CHAPTER VII.

THE HYMN OF THE CANNON-BALL.

The Cambridge Observatory had, in its memorable letter of October 7th, treated the question from an astronomical point of view--the mechanical point had still to be treated. It was then that the practical difficulties would have seemed insurmountable to any other country but America; but there they were looked upon as play.

President Barbicane had, without losing any time, nominated a working committee in the heart of the Gun Club. This committee was in three sittings to elucidate the three great questions of the cannon, the projectile, and the powder. It was composed of four members very learned upon these matters. Barbicane had the casting vote, and with him were associated General Morgan, Major Elphinstone, and, lastly, the inevitable J.T. Maston, to whom were confided the functions of secretary.

On the 8th of October the committee met at President Barbicane's house, No. 3, Republican-street; as it was important that the stomach should not trouble so important a debate, the four members of the Gun Club took their seats at a table covered with sandwiches and teapots. J.T. Maston immediately screwed his pen on to his steel hook and the business began.

Barbicane opened the meeting as follows:--

"Dear colleagues," said he, "we have to solve one of the more important problems in ballistics--that greatest of sciences which treats of the movement of projectiles--that is to say, of bodies hurled into space by some power of impulsion and then left to themselves."

"Oh, ballistics, ballistics!" cried J.T. Maston in a voice of emotion.

"Perhaps," continued Barbicane, "the most logical thing would be to consecrate this first meeting to discussing the engine."

"Certainly," answered General Morgan.

"Nevertheless," continued Barbicane, "after mature deliberation, it seems to me that the question of the projectile ought to precede that of the cannon, and that the dimensions of the latter ought to depend upon the dimensions of the former."

J.T. Maston here interrupted the president, and was heard with the attention which his magnificent past career deserved.

"My dear friends," said he in an inspired tone, "our president is right to give the question of the projectile the precedence of every other; the cannon-ball we mean to hurl at the moon will be our messenger, our ambassador, and I ask your permission to regard it from an entirely

moral point of view."

This new way of looking at a projectile excited the curiosity of the members of the committee; they therefore listened attentively to the words of J.T. Maston.

"My dear colleagues," he continued, "I will be brief. I will lay aside the material projectile--the projectile that kills--in order to take up the mathematical projectile--the moral projectile. A cannon-ball is to me the most brilliant manifestation of human power, and by creating it man has approached nearest to the Creator!"

"Hear, hear!" said Major Elphinstone.

"In fact," cried the orator, "if God has made the stars and the planets, man has made the cannon-ball--that criterion of terrestrial speed--that reduction of bodies wandering in space which are really nothing but projectiles. Let Providence claim the speed of electricity, light, the stars, comets, planets, satellites, sound, and wind! But ours is the speed of the cannon-ball--a hundred times greater than that of trains and the fastest horses!"

J.T. Maston was inspired; his accents became quite lyrical as he chanted the hymn consecrated to the projectile.

"Would you like figures?" continued he; "here are eloquent ones. Take

the simple 24 pounder; though it moves 80,000 times slower than electricity, 64,000 times slower than light, 76 times slower than the earth in her movement of translation round the sun, yet when it leaves the cannon it goes quicker than sound; it goes at the rate of 14 miles a minute, 840 miles an hour, 20,100 miles a day--that is to say, at the speed of the points of the equator in the globe's movement of rotation, 7,336,500 miles a year. It would therefore take 11 days to get to the moon, 12 years to get to the sun, 360 years to reach Neptune, at the limits of the solar world. That is what this modest cannon-ball, the work of our hands, can do! What will it be, therefore, when, with twenty times that speed, we shall hurl it with a rapidity of seven miles a second? Ah! splendid shot! superb projectile! I like to think you will be received up there with the honours due to a terrestrial ambassador!"

Cheers greeted this brilliant peroration, and J.T. Maston, overcome with emotion, sat down amidst the felicitations of his colleagues.

"And now," said Barbicane, "that we have given some time to poetry, let us proceed to facts."

"We are ready," answered the members of the committee as they each demolished half-a-dozen sandwiches.

"You know what problem it is we have to solve," continued the president; "it is that of endowing a projectile with a speed of 12,000 yards per second. I have every reason to believe that we shall succeed, but at

present let us see what speeds we have already obtained; General Morgan can edify us upon that subject."

"So much the more easily," answered the general, "because during the war I was a member of the Experiment Commission. The 100-pound cannon of Dahlgren, with a range of 5,000 yards, gave their projectiles an initial speed of 500 yards a second."

"Yes; and the Rodman Columbiad?" (the Americans gave the name of "Columbiad" to their enormous engines of destruction) asked the president.

"The Rodman Columbiad, tried at Fort Hamilton, near New York, hurled a projectile, weighing half a ton, a distance of six miles, with a speed of 800 yards a second, a result which neither Armstrong nor Palliser has obtained in England."

"Englishmen are nowhere!" said J.T. Maston, pointing his formidable steel hook eastward.

"Then," resumed Barbicane, "a speed of 800 yards is the maximum obtained at present."

"Yes," answered Morgan.

"I might add, however," replied J.T. Maston, "that if my mortar had not

been blown up--"

"Yes, but it was blown up," replied Barbicane with a benevolent gesture. "We must take the speed of 800 yards for a starting point. We must keep till another meeting the discussion of the means used to produce this speed; allow me to call your attention to the dimensions which our projectile must have. Of course it must be something very different to one of half a ton weight."

"Why?" asked the major.

"Because," quickly answered J.T. Maston, "it must be large enough to attract the attention of the inhabitants of the moon, supposing there are any."

"Yes," answered Barbicane, "and for another reason still more important."

"What do you mean, Barbicane?" asked the major.

"I mean that it is not enough to send up a projectile and then to think no more about it; we must follow it in its transit."

"What?" said the general, slightly surprised at the proposition.

"Certainly," replied Barbicane, like a man who knew what he was saying,

"or our experiment will be without result."

"But then," replied the major, "you will have to give the projectile enormous dimensions."

"No. Please grant me your attention. You know that optical instruments have acquired great perfection; certain telescopes increase objects six thousand, and bring the moon to within a distance of forty miles. Now at that distance objects sixty feet square are perfectly visible. The power of penetration of the telescope has not been increased, because that power is only exercised to the detriment of their clearness, and the moon, which is only a reflecting mirror, does not send a light intense enough for the telescopes to increase objects beyond that limit."

"Very well, then, what do you mean to do?" asked the general. "Do you intend giving a diameter of sixty feet to your projectile?"

"No."

"You are not going to take upon yourself the task of making the moon more luminous?"

"I am, though."

"That's rather strong!" exclaimed Maston.

"Yes, but simple," answered Barbicane. "If I succeed in lessening the density of the atmosphere which the moon's light traverses, shall I not render that light more intense?"

"Evidently."

"In order to obtain that result I shall only have to establish my telescope upon some high mountain. We can do that."

"I give in," answered the major; "you have such a way of simplifying things! What enlargement do you hope to obtain thus?"

"One of 48,000 times, which will bring the moon within five miles only, and objects will only need a diameter of nine feet."

"Perfect!" exclaimed J.T. Maston; "then our projectile will have a diameter of nine feet?"

"Precisely."

"Allow me to inform you, however," returned Major Elphinstone, "that its weight will still be--"

"Oh, major!" answered Barbicane, "before discussing its weight allow me to tell you that our forefathers did marvels in that way. Far be it from me to pretend that ballistics have not progressed, but it is well to

know that in the Middle Ages surprising results were obtained, I dare affirm, even more surprising than ours."

"Justify your statement," exclaimed J.T. Maston.

"Nothing is easier," answered Barbicane; "I can give you some examples. At the siege of Constantinople by Mahomet II., in 1453, they hurled stone bullets that weighed 1,900 lbs.; at Malta, in the time of its knights, a certain cannon of Fort Saint Elme hurled projectiles weighing 2,500 lbs. According to a French historian, under Louis XI. a mortar hurled a bomb of 500 lbs. only; but that bomb, fired at the Bastille, a place where mad men imprisoned wise ones, fell at Charenton, where wise men imprison mad ones."

"Very well," said J.T. Maston.

"Since, what have we seen, after all? The Armstrong cannons hurl projectiles of 500 lbs., and the Rodman Columbiads projectiles of half a ton! It seems, then, that if projectiles have increased in range they have lost in weight. Now, if we turn our efforts in that direction, we must succeed with the progress of the science in doubling the weight of the projectiles of Mahomet II. and the Knights of Malta."

"That is evident," answered the major; "but what metal do you intend to employ for your own projectile?"

"Simply cast-iron," said General Morgan.

"Cast-iron!" exclaimed J.T. Maston disdainfully, "that's very common for a bullet destined to go to the moon."

"Do not let us exaggerate, my honourable friend," answered Morgan; "cast-iron will be sufficient."

"Then," replied Major Elphinstone, "as the weight of the projectile is in proportion to its volume, a cast-iron bullet, measuring nine feet in diameter, will still be frightfully heavy."

"Yes, if it be solid, but not if it be hollow," said Barbicane.

"Hollow!--then it will be an obus?"

"In which we can put despatches," replied J.T. Maston, "and specimens of our terrestrial productions."

"Yes, an obus," answered Barbicane; "that is what it must be; a solid bullet of 108 inches would weigh more than 200,000 lbs., a weight evidently too great; however, as it is necessary to give the projectile a certain stability, I propose to give it a weight of 20,000 lbs."

"What will be the thickness of the metal?" asked the major.

"If we follow the usual proportions," replied Morgan, "a diameter of 800 inches demands sides two feet thick at least."

"That would be much too thick," answered Barbicane; "we do not want a projectile to pierce armour-plate; it only needs sides strong enough to resist the pressure of the powder-gas. This, therefore, is the problem:--What thickness ought an iron obus to have in order to weigh only 20,000 lbs.? Our clever calculator, Mr. Maston, will tell us at once."

"Nothing is easier," replied the honourable secretary.

So saying, he traced some algebraical signs on the paper, amongst which n^2 and x^2 frequently appeared. He even seemed to extract from them a certain cubic root, and said--

"The sides must be hardly two inches thick."

"Will that be sufficient?" asked the major doubtfully.

"No," answered the president, "certainly not."

"Then what must be done?" resumed Elphinstone, looking puzzled.

"We must use another metal instead of cast-iron."

"Brass?" suggested Morgan.

"No; that is too heavy too, and I have something better than that to propose."

"What?" asked the major.

"Aluminium," answered Barbicane.

"Aluminium!" cried all the three colleagues of the president.

"Certainly, my friends. You know that an illustrious French chemist, Henry St. Claire Deville, succeeded in 1854 in obtaining aluminium in a compact mass. This precious metal possesses the whiteness of silver, the indestructibility of gold, the tenacity of iron, the fusibility of copper, the lightness of glass; it is easily wrought, and is very widely distributed in nature, as aluminium forms the basis of most rocks; it is three times lighter than iron, and seems to have been created expressly to furnish us with the material for our projectile!"

"Hurrah for aluminium!" cried the secretary, always very noisy in his moments of enthusiasm.

"But, my dear president," said the major, "is not aluminium quoted exceedingly high?"

"It was so," answered Barbicane; "when first discovered a pound of aluminium cost 260 to 280 dollars; then it fell to twenty-seven dollars, and now it is worth nine dollars."

"But nine dollars a pound," replied the major, who did not easily give in; "that is still an enormous price."

"Doubtless, my dear major; but not out of reach."

"What will the projectile weigh, then?" asked Morgan.

"Here is the result of my calculations," answered Barbicane. "A projectile of 108 inches in diameter and 12 inches thick would weigh, if it were made of cast-iron, 67,440 lbs.; cast in aluminium it would be reduced to 19,250 lbs."

"Perfect!" cried Maston; "that suits our programme capitally."

"Yes," replied the major; "but do you not know that at nine dollars a pound the projectile would cost--"

"One hundred seventy-three thousand and fifty dollars. Yes, I know that; but fear nothing, my friends; money for our enterprise will not be wanting, I answer for that."

"It will be showered upon us," replied J.T. Maston.

"Well, what do you say to aluminium?" asked the president.

"Adopted," answered the three members of the committee.

"As to the form of the projectile," resumed Barbicane, "it is of little consequence, since, once the atmosphere cleared, it will find itself in empty space; I therefore propose a round ball, which will turn on itself, if it so pleases."

Thus ended the first committee meeting. The question of the projectile was definitely resolved upon, and J.T. Maston was delighted with the idea of sending an aluminium bullet to the Selenites, "as it will give them no end of an idea of the inhabitants of the earth!"