6130, 6130 to 6140, 6140 to 6150, 6150 to 6160, 6160 to 6170, 6170 to 6180, 6180 to 6190, 6190 to 6200, 6200 to 6210, 6210 to 6220, 6220 to 6230, 6230 to 6240, 6240 to 6250, 6250 to 6260, 6260 to 6270, 6270 to 6280, 6280 to 6290, 6290 to 6300, 6300 to 6310, 6310 to 6320, 6320 to 6330, 6330 to 6340, 6340 to 6350, 6350 to 6360, 6360 to 6370, 6370 to 6380, 6380 to 6390, 6390 to 6400, 6400 to 6410, 6410 to 6420, 6420 to 6430, 6430 to 6440, 6440 to 6450, 6450 to 6460, 6460 to 6470, 6470 to 6480, 6480 to 6490, 6490 to 6500, 6500 to 6510, 6510 to 6520, 6520 to 6530, 6530 to 6540, 6540 to 6550, 6550 to 6560, 6560 to 6570, 6570 to 6580, 6580 to 6590, 6590 to 6600, 6600 to 6610, 6610 to 6620, 6620 to 6630, 6630 to 6640, 6640 to 6650, 6650 to 6660, 6660 to 6670, 6670 to 6680, 6680 to 6690, 6690 to 6700, 6700 to 6710, 6710 to 6720, 6720 to 6730, 6730 to 6740, 6740 to 6750, 6750 to 6760, 6760 to 6770, 6770 to 6780, 6780 to 6790, 6790 to 6800, 6800 to 6810, 6810 to 6820, 6820 to 6830, 6830 to 6840, 6840 to 6850, 6850 to 6860, 6860 to 6870, 6870 to 6880, 6880 to 6890, 6890 to 6900, 6900 to 6910, 6910 to 6920, 6920 to 6930, 6930 to 6940, 6940 to 6950, 6950 to 6960, 6960 to 6970, 6970 to 6980, 6980 to 6990, 6990 to 7000, 7000 to 7010, 7010 to 7020, 7020 to 7030, 7030 to 7040, 7040 to 7050, 7050 to 7060, 7060 to 7070, 7070 to 7080, 7080 to 7090, 7090 to 7100, 7100 to 7110, 7110 to 7120, 7120 to 7130, 7130 to 7140, 7140 to 7150, 7150 to 7160, 7160 to 7170, 7170 to 7180, 7180 to 7190, 7190 to 7200, 7200 to 7210, 7210 to 7220, 7220 to 7230, 7230 to 7240, 7240 to 7250, 7250 to 7260, 7260 to 7270, 7270 to 7280, 7280 to 7290, 7290 to 7300, 7300 to 7310, 7310 to 7320, 7320 to 7330, 7330 to 7340, 7340 to 7350, 7350 to 7360, 7360 to 7370, 7370 to 7380, 7380 to 7390, 7390 to 7400, 7400 to 7410, 7410 to 7420, 7420 to 7430, 7430 to 7440, 7440 to 7450, 7450 to 7460, 7460 to 7470, 7470 to 7480, 7480 to 7490, 7490 to 7500, 7500 to 7510, 7510 to 7520, 7520 to 7530, 7530 to 7540, 7540 to 7550, 7550 to 7560, 7560 to 7570, 7570 to 7580, 7580 to 7590, 7590 to 7600, 7600 to 7610, 7610 to 7620, 7620 to 7630, 7630 to 7640, 7640 to 7650, 7650 to 7660, 7660 to 7670, 7670 to 7680, 7680 to 7690, 7690 to 7700, 7700 to 7710, 7710 to 7720, 7720 to 7730, 7730 to 7740, 7740 to 7750, 7750 to 7760, 7760 to 7770, 7770 to 7780, 7780 to 7790, 7790 to 7800, 7800 to 7810, 7810 to 7820, 7820 to 7830, 7830 to 7840, 7840 to 7850, 7850 to 7860, 7860 to 7870, 7870 to 7880, 7880 to 7890, 7890 to 7900, 7900 to 7910, 7910 to 7920, 7920 to 7930, 7930 to 7940, 7940 to 7950, 7950 to 7960, 7960 to 7970, 7970 to 7980, 7980 to 7990, 7990 to 8000, 8000 to 8010, 8010 to 8020, 8020 to 8030, 8030 to 8040, 8040 to 8050, 8050 to 8060, 8060 to 8070, 8070 to 8080, 8080 to 8090, 8090 to 8100, 8100 to 8110, 8110 to 8120, 8120 to 8130, 8130 to 8140, 8140 to 8150, 8150 to 8160, 8160 to 8170, 8170 to 8180, 8180 to 8190, 8190 to 8200, 8200 to 8210, 8210 to 8220, 8220 to 8230, 8230 to 8240, 8240 to 8250, 8250 to 8260, 8260 to 8270, 8270 to 8280, 8280 to 8290, 8290 to 8300, 8300 to 8310, 8310 to 8320, 8320 to 8330, 8330 to 8340, 8340 to 8350, 8350 to 8360, 8360 to 8370, 8370 to 8380, 8380 to 8390, 8390 to 8400, 8400 to 8410, 8410 to 8420, 8420 to 8430, 8430 to 8440, 8440 to 8450, 8450 to 8460, 8460 to 8470, 8470 to 8480, 8480 to 8490, 8490 to 8500, 8500 to 8510, 8510 to 8520, 8520 to 8530, 8530 to 8540, 8540 to 8550, 8550 to 8560, 8560 to 8570, 8570 to 8580, 8580 to 8590, 8590 to 8600, 8600 to 8610, 8610 to 8620, 8620 to 8630, 8630 to 8640, 8640 to 8650, 8650 to 8660, 8660 to 8670, 8670 to 8680, 8680 to 8690, 8690 to 8700, 8700 to 8710, 8710 to 8720, 8720 to 8730, 8730 to 8740, 8740 to 8750, 8750 to 8760, 8760 to 8770, 8770 to 8780, 8780 to 8790, 8790 to 8800, 8800 to 8810, 8810 to 8820, 8820 to 8830, 8830 to 8840, 8840 to 8850, 8850 to 8860, 8860 to 8870, 8870 to 8880, 8880 to 8890, 8890 to 8900, 8900 to 8910, 8910 to 8920, 8920 to 8930, 8930 to 8940, 8940 to 8950, 8950 to 8960, 8960 to 8970, 8970 to 8980, 8980 to 8990, 8990 to 9000, 9000 to 9010, 9010 to 9020, 9020 to 9030, 9030 to 9040, 9040 to 9050, 9050 to 9060, 9060 to 9070, 9070 to 9080, 9080 to 9090, 9090 to 9100, 9100 to 9110, 9110 to 9120, 9120 to 9130, 9130 to 9140, 9140 to 9150, 9150 to 9160, 9160 to 9170, 9170 to 9180, 9180 to 9190, 9190 to 9200, 9200 to 9210, 9210 to 9220, 9220 to 9230, 9230 to 9240, 9240 to 9250, 9250 to 9260, 9260 to 9270, 9270 to 9280, 9280 to 9290, 9290 to 9300, 9300 to 9310, 9310 to 9320, 9320 to 9330, 9330 to 9340, 9340 to 9350, 9350 to 9360, 9360 to 9370, 9370 to 9380, 9380 to 9390, 9390 to 9400, 9400 to 9410, 9410 to 9420, 9420 to 9430, 9430 to 9440, 9440 to 9450, 9450 to 9460, 9460 to 9470, 9470 to 9480, 9480 to 9490, 9490 to 9500, 9500 to 9510, 9510 to 9520, 9520 to 9530, 9530 to 9540, 9540 to 9550, 9550 to 9560, 9560 to 9570, 9570 to 9580, 9580 to 9590, 9590 to 9600, 9600 to 9610, 9610 to 9620, 9620 to 9630, 9630 to 9640, 9640 to 9650, 9650 to 9660, 9660 to 9670, 9670 to 9680, 9680 to 9690, 9690 to 9700, 9700 to 9710, 9710 to 9720, 9720 to 9730, 9730 to 9740, 9740 to 9750, 9750 to 9760, 9760 to 9770, 9770 to 9780, 9780 to 9790, 9790 to 9800, 9800 to 9810, 9810 to 9820, 9820 to 9830, 9830 to 9840, 9840 to 9850, 9850 to 9860, 9860 to 9870, 9870 to 9880, 9880 to 9890, 9890 to 9900, 9900 to 9910, 9910 to 9920, 9920 to 9930, 9930 to 9940, 9940 to 9950, 9950 to 9960, 9960 to 9970, 9970 to 9980, 9980 to 9990, 9990 to 10000, 10000 to 10010, 10010 to 10020, 10020 to 10030, 10030 to 10040, 10040 to 10050, 10050 to 10060, 10060 to 10070, 10070 to 10080, 10080 to 10090, 10090 to 10100, 10100 to 10110, 10110 to 10120, 10120 to 10130, 10130 to 10140, 10140 to 10150, 10150 to 10160, 10160 to 10170, 10170 to 10180, 10180 to 10190, 10190 to 10200, 10200 to 10210, 10210 to 10220, 10220 to 10230, 10230 to 10240, 10240 to 10250, 10250 to 10260, 10260 to 10270, 10270 to 10280, 10280 to 10290, 10290 to 10300, 10300 to 10310, 10310 to 10320, 10320 to 10330, 10330 to 10340, 10340 to 10350, 10350 to 10360, 10360 to 10370, 10370 to 10380, 10380 to 10390, 10390 to 10400, 10400 to 10410, 10410 to 10420, 10420 to 10430, 10430 to 10440, 10440 to 10450, 10450 to 10460, 10460 to 10470, 10470 to 10480, 10480 to 10490, 10490 to 10500, 10500 to 10510, 10510 to 10520, 10520 to 10530, 10530 to 10540, 10540 to 10550, 10550 to 10560, 10560 to 10570, 10570 to 10580, 10580 to 10590, 10590 to 10600, 10600 to 10610, 10610 to 10620, 10620 to 10630, 10630 to 10640, 10640 to 10650, 10650 to 10660, 10660 to 10670, 10670 to 10680, 10680 to 10690, 10690 to 10700, 10700 to 10710, 10710 to 10720, 10720 to 10730, 10730 to 10740, 10740 to 10750, 10750 to 10760, 10760 to 10770, 10770 to 10780, 10780 to 10790, 10790 to 10800, 10800 to 10810, 10810 to 10820, 10820 to 10830, 10830 to 10840, 10840 to 10850, 10850 to 10860, 10860 to 10870, 10870 to 10880, 10880 to 10890, 10890 to 10900, 10900 to 10910, 10910 to 10920, 10920 to 10930, 10930 to 10940, 10940 to 10950, 10950 to 10960, 10960 to 10970, 10970 to

one *juang-tai* outburst to fire was called the cannon-firing gun (*tsai kang chuang*) and is described in the *Ping Tao* of + *tsi* with a diagrammatic illustration. Before long the breech-loading principle was extended to quite heavy guns, like the 'invincible general' (*tsu ti ta chung chun*) illustrated and described by Chhi Chhi-Kuang (Figs. 140, 141).⁷ This weighed 1030 catties, and was carried into position on a kind of barrow. Here a good new term was at last found for the chambers, *tsu chung*.⁸ The range for grape-shot was over 200 ft.

Cannon of this name we have already come across (p. 338), but like all the largest ones they were muzzle-loading. Let us look at another one in the *Chou Hai Tzu Pen*, that called the 'bronze outburst cannon' (*chung ta tung*).⁹ Fig. 142. Cheng Ju-Tsing says:

Each of these weighs 500 catties or thereabouts, and fires too lead shot, each weighing about 4 catties. It is a powerful weapon for assaulting city-walls, as also for attacking the enemy when tens of thousands of them are gathered in massed formations. The stone cannon-balls are as large as a small peck measure, and any object struck by them must inevitably disintegrate. Walls will be penetrated, houses in their path will crumble, trees hit by them will fall, and from any men or animals that get in the way blood will flow in streams. If fired at a mountain-side, the balls will bury themselves several feet deep. Not only are the cannon-balls not to be withstood, but objects which are struck by them will ricochet and strike other objects—even parts of the human body like limbs and trunks thrown about in this way will also cause damage.

Not only are the cannon-balls so powerful and frightening, but after the priming-powder (*i*) is ignited, the gas (*chi*) coming from (the explosion) is poisonous, the blast can blow people to death, and even the earthquake-like noise can kill. Hence before letting off a bronze outburst cannon it is necessary to dig a trench in which the gunner can take cover before lighting the fuse. Then, as the fire, the gas, and the roar all go upwards, he is protected from injury and death.¹⁰

Of course it is always necessary to guard the gun with a detachment of brave soldiers so as to prevent the misfortune of the enemy capturing it. But if you are not attacking strong defensive works, nor getting out of a dangerous situation, you do not need to use this (great siege cannon).

⁷ *Tai Chi*, ch. 5, pp. 166, 174, with two pages of description following Fig. 138.

⁸ *Chi*, 12, p. 282, b.

⁹ *Tai Chi*, ch. 5, pp. 138-162.

¹⁰ The caption of the illustration has *lung*² without the fire radical, but properly *lung*³ means any great piece of ordnance.

¹¹ *Chi*, 13, pp. 346, 354, ff. and. The same picture appears in *HLC*, p. 2, ch. 2, p. 24, with text on pp. 28, 30, identical with that translated here. It is also in *WPC*, ch. 122, pp. 48, 54, b.

¹² One remembers having come across this curious procedure before, and in fact it is (derivatively) in the *Tsai Kang K'ai Yi* (+ 1675), ch. 15, p. 76 (Sun & Sun tr., p. 271, Li Chiao-Ping tr., p. 203, both misinterpreting in different ways). The wonder whether it is not a relic of the ever-present danger of these early big guns bursting and killing the gunners.

¹³ *Tai Chi*, ch. 5, pp. 166, 174, with two pages of description following Fig. 138.

¹⁴ *Chi*, 12, p. 282, b.

¹⁵ *Tai Chi*, ch. 5, pp. 138-162.

¹⁶ The caption of the illustration has *lung*² without the fire radical, but properly *lung*³ means any great piece of ordnance.

¹⁷ *Chi*, 13, pp. 346, 354, ff. and. The same picture appears in *HLC*, p. 2, ch. 2, p. 24, with text on pp. 28, 30, identical with that translated here. It is also in *WPC*, ch. 122, pp. 48, 54, b.

¹⁸ One remembers having come across this curious procedure before, and in fact it is (derivatively) in the *Tsai Kang K'ai Yi* (+ 1675), ch. 15, p. 76 (Sun & Sun tr., p. 271, Li Chiao-Ping tr., p. 203, both misinterpreting in different ways). The wonder whether it is not a relic of the ever-present danger of these early big guns bursting and killing the gunners.

¹⁹ *Tai Chi*, ch. 5, pp. 166, 174, with two pages of description following Fig. 138.

²⁰ *Chi*, 12, p. 282, b.

²¹ *Tai Chi*, ch. 5, pp. 138-162.

²² The caption of the illustration has *lung*² without the fire radical, but properly *lung*³ means any great piece of ordnance.

²³ *Chi*, 13, pp. 346, 354, ff. and. The same picture appears in *HLC*, p. 2, ch. 2, p. 24, with text on pp. 28, 30, identical with that translated here. It is also in *WPC*, ch. 122, pp. 48, 54, b.

²⁴ One remembers having come across this curious procedure before, and in fact it is (derivatively) in the *Tsai Kang K'ai Yi* (+ 1675), ch. 15, p. 76 (Sun & Sun tr., p. 271, Li Chiao-Ping tr., p. 203, both misinterpreting in different ways). The wonder whether it is not a relic of the ever-present danger of these early big guns bursting and killing the gunners.

²⁵ *Tai Chi*, ch. 5, pp. 166, 174, with two pages of description following Fig. 138.

²⁶ *Chi*, 12, p. 282, b.

²⁷ *Tai Chi*, ch. 5, pp. 138-162.

²⁸ The caption of the illustration has *lung*² without the fire radical, but properly *lung*³ means any great piece of ordnance.

²⁹ *Chi*, 13, pp. 346, 354, ff. and. The same picture appears in *HLC*, p. 2, ch. 2, p. 24, with text on pp. 28, 30, identical with that translated here. It is also in *WPC*, ch. 122, pp. 48, 54, b.

³⁰ One remembers having come across this curious procedure before, and in fact it is (derivatively) in the *Tsai Kang K'ai Yi* (+ 1675), ch. 15, p. 76 (Sun & Sun tr., p. 271, Li Chiao-Ping tr., p. 203, both misinterpreting in different ways). The wonder whether it is not a relic of the ever-present danger of these early big guns bursting and killing the gunners.

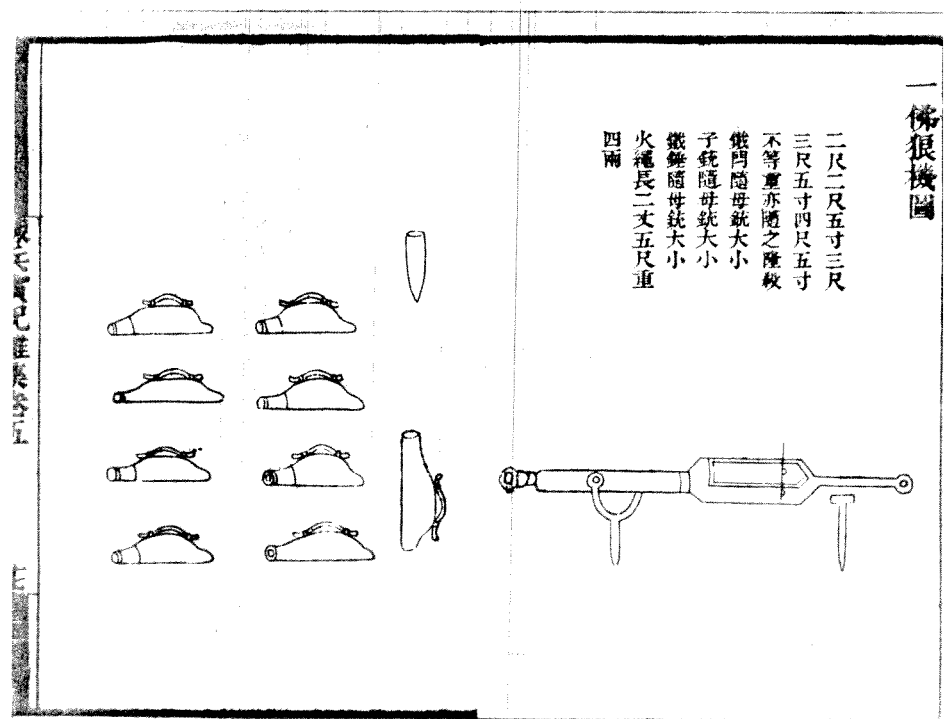


Fig. 138. A Frankish culverin shown in the same book (ch. 5, pp. 166, 174), together with nine calasces to fit into it.

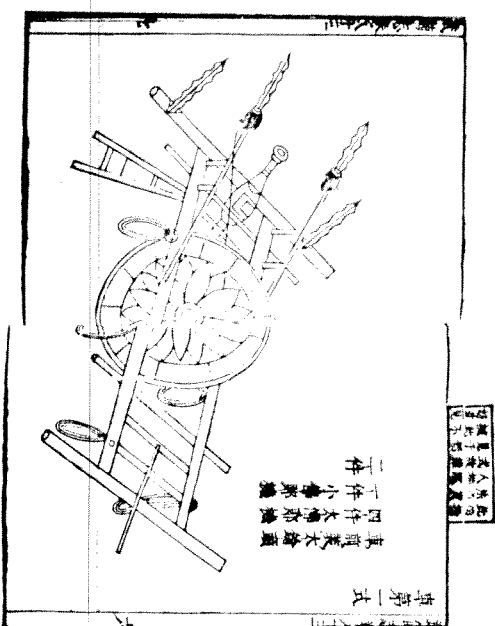


Fig. 139. One of Chhi-Chiu Kuang's vase or bottle-shaped breech-loaders (cf. Fig. 137) mounted at the front of an assault wheebarrow (HPC, ch. 82, pp. 64, 72) accompanied by four spurs. The text says that there were three such cannon, one large and two small, but only a single one is shown.

And the text goes on to say that this weapon could also be used on board ships at sea, if the vessels were large, and part of a fleet: it was also good for defending the gates of cities or encampments. The design was derived from the countries of the Western-ocean barbarians (Hsi-Yang Fan Kuò) in the Chia-Ching reign-period (+1522 to +1566).

The passage further adds that just as the first bronze outburst cannons were developed from foreign examples, so Chinese ingenuity (*chiao sui*) produced a smaller version of the *fo-lang-tai* breech-loaders, and called it the 'lead-and-in gun' (*chhen hai chhang*), presumably because of the shot it fired. One of these is in the Tower of London (Figs. 143*a, b*);³ it has a swivel mounting though hardly larger than a musket.

By +1605, when Ho Ju-Pin was writing his *Ping Lu*, even the terminology for cannon was reflecting Western usage, as we can see in Table 5, where 'serpent-

³ Kredits provided by Mr. Hsu and Mr. Kuang. One of the four spurs of a wheelbarrow shows such a version as with mouse (Fig. 141, 142, Fig. 72 on p. 47).

⁴ 四件小輪

⁵ 四件

⁶ 車前大輪

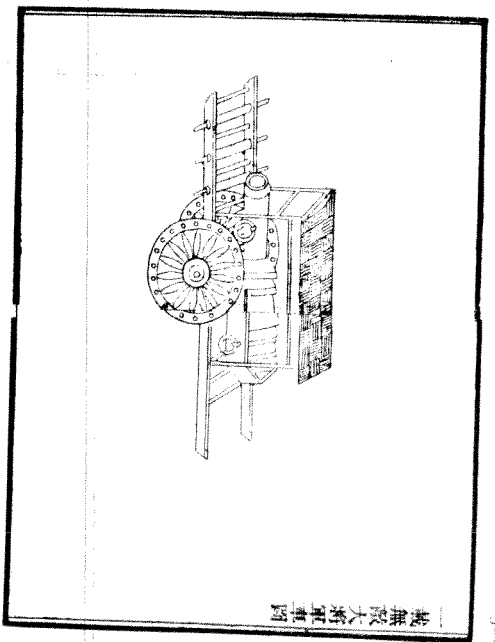


Fig. 140. The Chinese breech-loader applied to larger cannon, the 'invincible general' (see it as *chhang-chang*) on its two-wheeled carriage (LPC, [TC], ch. 5, p. 14*a, b*).

time', 'falconet' and 'saker' had their counterparts in Chinese. Illustrations too, now often show clear influence from the West, e.g. the field-gun with its trunnions (*chun chhang*)² the heavy garrison piece (*shou chhang*)³, and the siege gun ornamented in very European style (*lung chhang*)⁴, Fig. 145.⁵ Variations in elevation are shown by the pictures in Figs. 146, 147, with the quadrant and plumb-bob at the cannon's mouth, set in the howitzer case at 60°, as the inscription says.⁶ The carriage here resembles closely those of late +16th-century cannon in the West.⁷ Finally, the 'tiger-cat mortar' (*fei piao chhang*)⁸ is illustrated (Fig. 148) in the act of bombarding a city, which with its church towers and crenellated walls seems likely to have come out of some Western gunnery book.⁹

¹ PL, ch. 13, p. 6*a*.

² Ibid. p. 32*a*.

³ Ibid. p. 14*b*.

⁴ Ibid. p. 20*b*.

⁵ Blackstone (4-5, p. 12). When we come down as late as Chhi-kuo one can find in the *Hsi-Kuo-Pao* (ch. 10, p. 142) good drawings of a muzzle-loading ship's gun, like those which I printed in the 'Western world of Ming' book.

⁶ PL, 20, 14-15, 14*b*. Ho Ju-Pin's name has come down to us as the inventor of a 'great' elevating mortar (a kind of great mortar) named 'Invincible General' in the *se-ku* (1. Kuomintang edition, 1924), see Hsiang-shan, 27, 4*b*, 17, p. 100*a*.

⁷ 虎無敵大砲

⁸ 第一式

⁹ 虎無敵大砲

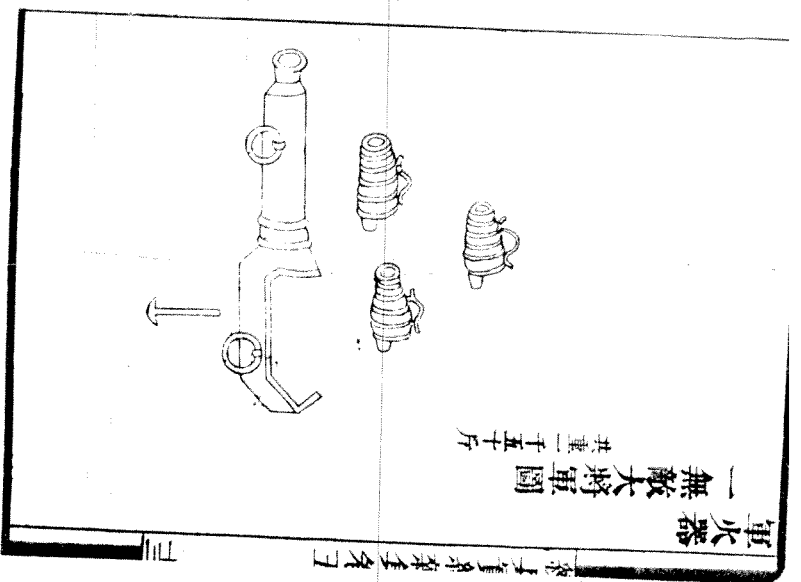


Fig. 141. Three chambers or calibers for the same *ILSC* (TC), ch. 5, p. 170.

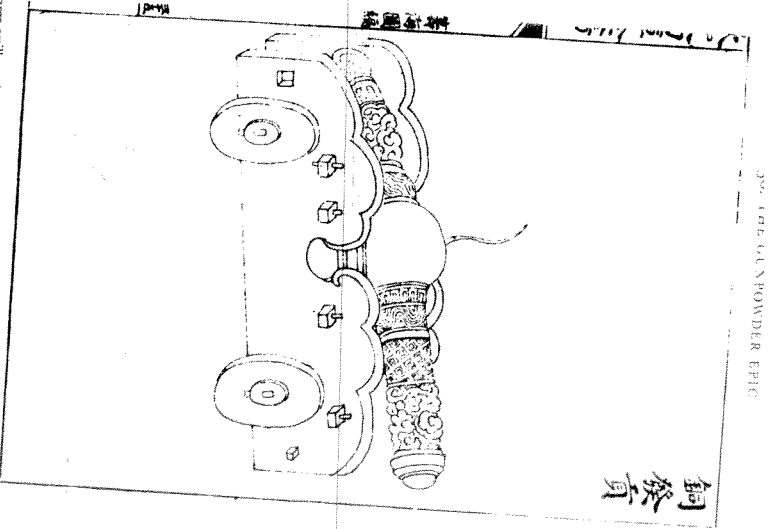


Fig. 142. A large artillery piece of the +16th century, the 'bronze outburst cannon' (*huang fa bang*), muzzle-loading. From *CHP*, ch. 13, p. 354; *CI WPC*, ch. 22, p. 48.



Fig. 142. Breech and muzzle of a muzzle-size breech-loading gun in the Tower Armouries (photo, Blackmore). Overall length 11 ft.

Fig. 143b. Close-up photograph of the same gun, with chamber removed.

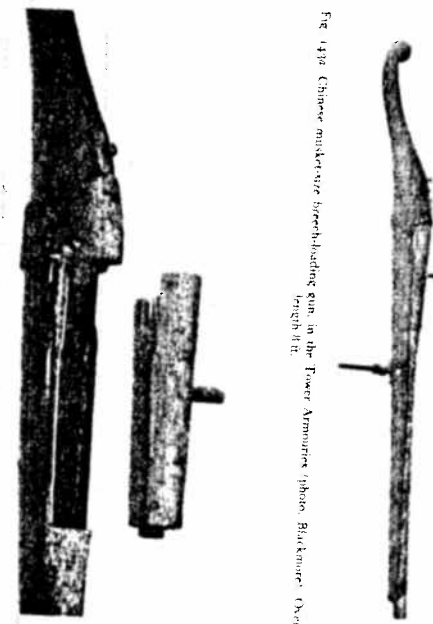


Fig. 143a. Chinese muzzle-size breech-loading gun in the Tower Armouries (photo, Blackmore). Overall length 11 ft.

Table 5. Artillery pieces described in the Ping Lu (+1606)

	name		weight in catties		range in paces		ref.
			projectile	powder charge	horizontal	upwards (howitzer-style)	
Light guns	demu-serpentine ¹	<i>pan she chung</i> ¹	9-17	eq.	550-650	3,500-6,150	13/14b, 14a
	large serpentine	<i>ta she chung</i> ²	18-25	eq.	700-900	6,000-7,250	
	extra-large serpentine	<i>pei ta she chung</i> ³	26-40	eq.	980	7,000	
	small Frankish sling	<i>hsiao fo-lang-chi</i> ⁴	1		350	2,000	
	large Frankish sling	<i>ta fo-lang-chi</i> ⁵			400	1,000	
Semi-guns	flying tiger-cat mortar	<i>fei piao chung</i> ⁶					13/14b and 14a
	falconet	<i>ying shun chung</i> ⁷	9-13	2/3 wt	500	3,500	20a-21a
	pouncing-owl cannon	<i>hsiao chu chung</i> ⁸	14-18	2/3 wt	600	4,000	13/14b, 14a
	demu-saker ⁹	<i>pan chen chung</i> ⁹	40		100	1,000	13/14a
	larger saker	<i>ta chen chung</i> ¹⁰	50		950	1,750	13/14b-14b
	extra-large saker	<i>pei ta chen chung</i> ¹¹	60		1,000	4,000	
	roaring-tiger cannon	<i>hu hsiao chung</i> ¹²	60-100				
	demu running-hog cannon	<i>pan thuan chung</i> ¹³	6-12				13/15b-20a
Heavy guns	large running-hog cannon	<i>ta thuan chung</i> ¹⁴	12-18				13/27b-14b
	extra-large running-hog cannon	<i>pei ta thuan chung</i> ¹⁵	19-25				
	leaping tiger cannon	<i>hu chu chung</i> ¹⁶	20-50				

¹ This means for a small cannon should not be confused with the similar name for the lever in arquebuses that brought the blow match to the touch-hole (14 pp. 14-15).

² The word "saker" originally meant a kind of hawk; here *chen* is the serpent-eagle or poison-falcon, *Spilornis cheha* (R 12). Ching Tso Hsiao (2), vol. 2, p. 104.

³ Here there seems to be many printing errors.

⁴ Said to be the next to be of Western origin.

1. 小蛇銃 2. 大蛇銃 3. 大蛇銃 4. 小佛郎機 5. 大佛郎機 6. 飛龍銃 7. 飛虎貓 8. 飛虎貓
9. 大馬銃 10. 大馬銃 11. 大馬銃 12. 虎咆銃 13. 虎咆銃 14. 虎咆銃 15. 虎咆銃 16. 虎咆銃

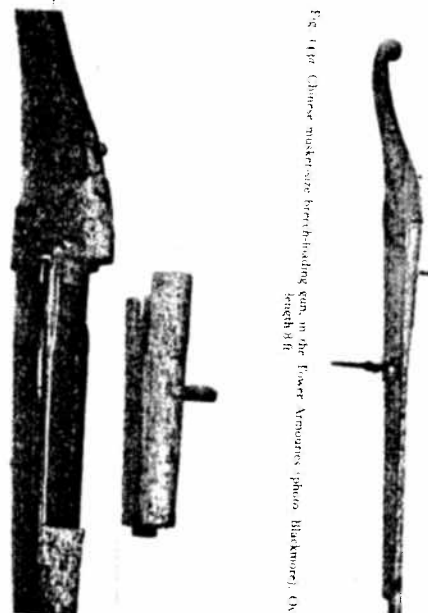
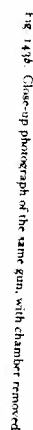


Table 5. Artillery pieces described in the *Ping Lu* (+ 1600)

Table 5. Artillery pieces described in the <i>Ping Lu</i> (+1600)						
	name	weight in catties		range in paces		ref.
		projectile	powder charge	horizontal	upwards (howitzer-style)	
Field guns	demiserpentine*	<i>pan shé chuang</i> ¹				
	large serpentine	9-17	eq.	550-650	1500-6180	13/18b, 9b
	extra-large serpentine	18-25	eq.	700-900	1600-7270	
	small Frankish sling	26-40	eq.	960	7100	
	large Frankish sling	1		350	2900	
Semi-field guns	flaming tiger-cat mortar	<i>ta fo-lang chí</i> ⁵		400	1000	13/10b, 11a
		<i>fei piao chuang</i> ⁶				
	talocnet	<i>ying shen chuang</i> ⁷				13/14b and 20a-21a
	poisoning owl cannon	9-13	2/3 wt	500	3540	13/10b, 17a
	demisaker ^{1b}	14-18	2/3 wt	600	4300	13/17a
	large saker	16		100	1020	13/17b-18b
	extra-large saker	50		900	1750	
Defensive guns	coasting tiger cannon	60		1000	1050	13/18b-20a
		<i>hu hsiao chuang</i> ¹²				
	demisunning-hog cannon	60-100				
	coarse sunning-hog cannon	<i>pan thuan chuang</i> ¹³		6-12		
	extra-large sunning-hog cannon	<i>ta thuan chuang</i> ¹⁴		12-18		
	humping tiger cannon	<i>pei ta thuan chuang</i> ¹⁵		19-25		13/24b-24c
		<i>hu chu chuang</i> ¹⁶		26-50		

The name for a small cannon should not be confused with the similar name for the lever in arquebuses that brought the shot train in to the muzzle, *le petit cul*.¹

The word *chouet* originally meant a kind of hawk, here *chouet* is the serpent eagle or poison falcon, *Spizans chrysus* R₁₇. Chouet is a H₁₆ word, vol 2, p. 104.

There seems to be many printing errors.

Some words need to be of Western origin.

[illegible]

and all he could do was to get their size reduced from 75-pounders to 40-pounders; of these twenty were cast and 500 smaller ones in the year following. It was at this time that he collaborated with Chiao Hsu¹ in producing the book *Huo Kung Chih-shi* (Essentials of Gunner), an admirable work, which we quote from time to time. Schall von Bell survived both the end of the Ming and a wave of severe persecution also, not dying till +1666, at which time he handed over his astronomical position to another Jesuit, the Belgian, Ferdinand Verbiest (San Hui-fen²).

It must not be supposed that the Ming metal-workers were incapable of designing and casting good cannon themselves. In 1652 when in Shenyang, I visited the home of a former warlord, Thung Yu-lin³, and found outside two big guns, the larger one about 12 ft long and of 5 in. bore. It had on it the following inscription, which I copied:

Great General Pacificing Manchuria. Cast for the Regional Commander-in-Chief and High Commissioner for Military Affairs in Liaoning, Wu Chien-Tzu⁴, Arsenal Superintendent and Regional Commander, Sun Ju-Chi⁵, Staff Officer in charge, Wang Peng-Wen⁶, Chief bronze-founder Shih Chun-Hien⁷. Made on a fortunate day, in the 12th month of the 13th year of the Ching-Chien reign-period.

That was +1642, and the day cannot have been so fortunate, for only two years later the Manchus captured Peking, and the cannon was probably used by them during the ensuing century.

What happened to Schall von Bell happened also to Verbiest—a decade later, the identical play was acted over again. Wu San-Kuei⁸, the powerful general who had joined his army with the Manchu troops of Dongron⁹ in +1644 to capture the capital from the Ming, and then served the Ching dynasty loyally for nearly thirty years, especially by his successful campaigns against the remnants of the Southern Ming in Yunnan and Burma,¹⁰ became in the end disaffected, and set up a standard of revolt in Kweichow and Hunan in +1673. He pro-

¹ Schall von Bell (1), pp. 63 ff., 80 ff. ² Cf. Table 2, p. 18, above.

³ Actually the Ming had already fallen, and the last emperor had committed suicide, so the invaders were liquidating a great peasant uprising under Li Tzu-Ching¹¹, who had organized a 12,000-man army. This has always been regarded as a classic case of class interest prevailing over national feeling.

⁴ The Southern Ming were also capable of casting good cannon, and one of them, ordered up from Kuaiak Bay in 1656, now stands beside the Central Government Offices in Hongkong. Fig. 140. The inscription gives the names of the three generals who ordered the casting, which was directed by a captain, Hsiao Yu-fan, and was of the Yang-Li reign-period, precisely the last that the Ming ever had, i.e. +1656. This was twelve years before the last extinction of the line, when the Mong Perimeter (Fuu Yu-Kang¹²), was executed at Kienning. What were the gun cast before being sunk in the sea, we do not know. From footnote 121 we learn that after the Southern Ming nation fell in the same year had been found near Hsienkung, and the name of Hsiao Yu-fan is given as a witness to the fact that the cannon was cast at Hsienkung. The inscription on the gun reads: "A great war was fought, a great victory was won, and the great Ming was restored." (The inscription on the gun is in Chinese and is not translated here.)



Fig. 140. Southern Ming cannon cast in +1656, derelict up from Kuaiak Bay in 1946, and now standing beside the Central Government Offices in Hongkong. See Lo Hsiang-lun 61. Photo: John Gunther Hong Kong.

claimed himself emperor of a new dynasty, the Chou¹, in +1678, but died of dysentery that same year. It was therefore perhaps not surprising that Verbiest, who had been re-equipping the Peking Observatory with splendid bronze instruments from +1669 to +1673,² should receive a summons in +1675 to set up another cannon-foundry, this time for the Manchus.

Let us listen to the elegant account of another Jesuit, Louis Lecomte (Li Ming³) written twenty years or so later:⁴

After the Emperor had tried many feverish ways to no purpose, he saw plainly that it was impossible to force them [i.e. the troops of Wu San-Kuei] from the places where they had entrenched without using his great Artillery: but the Cannon which he had were from, and so heavy that they dared not carry them over such deep Rooks, as they must do to come to him. He thought Father Verbiest might be affiant to him in this matter; he commanded the Father therefore to give directions for calling some Cannon after the European manner. The Father presently excused himself, saying that he had lived his whole life far from the noise of War, that he was therefore little instructed in those affairs. He added also that being a Religious, and wholly employed in the concerns of another World, he would pray for his Majesty's good success; but that he humbly begged that his Majesty would be pleased to give him leave not to concern himself with the warfare of this World.

The Father's Enemies (for a Missionary is never without former though that now they had an opportunity to undermine him). They persuaded the Emperor that what he commanded the Father to do was necessary to the well or misfortune of the Empire, and

Mathematical Instruments, especially when the good and talents of the Empire were concerned; that therefore without doubt the reason of the Emperor's refusal was because he kept correspondence with the Enemy, or at least because he had no respect for the Emperor. So that at last the Emperor gave the Father to understand, that he expected obedience to his last Order, not only upon pain of losing his own Life, but also of having his Religion utterly rooted out.

This was to touch him in the most terrible part, and he was indeed too wise to find out for a nicety or a tripe at the hazard of losing all that was valuable. I have already assured your Majesty [he said] that I have very little understanding in curing Cannon, but your Majesty commanded me I will endeavour to make your Workmen understand what the Cannon was proved before the Emperor, and found to be extraordinary good. The Emperor was so well pleased with the Work, that he pulled off his Mantle, and in the presence of the whole Court gave it to Father Verbiest for a token of his Affection.

All the Pieces of Cannon were made very light and small, but fringed with a flock of Wood from the mouth to the breech, and yet with several hands or Iron, so that the Cannon were strong enough to bear the Force of Powder, and light enough to be carried upon a Cart. The Enemy were obliged to leave their Intrenchments in disorder, and soon after to Capitulate, for they did not think it possible to hold out against these any longer, who could destroy them without coming themselves into reach.

It seems that the Manchju artillery had about 150 Cannon, but (as Lecomte says) many were too heavy for a mountain campaign, so Verbiest was called upon to cast a lot of smaller ones. Having duly organised the foundry he cast twenty in the first month, then 320 during the rest of the year.¹ On a previous occasion we could not help commenting adversely on the Christian ceremonies that Schall von Bell carried out in his foundry,² but now Verbiest did not hesitate to bless the guns liturgically with asperges and incense, giving to each one the name of a saint, and inscribing it accordingly. He was awarded the title of Deputy Minister of Public Works (Kung Pu Shih Lang) for his pains. By an extraordinary coincidence, two of his guns are still preserved in the Tower of London,³ having been captured at the Taku Forts in 1860 (Fig. 150). One has a legible inscription, which runs as follows:

General of Holy Authority. Cast in the 28th year of the Khang-Hsi reign-period (1 + 1688). It takes 1 catty, 12 liang, of powder as charge, and fires an iron ball weighing 3 catties, 8 liang.⁴ Height of the sight 6 *jin*, 3 *li*.⁵ Official in charge, Nan Huan-fu.

¹ See Berman, *loc. cit.* and Pictet, *loc. cit.* pp. 142-4. What is interesting here, as Dr. Claxton Bristol points out, is that Verbiest seems simply to have made improvements on the long-established Chinese tradition of producing large and light-weight cannon, rather than introducing imported Western types. All the *Hao Lang* (Great Cannon) models, however, were of the same size, and were made of cast iron, as were the *Hao Lang* (Great Cannon) models, and were of the same size, and were made of cast iron, as were the *Hao Lang* (Great Cannon) models.

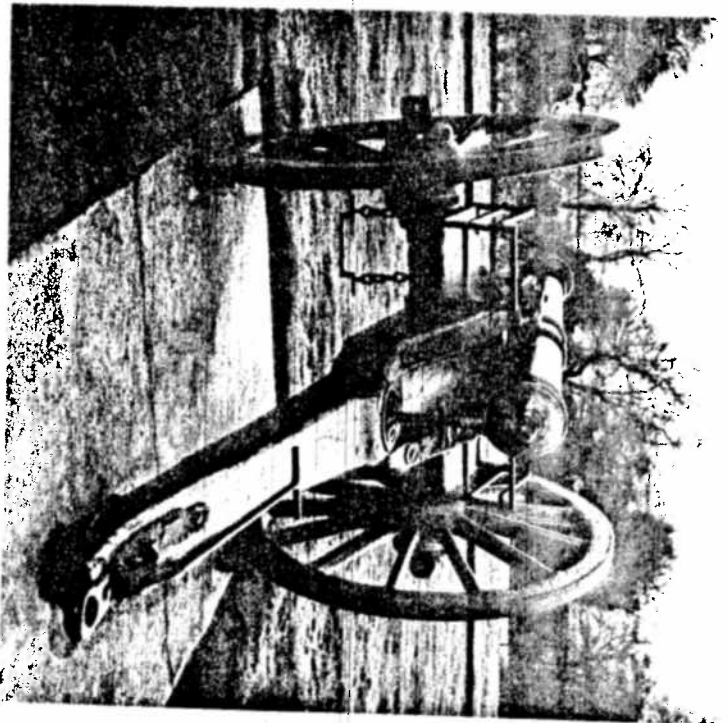


Fig. 150. One of Ferdinand Verbiest's field-guns, set on a mounting of about 1750 style, preserved at the Tower of London. Blackmore, *op. cit.* volume IV, p. 113, nos. 102 and 103. A number of these cannon bears the date of 1688.

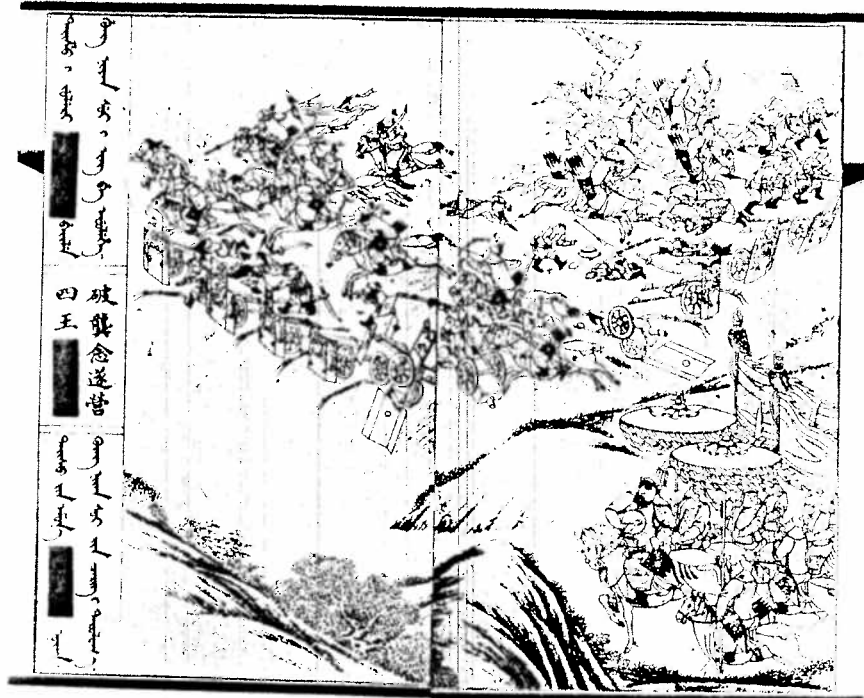


Fig. 154. A drawing from *TSLT* (no. 24, b) showing Nurhachi's cavalry taking a Ming battery from the rear. The eleven field-guns shown are mounted on two-wheeled barrows, the handles of which form the trails, and most of the gunners are either dead or fleeing. Normally a shield, presumably of metal, protects them. Note between each field-gun a double-barrelled bird-beak musket with prongs protruding beyond the muzzles as supports. The battery is described as one of those under the command of the Ming general Kung Nu-ni-hui.

partly or wholly overturned, and the gunners are dead or fleeing. Between each gun there are double-barrelled bird-beak muskets with prongs¹ at the front end as supports;² six of these can be seen, but more in use. One gets the general impression that the Chinese artillery was good when emplaced, but rather lacking in mobility.

Another picture (Fig. 153) shows a frontal attack on a Ming battery by Manchū archers, both mounted and on foot, with Nurhachi himself commanding in the right-hand bottom corner. Again there are the field-guns and the shields to protect the gunners,³ but besides these one can see five more guns simply resting on the parapet of the entrenchment, with a bombardier just about to fire one off at the bottom on the left.⁴ The priming-pans of the cannon are carefully drawn in, and twelve of the bird-beak muskets may be noted, this time single-barrelled.⁵ Double-barrelled muskets appear again, however, in Fig. 154, where the front line of Kiang Ying-Chien's⁶ men is firing six of them, while he himself is indicated commanding behind.⁷ The musketeers have quilted armour, but not the swordsmen with round shields.

The two-wheeled barrow-carriage was not the only way in which field-guns were mounted at this time, for Fig. 155 shows another frontal attack on a battery by the Manchū cavalry,⁸ and here the guns are all attached to what we can only call carpenter's bench trailers.⁹ These trailers seem at first sight to have wheels at the end of each of their splayed legs, but a more careful look suggests that they were simply round flat feet, in which case the mobility was very poor.¹⁰ Two of these trailers have overturned in the combat.¹¹ This curious type of carriage appears again in other illustrations, such as that depicting Nurhachi's siege of Liaoyang, which fell in 1621. Here they are all mounted on the flat ground between the city-wall and the moat, and in several cases the gunners can be seen applying their match (Fig. 157).¹² One could hardly get a better insight into

¹ Anyone wishing to see a photograph of such prongs in contemporary use may find it in Stone (1), p. 265, fig. 208, who calls them 'A-shaped rests'. The example comes from the Lamut, a Tungusic people in Siberia. And the Chinese army still had them on its muskets in 1896 (Fig. 196).

² On muskets see the following notes, pp. 429 ff.

³ Under the general Pisan Tsung-Yen's banner, who do not seem to be doing anything, however.

⁴ One gun-carriage is already overturned.

⁵ This lack of any form of carriage or mounting appears also in another drawing, which depicts the death of the Ming general Liu Tsung¹ in 1619. On the whole campaign of this year see the paper of Hsiao Jen-Yin (6).

⁶ Two of them can be seen firing in the top right-hand corner of the picture.

⁷ Besides these there are thirteen bird-beak muskets to be seen.

⁸ The Chinese were here commanded by a general named Ma Tiao², and this may well be part of the battle of 1619 in which he was killed.

⁹ The Manchū archers, however, as in other pictures, were mounted on horseback.

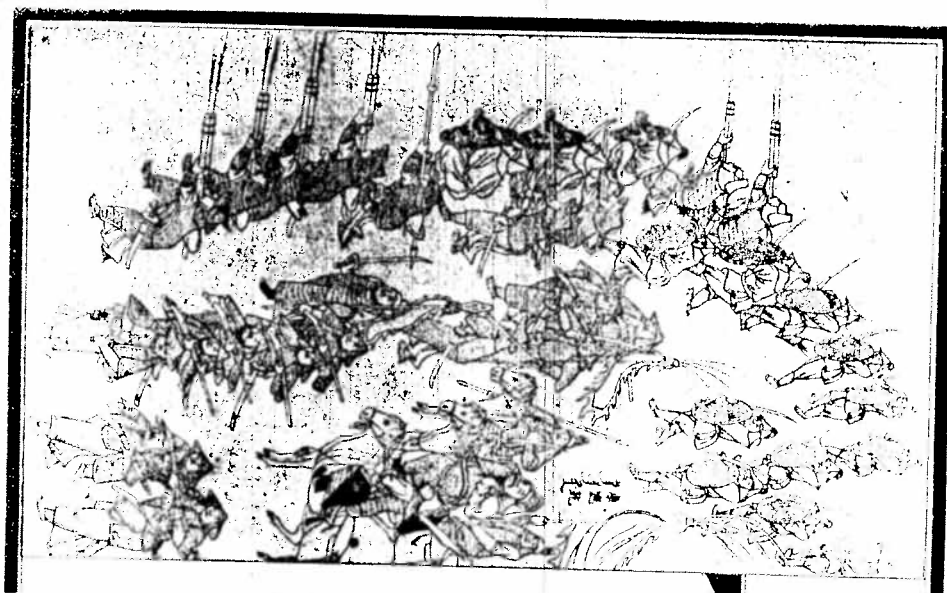
¹⁰ Besides the bird-beak muskets, one can also see a number of other types of arms.

¹¹ As in other pictures, the Chinese were mounted on horseback.

¹² As in other pictures, the Chinese were mounted on horseback.



Fig. 153. Another drawing from the same work, *YTSLT* (no. 42, 5). Manchu archers, both mounted and on foot, are attacking frontally a Ming battery commanded by the general Phan Tsung-Yen, who is himself seen in the top left corner, while Nurhachu is depicted opposite at the bottom on the right. Besides the field guns with their shields and the pronged muskets, several guns are simply resting on the parapet of the entrenchment, with an artilleryman about to fire one of them.



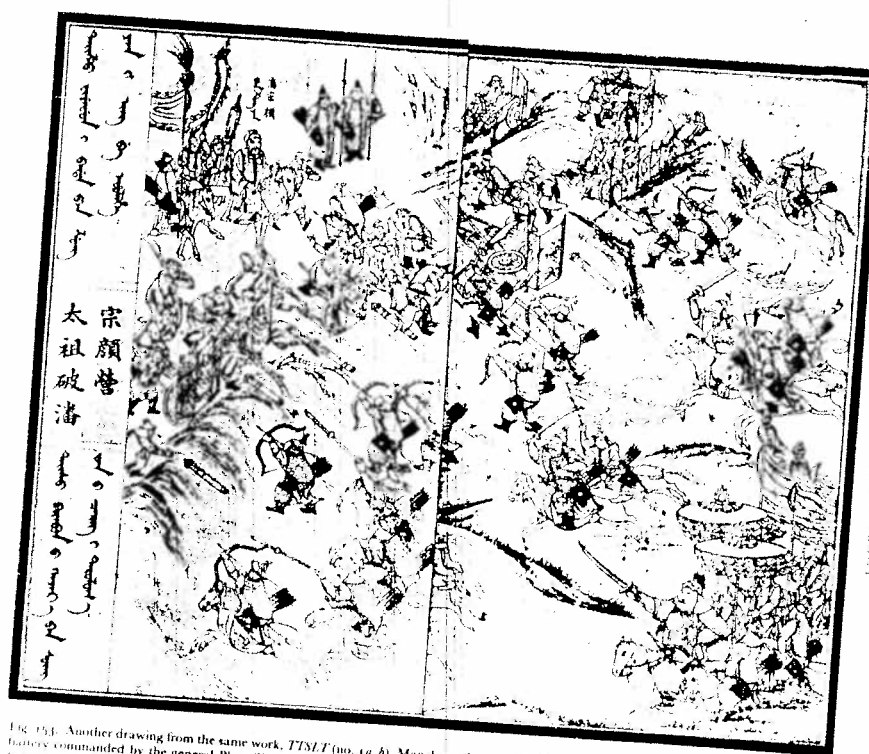
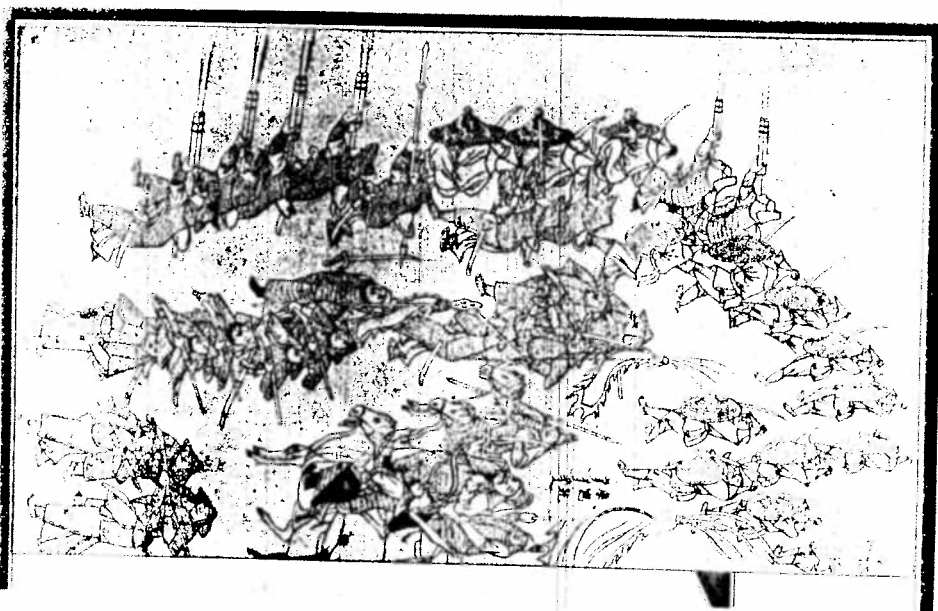


Fig. 153. Another drawing from the same work, *TSLT* (no. 14, b). Manchuz archers, both mounted and on foot, are attacking frontally a Ming entrenchment commanded by the general Phan Tsung-Yen, who is himself seen in the top left corner, while Nurbachi is depicted opposite at the bottom on the right. Besides the field-guns with their shields and the pronged muskets, several guns are simply resting on the parapet of the entrenchment, with an artillery man about to fire one. It is not a detail from the same work.



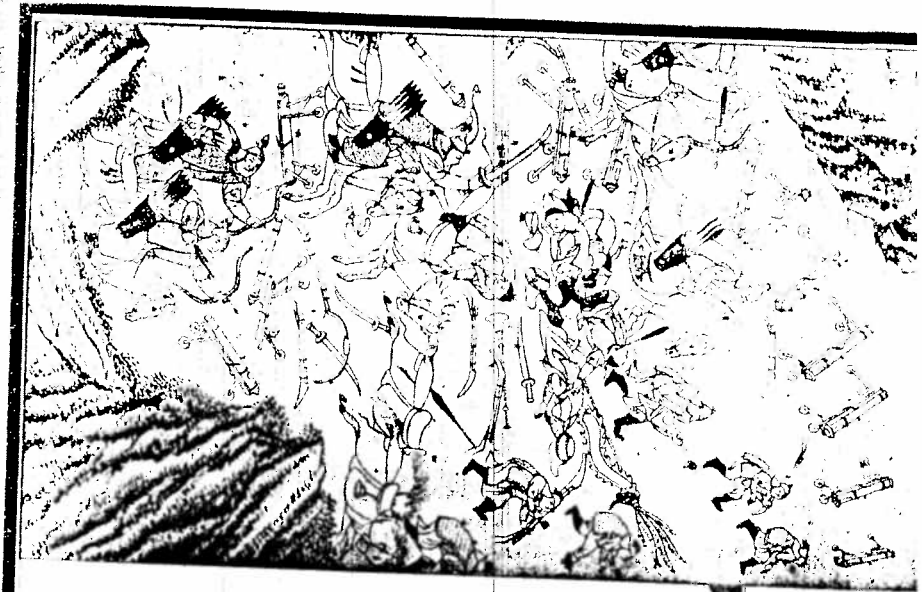


Fig. 155. Another drawing of a battle scene, showing a group of soldiers in a field. The soldiers are shown in various poses, some on horseback and some on foot. The scene is filled with smoke and the sounds of battle. The illustration is framed by a simple border.

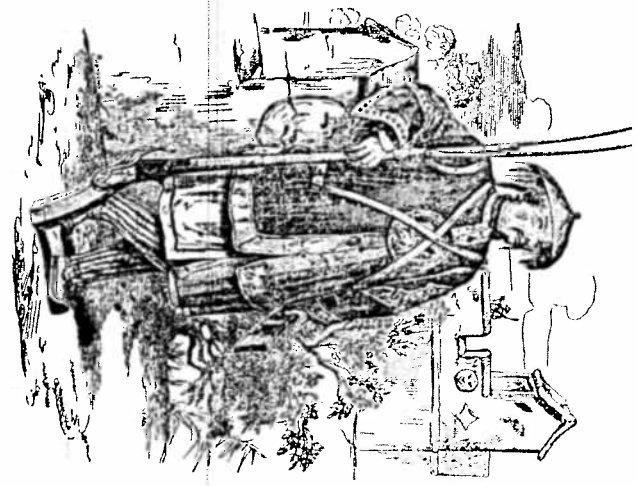


Fig. 156. Promys still in use on muckets in 1860, a drawing from *Hatching*, California Magazine for June of that year, p. 335. Ref. courtesy of Michael Rosen. The promys are shown erroneously, however, they were evidently intended to help aiming when firing over a parapet or on the ground, and should therefore curve in the same direction as the butt (cf. the 1752/7 illustrations). The present artist was not the only one who fell into this mistake, for it was also made in the illustration of Adom & Wright (1), vol. 1, opp. p. 67 in 1843, depicting a military guard-station at Thung-chang-in on the Grand Canal (cf. Vol. 4, pt. 3, fig. 718 above).

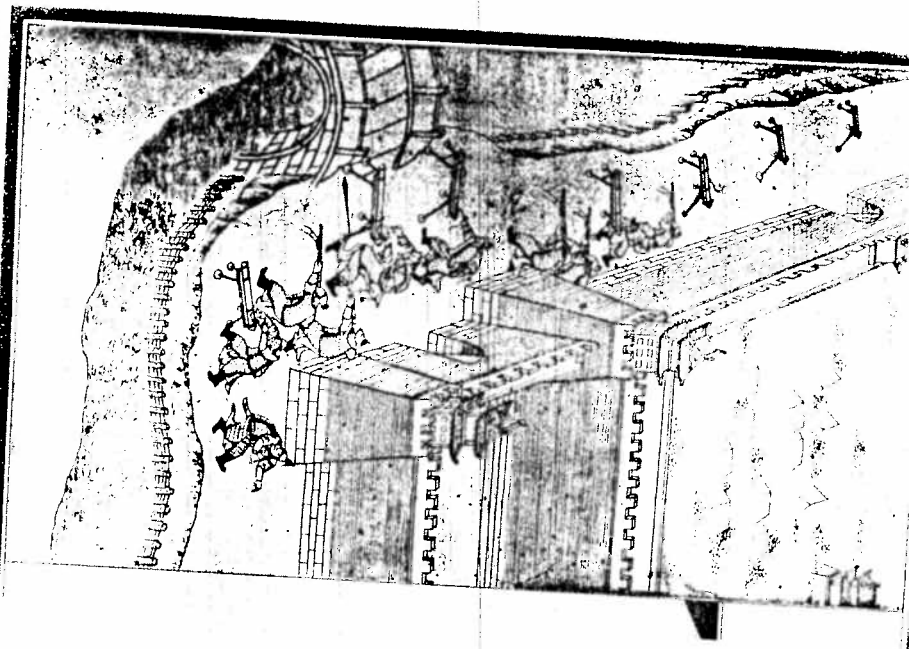


Fig. 155. A Japanese sketch of a fortification, showing the use of a cannon. The sketch is from a Japanese book, 'The Ming and Ching dynasties', published in the 18th century. The sketch is a reproduction of a drawing from the Ming and Ching dynasties, showing the use of a cannon. The sketch is a reproduction of a drawing from the Ming and Ching dynasties, showing the use of a cannon.

use of artillery in China in the early 17th century than from these drawings. The world of learning has perhaps been unduly dazzled by the cannon of the Jesuits, so that the real achievements of the indigenous artillery have been somewhat overlooked.

All through the 16th and 17th centuries artillery was very prominent in the Chinese culture-area. One can see this from the many memoirs of adventures and narrow escapes in those troubled times, especially when the Manchus were fighting the remnants of the Ming, and both were in arms against the popular leader Li Tzu-Ch'eng¹ and the tyrant of Szechuan Chang Hsien-Chang². They constitute a whole genre of literature. For example, Shen Hsin-Wei³ went with his father to Szechuan in +1642 at the age of five, then later his father was martyred by the tyrant, and he spent the rest of his youth escaping from manifold dangers, as he tells in his *Shu Yen Hui Liao*⁴ (Records of the Difficulties of Szechuan),⁵ by which he meant something equivalent to our own 17th-century phrase: 'battle, murder, sudden death and other inconveniences'. In this book there are many references to gunpowder, gunfire and cannonades.⁶ Another writer, Huang Hsiang-Chen⁷, who described a decade of peregrinations escaping from combat zones (+1641 to 51), speaks in his *Huang Hsiao Tzu Wan Li Chi Ch'eng*⁸ of hearing the noise of cannon, and seeing the distant fire and smoke.⁹ In another place, he says that the sound of gunfire was like thunder, shaking the very mountains and valleys.¹⁰ Similar descriptions come in Pien Ta-Shou's *Hu K'iao Yu Sheng Ch'ia*¹¹ (Life Regained out of the Tiger's Mouth)¹² of +1645, a book so called because after having devastated the tombs of Li Tzu-Ch'eng's ancestors in order to stop his conquests, he actually fell into the hands of one of his commanders, but managed to escape therefrom.¹³

Nor was the age lacking for inventors, such as Ong Wan-Ta¹⁴, who presented improved firearms in +1546,¹⁵ while in the same year Chang To¹⁶ offered prototypes of four-barrel and ten-barrel guns made of bronze, and capable of a range up to 700 paces.¹⁷ In +1596 the judge Hua Kuang-Ta¹⁸ presented further gunpowder-weapon inventions made by his father.¹⁹ There were also great artillery generals such as Ch'ien Lin²⁰, who was prominent during the second invasion of Korea by the Japanese in +1597, and fought some decisive naval battles

* Further information on the early Manchu use of artillery can be obtained from Tanaka Katsunori (1). He gives the first use in +1638, and says that it was very prominent in +1645, but much less so in the war against Koxinga (Ch'ing Ch'ing-King²¹), who apparently made little use of field-guns. Tanaka noted that the artillery arsenals were always under the Eight Chinese Banners.

¹ Cf. Stronze (1), pp. 340, 362.

² E. & P. pp. 44 & 356 & 398.

³ P. 41b.

⁴ Cf. Hummel (2), p. 741.

⁵ Wang (2), ch. 32, p. 274.

⁶ Wang (2), ch. 32, p. 274.

⁷ Wang (2), ch. 32, p. 274.

⁸ Wang (2), ch. 32, p. 274.

⁹ Wang (2), ch. 32, p. 274.

¹⁰ Wang (2), ch. 32, p. 274.

¹¹ Wang (2), ch. 32, p. 274.

¹² Wang (2), ch. 32, p. 274.

¹³ Wang (2), ch. 32, p. 274.

¹⁴ Wang (2), ch. 32, p. 274.

¹⁵ Wang (2), ch. 32, p. 274.

¹⁶ Wang (2), ch. 32, p. 274.

¹⁷ Wang (2), ch. 32, p. 274.

¹⁸ Wang (2), ch. 32, p. 274.

¹⁹ Wang (2), ch. 32, p. 274.

²⁰ Wang (2), ch. 32, p. 274.

²¹ Wang (2), ch. 32, p. 274.

ried one heavy cannon (*ta kang*)¹, one mortar (*ta tai phao*)², six large culverins (*ta-long-chi*)³, three falconets (*tan khou thung*)⁴, and sixty fire-lances (*phiu tang*)⁵; finally a number of *shen chi chui*⁶, probably arrows shot from guns.⁸ Another Chinese gunner officer who distinguished himself in these campaigns was Lo Shih⁷, who successfully defended Chiang-hua against the Japanese, and repulsed an attack by 500 of their ships upon the port-town of Phu-khou using shore-based artillery.⁸

The following century also produced some remarkable inventors. We may give the life-story of just one, Tai Tzu.⁹ His biography runs as follows:¹⁰

Tai Tzu, whose other name was Tai Wen-Khai,¹¹ was a Chien-chang man from Chien-kang. His remarkable ingenuity appeared even while he was still young. He himself made a gunpowder weapon which could hit (a target) at more than a hundred paces away.

In the beginning of the Khang-Hsi reign-period (+1673) K'ang Ching-Chung¹² rebelled in Chekiang, and Prince Gyetsu (Chih-Shu)¹³ led a government army south to overcome the uprising. Tai Tzu as a simple commoner or private scholar joined this army, and presented a design for a rapid-fire machine-gun (*tan chu tai chung*)¹⁴. Its shape was like that of a balloon-gunier (*phi-pho*)¹⁵. The gunpowder and lead balls (*tan yao*, by means of a wheel mechanism (*chi lun*)¹⁶. There were also two parts fitting into each other like male and female. If one lever was pulled the gunpowder and lead bullets fell automatically into the barrel, whereupon the other mechanism followed suit and moved fired off accordingly. After twenty-eight rounds, the magazine came out, and the gun bullets. The design was in principle similar to that of the guns of the Westerners (*chi kaan chung*)¹⁷. But the weapon was not at that time widely used, and the prototype was kept at Tai's home. This was still in existence during the Chien-Lung reign-period (+1736 to 93).

When some Westerners presented 'coiled intestine (helical screw) bird guns' (*phiu*

¹ Lo Jung-Pang, in Goodrich & Fang Chiao-Ying (1), vol. 1, pp. 167, 173.
² Cf. p. 328 above.
³ Cf. p. 327 above.
⁴ Cf. p. 321 above.
⁵ Cf. p. 319 above.
⁶ It is not generally known that in +1588 Sir Francis Drake was still firing arrows from his muskets. Even as late as +1693 improvements to this system were still being canvassed. See Blackmore (1), p. 12.
⁷ If Parker (9) was right, the Japanese were distinctly backward in the weapons at this time, still using Chinese-style *tan* (gun).
⁸ Chih-Hsiung & Tai Jui-Lan (7), pp. 90-1 [CCL p. 7], et al.
⁹ K'ang was a Chinese, but Gyetsu was a Manchu, with the princely title of Khang (Chin Wang) 'The Formidable'.
¹⁰ Here follows a long paragraph about Tai's career, which we omit at the conclusion of the passage.
¹¹ 戴文開
¹² 康清忠
¹³ 濟世
¹⁴ 彈車
¹⁵ 氣球
¹⁶ 輪機
¹⁷ 西人槍

(*chang-miao chung*)¹. Tai Tzu copied a number of times at our request the emperor's (11) of his make were presented to the Western officials.²

Tai was also commissioned to design and make a 'mother-and-son' cannon (*tan phiu*)³. It fired a projectile which burst and sent forth other projectiles that all fell down upon the enemy (*tan tang tai chu tai tai tai*)⁴. It was rather like a Western mortar (*tan phiu*)⁵. The emperor, accompanied by all his ministers, watched a demonstration of it, and honoured the device with the name 'Awe-inspiring Far-reaching General' (*Hsi Yuan Ching-Chang*)⁶. The name and title of the inventor and maker was inscribed on the back of the cannon. When later the emperor personally commanded in the campaign against Galdan⁷, this weapon was among those used to defeat the enemy.

Because of this part in the expeditionary force of Gyetsu against K'ang, when national authority was restored over the territory, Tai Tzu was given the title of 'Acting Circuit Instructor' (*Tao Yuan Tu Fu Shih*)⁸. Returning (to the capital) he had an interview with the K'ang-Hsi emperor, who recognised his literary ability and examined him on the poem 'Dawn Audience in Springtime'. So he was given a post in the Han-Lin Academy as Expositor (*Shih Chang*)⁹, and (then), together with Kao Shih-Chih¹⁰ and was seconded to the Nan Shu Fang¹¹ (as one of the emperor's secretaries), and later to the Yang Hsin Tien¹². Tai was expert in astronomy and mathematics, but when the *Lü Tai Ching* (¹³ Collected Principles of Acoustics and Music) was being edited, his views were not in agreement with those of Nan Hui-jen¹⁴ (Ferdinand Verbiest) and the other Westerners. So everybody envied him, and was at the same time jealous of him.

Unfortunately there was a person named Chen Hung-Hsin¹⁵, who had been a foster-son of Chang Hsien-Chung¹⁶, but switched his allegiance and became an official under the Ch'ing. This man accused (Tai) falsely, and it came to blows, so the matter was taken to court, giving Tai's enemies the opportunity of vilifying him; thus he lost his office, and was exiled to Kuan-tung. Later he was pardoned and went home, where he stayed at Thieh-ling for the rest of his life.

Thus was a remarkable talent wasted. How striking it was that when the Khang-Hsi emperor saw that he was literate, and called him into his direct service, all he could think of was to examine him in poetry. His scientific and technical ability was evidently considered quite secondary, and even so it got

¹ I hesitate to write 'ambassadors', though that is what *shih chih* should mean, because in those days there were no resident envoys at the Chinese court. But it could be a reference to the Russian embassy of +1693 headed by the Dutchman E. Ybarra de Hies (cf. Vol. 4, pt. 3, p. 96), or some other mission of those times. If not, it must mean some of the Jesuits, who held many scientific offices under the crown. Cf. p. 366 (7).
² Not a very original name; cf. p. 315 above.
³ This was the Buddhist Khan of the Sungen (part of the Eleuths), a tribal people like the Kalmyks or Western Mongols. He had conquered Sinkiang by +1673, and then fought against the Khang-Hsi emperor from +1689 till his death in +1697.
⁴ Poet and calligrapher of note (+1645 to 1703), who spent many years as one of the Khang-Hsi emperor's private secretaries.
⁵ The South Library and the Hall of Healing for the Soul were literary institutions at the imperial court.
⁶ This was eventually issued as part of the *Tai Li Yuan Yuan* 'Observations of Calendrical and Acoustic Calculations', and finished in +1713.
⁷ The previous version of *Shih-chuan* already mentioned (+1693 to 1713).
⁸ 戴進賢
⁹ 康清忠
¹⁰ 高士奇
¹¹ 南書房
¹² 楊心
¹³ 律呂集要
¹⁴ 南懷仁
¹⁵ 陳洪賓
¹⁶ 張獻忠

Canon, the +3rd-century engineer and inventor, which we told earlier on.⁴ Even in our own time and in the Western world, four centuries after the Scientific Revolution, the only avenue of promotion in technical services is all too often from 'blue-collar' practice to 'white-collar' paper-work.⁵

If we look at Tai's inventions in order, we see that the first must have been some kind of quick-firing machine-gun. It was a time when people everywhere were trying to make devices of this kind—for example, in Samuel Pepys' Diary for 3 July 1662 we read that the attention of the Royal Society was drawn to a 'rare mechanician' who claimed to be able 'to make a pistol shooting as fast as it could be presented, and yet to be stopped at pleasure, and wherein the motion of the fire and bullet within was made to charge the piece with powder and bullet, to prime it, and to bend the cock'. But the problem was not practically resolved till +1718, when James Puckle developed his breech-loading gun with a revolving set of chambers which could fire sixty-three shots in seven minutes.⁶ Thereafter the line led straight to the multi-barrel 'pepper-box' pistols and revolving 'coffee-mill' guns of Ethan Allen (1837) and others, thence to the Gatling gun of the American Civil War (1862) and the Maxim gun of 1883,⁷ described (p. 6 (e), 2, iv) the magazine crossbow, widespread in +16th-century Ming use, as also (pp. 263–4) the magazine eruptor, which may well have been common considerably earlier, indeed back to +1410 or even +1350. All the same, we should very much like to have further details about Tai Tzu's guitar-shaped machine-gun.⁸

The second of his exploits is more difficult to pin down, but it could have been some kind of screw-chamber breech-loader.⁹ If it was a variety of musket, as one might at first sight suspect from the name 'bird-gun', a screw of one sort or another was evidently involved.¹⁰ Here rifling would not come altogether amiss.

⁴ Vol. 4, pt. 2, pp. 39 ff.

⁵ Tai Tzu's engineering skill became legendary. A century or more later, Ling Yang-Tzu asserted that Verheest had tried to cast cannon for a year without success, while Tai Tzu, when called upon by the emperor, succeeded in eight days. *Li Shao Phun*, ch. 40 (p. 650). They were certainly contemporaries and knew each other. Tai probably knew Verheest's cannon-foundry too. Earlier, Ling says that Tai made *ju-lang-chi* mortars.

⁶ (1). Everington et al., vol. 1, p. 271, noted by Hall (5), pp. 358–9. Cf. Birch (1), vol. 1, p. 396. (2). *Red* (1), pp. 165 ff. ⁷ *Ibid.* pp. 303–5. ⁸ *Ibid.* pp. 221 ff.

⁹ Another fore-runner was the magazine musket (*tan tzu shing*) described by Chih Chih-Kuang in +1760 (see *CHHS*, ch. 15, p. 284, 2, and note p. 72, ch. 12, p. 398). An iron side-stile was arranged to feed the ball-bullets into the barrel. But Chih-Kuang regarded the gun as complex and unreliable, so he only included it, he said, for the sake of completeness.

¹⁰ Cf. p. 306 (f) above. ¹¹ Cf. p. 412 below.

¹² Cf. Vol. 4, pt. 2, p. 121 and Fig. 10, p. 10, from 377H. Chih Yang-wen, ch. 8, p. 164 (17660). As *Hsiao-yi* noted, this was an early illustration of the screw-chamber breech-loader in China, but the screw was not indigenous (ibid. 1, p. 413, 243). See also Fig. 171 below.

¹³ p. 13.

¹⁴ p. 12.

the traditional administration in a projectile's origin or movement, and due to spiral grooves cut inside the barrel, may go back to Leonardo,¹¹ and in any case began to be fairly frequently used by gunsmiths from about +1500 onwards.¹² A number of examples have survived from the second half of the +16th, and from the following, century. These however were sporting guns, and general military use did not come in until the American War of Independence, from the late +18th century onwards.¹³ Still, it is not at all impossible that rifling was what interested Tai Tzu at this point; the text says 'bird', not 'bird-beak', so it might well refer to the use, rather than to the shape of the cock or butt, hence perhaps the presentations to the ambassadors or officials, to please them in their fowling.¹⁴

The third and last of his designs was fairly clearly a shell-firing cannon, for the projectile burst and released other projectiles, falling down like the shower of sparks from a fireworks rocket. Shells had been known in Europe since the +15th-century *Fuenteovejuna*, probably of +1437, and they are also described in Valerio's *De Re Militari* of +1460.¹⁵ Moreover, we met with them already in China in connection with eruptors (p. 264, cf. p. 317), which would take them back to the +15th, if not the +14th century; and they were only a logical development from the 'thunder-crash' bombs with iron casings (p. 170 above), which were older still. It was only to be expected therefore that people in China should by this time (late +17th century) have been experimenting with shells. They finally came into their own in a memorandum addressed to the emperor by Lin Tse-Hsi in 1846, entitled *Chia Phao Fao*.¹⁶ But it is interesting (and certainly not generally known) that shells or shrapnel of some kind were used by Kiang-Hsi's artillery in the war against the Eleuths at the end of the seventeenth century.

Mention of the period of the Opium Wars¹⁷ reminds us that an important gun-founding invention was made at this time by a pioneering Chinese engineer, Kung Chen-Lin,¹⁸ some thirty years before its adoption in the West.¹⁹ This was

¹⁵ Cf. Partington (5), p. 175. In the *Codex Atlanticus*.

¹⁶ *Red* (1), pp. 112–13, 143. Certainly by +1540 (Blackmore (1), pp. 14–15).

¹⁷ *Red* (1), pp. 167, 209.

¹⁸ Ling Yang-Tzu, in his *Li Shao Phun*, ch. 40 (p. 650), dates the event at +1776, in which case the embassy would have been the Russian one headed by the Kamennai (Moldavian) scholar, Nikolai Stepanovich Miloshev. On this see Gardner (1), vol. 3, p. 271, and Vol. 4, pt. 3 above, p. 149, with refs.

¹⁹ *Everington* (5), pp. 149, 157, 164, 5. ²⁰ *Hsiao-yi*, ch. 15, p. 284, 2, and note p. 72, ch. 12, p. 398. Shells at the siege of Chobatur in +1798 and Shrapnel's spontaneous invention of 1823. Cf. *Red* (1), p. 188.

²¹ A number of Chinese cannon of this period (1841), cast under the superintendence of the Government Yen Po-Tzu and Liu Hsing-Ao, are preserved inside the western wall of the campus of Anqing University; they have been described by Ching Ts-Khun (18, 19). It is not generally known that Wang Tsung-Shan, the famous collaborator of James Legge, wrote a book rather later on, the *Tsiao Shing Jue Fao*, 'Thoughts on Tools for Casting' (written on cannon, gun-founding and bearing, the manufacture and use of compasses etc.). Chih Chih-Kuang (1, p. 413, 243). A biographical of Kung Chen-Lin in Chih Chih-Kuang (1, p. 413, 243). *Hsiao-yi* (1, p. 413, 243).

²² *Chih Chih-Kuang* (1, p. 413, 243).

²³ p. 13.

²⁴ p. 12.

²⁵ p. 12.

²⁶ p. 12.

²⁷ p. 12.

²⁸ p. 12.

Japanese official named Sakamoto Shungo² had described cannon-founding in his *Tahō Chizōho*³, with illustrations in traditional style, showing *intara* bellows⁴ and the boring of the barrels, but his moulds were still of sand.⁵

Kung Chen-Lin's invention was all the more piquant in that cast-iron moulds – 4th-century finds from Hsing-ling in Jehol bear witness.⁶ Such moulds are in wide use still today, since they have the advantage of producing a chill casting with increased hardness and resistance to wear. To avoid any risk of adherence of the casting to the mould, a dressing of plumbeo or lamp-black is usually applied, but this is probably not essential as long as the volume ratio of mould to cast metal is sufficient to avoid undue mould heating and damage. This was an astonishingly high development of metallurgical technology for the Warring States period, and it was remarkable that it should have appeared again at the other end of history.⁷ Afterwards the same process was announced in 1873 by three inventors simultaneously, Lavrov in St Petersburg, Uchatius at Vienna, and Rosset at Turin. Of course, cast-iron moulds or 'coquilles' had been used for casting iron cannon-balls in Europe from +1514 onwards, a practice seemingly introduced by François Gilbert of Dijon.⁸ The rapid cooling of the surface-layers gave the skin a white (ferric carbide) quality, hardening it and increasing its efficiency of fragmentation.⁹ But this was a much simpler matter than the casting of cannon themselves.

There is one last brilliant innovation which calls for description here, and that is the use of telescopic sights with artillery, or perhaps it would be better to call them spotting telescopes. Knowledge of this arose when we discovered in the *Mi Hsien Chih*¹⁰ (Local History and Geography of Suchow) a remarkable account of two 'optick artists' of that city – Po Yü¹¹ (active between +1628 and +1644) and Sun Yün-Chih¹² (active between +1650 and +1660). Of Po Yü it is said that in the Ching-chen reign-period [+1628 to +1631], when the rebels invaded Anhui (i.e. Anhui province) the Provincial Governor Chang Kuo-Wei¹³ commissioned Po Yü to cast bronze cannon. These had a range of 30 li,¹⁴ and whenever they were shot off they did great execution, because (the gunners) had telescopes (*shih in ding*), which showed just where the enemy had concentrated his forces.¹⁵

² This also was reported in *Hsi Kuo Tzu Chih*, ch. 86, pp. 12 ff.
³ Cf. Vol. 4, pt. 2, pp. 372 ff. and Needham (32), p. 19 and figs. 32, 33.
⁴ Repr. in NKZ, 193, pp. 100–101, figs. 4, p. 493.
⁵ Centuries before Europe knew anything about cast iron at all.

⁶ Figured e.g. in Needham (32), figs. 4–8, of p. 6. The effective publications were those of Ching Chen-Tsao (7) and Ching Shao-Tsung (7). Ching Chen-Tsao (7) was clear that the moulds were used for casting iron implements.

It is almost certain that Kung Chen-Lin did not know of his ancient predecessors.

⁷ See Johansen (3), p. 1463 (4).

⁸ 15 km, was surely an overstatement.

⁹ Ch. 77 ff. *Liuh Chuan*, i, ch. 11, Northern & Eastern Dyn. (6), pp. 113, 123.

¹⁰ 鐵砲圖說

¹¹ 安寧

¹² 吳淞

¹³ 吳淞

¹⁴ 吳淞

¹⁵ 吳淞

Ching¹, which eventually succeeded in overrunning the Manchu government of the last Ming emperor, and capturing Peking; only to be defeated in their turn by the general Wu San-Kuei² who opened the gates to the Manchus from the north with the intention that they should help him to recover the country for the Ming. As history so well knows, they took over the empire for themselves.

Po Yü had other connections with military technology, for he made explosive mines (*li lei*)³ and spring-trap guns (*in mi*)⁴, both said to be very effective. As for the younger man, Sun Yün-Chih, he was also a maker of telescopes, as the *Mi Hsien Chih* records, but there is no reference to his use of them in a military context. However, he wrote a book on optical instruments with the title *Ching Shih*⁵, though it seems never to have got into print.⁶

Po Yü may actually have been one of the several inventors of the telescope,⁷ but in any case he deserves much credit for applying it to gunnery, and that must have happened about +1635. This seems to precede by some time any similar application in Europe, though Galileo in +1609 was already aware of the possible use of the telescope in naval warfare, as he demonstrated in a famous incident to the high officials of the Signoria in Venice. Later in the same century optical sights were proposed by the Jesuit Francesco de Lana, in his *Magisterium Naturae et Artis* of +1684, and the application of a four-lens telescope to a gun was described in the *Ordnance Artificer's Treatise* of Johann Zahn in +1703.

After that, telescopic sights figure throughout the +18th century, and Frederick the Great in his diary recorded trying one at a Schützenfest in +1737. By the mid-nineteenth century they were commonplace.⁸ But the first date after Galileo's forecast of what the telescope could do in war remains the time when Po Yü introduced his optical equipment for artillery in China, +1635. It was certainly a memorable day.

Of the skill and gallantry of Chinese gunners through the ages nothing has been said, and perhaps a history of technology is not the place for it. But we cannot forbear from quoting a couple of statements from Li Ouchterlony, a Scottish soldier who wrote an account of what he saw during the Opium Wars. For example:⁹

In the earlier period of the war in 1840, Her Majesty's brig *Albatross*, commanded by Lt Mason, was on her way to the mouth of the Yang-tse-Kiang, in company with the *Comary* frigate, and paid a flying visit to the port of Chapoo, upon which occasion a fire was opened upon her from some works near the town, which was well sustained for some time, during which the coolness and steadiness of the Chinese gunners excited much applause from the officers and crew of the brig. But the *Albatross*, having anchored with

¹ Interestingly, his mother wrote a preface for it, but nothing has survived.

² Like Leonard Digges (5), B. della Porta and Johannes Teysschere.

³ Reed (1), pp. 134–5.

⁴ Together they are applied to anti-tank rocket-launchers of Reed (1), pp. 213, 218.

⁵ (1), pp. 248–9.

⁶ 吳淞

⁷ 吳淞

⁸ 吳淞

⁹ 吳淞

1964-75.

The engagement was a fire spectacle, but beyond the picturesque of the batteries of Ko-ling-sou,² afforded no point worthy of comment, save that it furnished strong evidence of the science of the Chinese batteries, upon which the fire of the seventy-four, though maintained for fully two hours, produced no effect whatever, not a gun being found disabled, and but few of the enemy killed in them when our troops retired. The principle of their construction was such as to render them almost impervious to the effects of their masonry, of which the parapets were formed, as, in addition to the solid mass of constructed on the outer face, leaving to view only the

(iii) Shields, 'ball-carrier' and 'ball-carrier'

In Figs. 153 and 153, taken from the *Thao Tai Shih Lu Thu*, we have already seen pictures of the shields, presumably of iron, which protected the men who worked the field guns, mostly on the Ming side, during the first quarter of the 17th century. But shields adapted to the uses of fire-weapons did not begin with guns and light cannon, they began with fire-lances (cf. pp. 236ff. above). Breaking fire-arms from an item called the

rather enigmatic description the meaning of which will in a moment be clear. The *Huo Lung Ching* we read:¹⁶

The apparently automotive fibre-flame-spouting^e shield for use with cutlass-wielding soldiers to destroy enemy formations, is covered with fresh ox-hide. In it are concealed thirty-six (fire-lance) tubes, containing magical

(1), pp. 174-5.
Pl. 1 ch.

A strict interpretation of these words would insist on a

usually think, after all, we have seen a depiction (Fig. 2) of a similar kind had been used with petrol flames—centuries earlier. On the other hand, these devices may have been used with petrol flames—centuries earlier. On the other hand, these devices may have been used with petrol flames—centuries earlier.

[illegible]

blinding gunfire and bursting gunpowder. The first group, some three hundred men, were ordered to march in a column, with slow-march as held by each man in the formation to fight the first attack as may seem best. When two opposing armies are confronting one another, and the first group of the first group, the shields are rolled forward into action, and when they are, the flanks signal, the shields are rolled forward into action on the left; back the shields, shoot 20 or 30 forward. One group of men in armour on the left; back the shields, while another group on the right wield their cutlasses. They aim to decimate the enemy soldiers, and to cut off the legs of their horses during the first storm caused by the enemy's arrows. One single one of these shields is in itself worth ten or twelve cutlasses, pikes, and arrows. One single one of these shields is in itself worth ten or twelve cutlasses,

This may be considered fairly archaic, but the fact that it comes in the oldest stratum of the book means that it must belong at least to -11.2 , and most probably to $+1.350$ or before. Fig. 158 shows the usual *liger* 𐎧𐎠𐎢𐎽 and no obvious means of movement, yet the verb *kmt* 'rolled', used in the text, indicates that the mobile weapon was mounted on some kind of mobile stand, probably a two-wheeled harrow pushed by the fire-lance operators.

Actually the mobile shield had a long history going back before the time of guns and cannon if not of fire-lances. Wei Sheng,² a Sung general already mentioned (p. 157) made in +1163 many hundreds of shielded vehicles, pushed or drawn by hand, which could be packed in defensive arrays to protect encampments and strategic positions. Some of these carried trebuchets hurling stones or weak-casing gunpowder bombs, while others bore multiple-bolt crossbows with two or three springs. Others again could transport personal armour and munitions.³

Indeed one can trace the isager tactic far back in Chinese military history. The 'deer-horn cart camp' (*lu chao che ying*) may perhaps be as old as the Warring States time with Wu Chih' (d. -981), but it was certainly used in the +3rd century under Ma Lung.⁶ There may well have been also some relationship with the 'mobile city-walls' (*hsing ching*) mentioned in the *Maist* military chapters, as also with the watch-towers mounted on carts which patrolled the frontiers of the Han.

By the +16th century there had been a great development of shields, though they were still made of wood. The celebrated general Chhi Chi-Kiang⁸ (+1528-1588) based much of his tactics on what we may call 'barle-carts', which carried protective screens and could be formed into a laager, as seen in Fig. 1, 565, taken from his *Lien Ping Shih Chi* (+1571).⁹ These large two-wheeled carts were

^a On these forms of gunpowder see p. 180 above

^b The passage (along with ch. 388, pp. 154, 166) is given in translation in *Principles of Mathematics*, 2nd ed. (1961), pp. 230–231, which also contains a discussion of the passage. Gödel himself was inspired by the resemblance to the *beginning* of the Humean epistemology of the Humeans (pp. 230–231 of ch. 421 of *Principles*). Unfortunately, he translated *phainai* as *prove*, presumably of arithmetic, instead of *seem* (as in the Humean).

¹ *Chia Shu-ch'ing*, p. 32; Yang Hsiung-*ts'ang*, pp. 42-3; and Boberg, p. 270. The name obviously derived from the fact that this is a square vehicle fitted with a wheel of a square.

一、**詞**
1. 詞

二、**讀**
1. 讀

三、**寫**
1. 寫

四、**譯**
1. 譯

五、**評**
1. 評

六、**答**
1. 答

七、**問**
1. 問

八、**思**
1. 思

九、**行**
1. 行

十、**止**
1. 止

十一、**坐**
1. 坐

十二、**臥**
1. 臥

十三、**立**
1. 立

十四、**走**
1. 走

十五、**跑**
1. 跑

十六、**跳**
1. 跳

十七、**爬**
1. 爬

十八、**滾**
1. 滾

十九、**摔**
1. 摔

二十、**打**
1. 打

二十一、**拍**
1. 拍

二十二、**擦**
1. 擦

二十三、**洗**
1. 洗

二十四、**刷**
1. 刷

二十五、**掃**
1. 掃

二十六、**擦**
1. 擦

二十七、**洗**
1. 洗

二十八、**刷**
1. 刷

二十九、**掃**
1. 掃

三十、**擦**
1. 擦

三十一、**洗**
1. 洗

三十二、**刷**
1. 刷

三十三、**掃**
1. 掃

三十四、**擦**
1. 擦

三十五、**洗**
1. 洗

三十六、**刷**
1. 刷

三十七、**掃**
1. 掃

三十八、**擦**
1. 擦

三十九、**洗**
1. 洗

四十、**刷**
1. 刷

四十一、**掃**
1. 掃

四十二、**擦**
1. 擦

四十三、**洗**
1. 洗

四十四、**刷**
1. 刷

四十五、**掃**
1. 掃

四十六、**擦**
1. 擦

四十七、**洗**
1. 洗

四十八、**刷**
1. 刷

四十九、**掃**
1. 掃

五十、**擦**
1. 擦

五十一、**洗**
1. 洗

五十二、**刷**
1. 刷

五十三、**掃**
1. 掃

五十四、**擦**
1. 擦

五十五、**洗**
1. 洗

五十六、**刷**
1. 刷

五十七、**掃**
1. 掃

五十八、**擦**
1. 擦

五十九、**洗**
1. 洗

六十、**刷**
1. 刷

六十一、**掃**
1. 掃

六十二、**擦**
1. 擦

六十三、**洗**
1. 洗

六十四、**刷**
1. 刷

六十五、**掃**
1. 掃

六十六、**擦**
1. 擦

六十七、**洗**
1. 洗

六十八、**刷**
1. 刷

六十九、**掃**
1. 掃

七十、**擦**
1. 擦

七十一、**洗**
1. 洗

七十二、**刷**
1. 刷

七十三、**掃**
1. 掃

七十四、**擦**
1. 擦

七十五、**洗**
1. 洗

七十六、**刷**
1. 刷

七十七、**掃**
1. 掃

七十八、**擦**
1. 擦

七十九、**洗**
1. 洗

八十、**刷**
1. 刷

八十一、**掃**
1. 掃

八十二、**擦**
1. 擦

八十三、**洗**
1. 洗

八十四、**刷**
1. 刷

八十五、**掃**
1. 掃

八十六、**擦**
1. 擦

八十七、**洗**
1. 洗

八十八、**刷**
1. 刷

八十九、**掃**
1. 掃

九十、**擦**
1. 擦

九十一、**洗**
1. 洗

九十二、**刷**
1. 刷

九十三、**掃**
1. 掃

九十四、**擦**
1. 擦

九十五、**洗**
1. 洗

九十六、**刷**
1. 刷

九十七、**掃**
1. 掃

九十八、**擦**
1. 擦

九十九、**洗**
1. 洗

一百、**刷**
1. 刷

● ● ●

25

三、